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BIO - CREATION AND PEACE PROCEEDINGS

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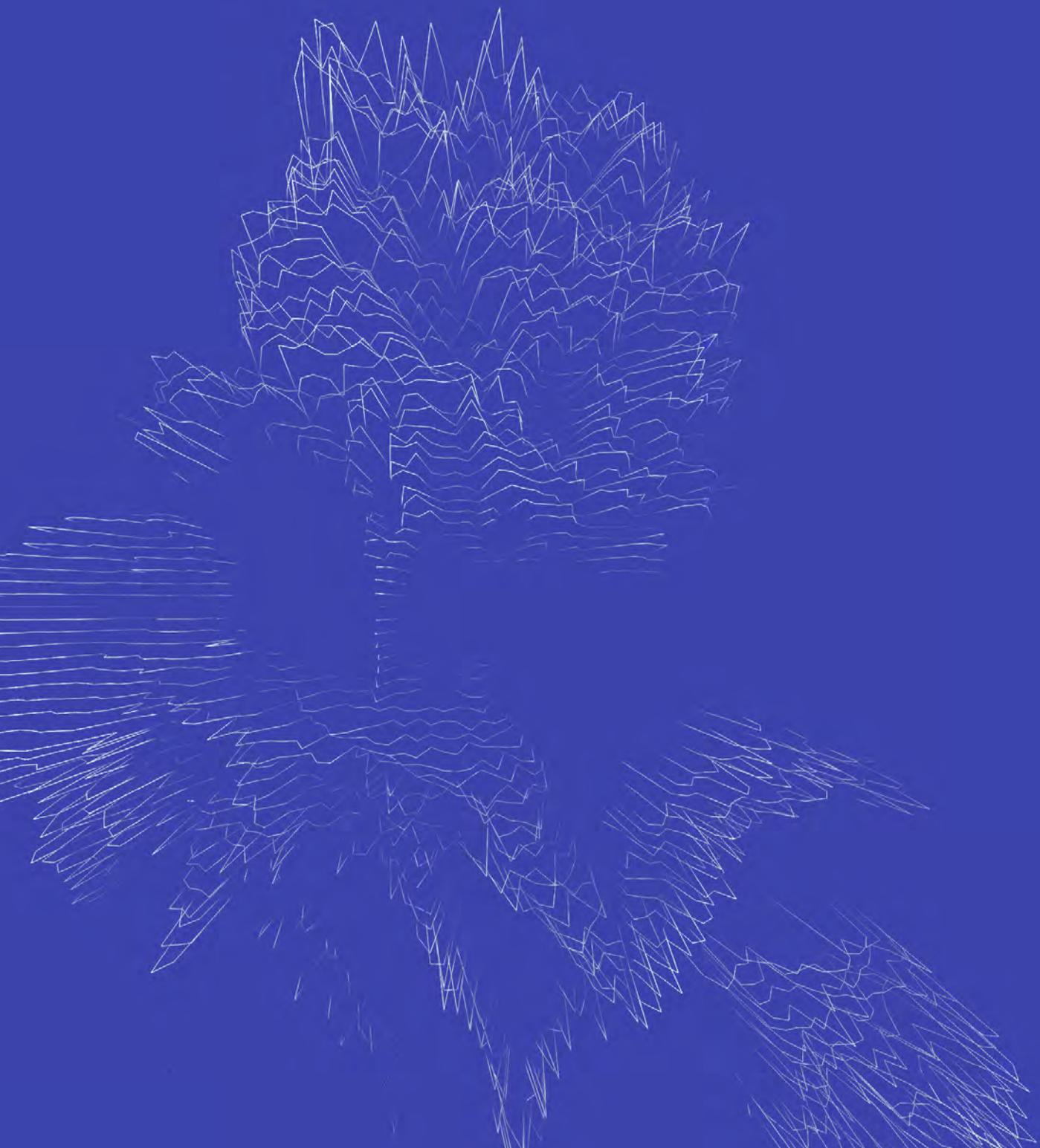
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ISEA2017 Manizales BIO-CREATION AND PEACE

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Presentation

In behalf of the University of Caldas, partner institutions, and organizing committee, we are glad to present the ISEA2017 proceedings. The 23rd International Symposium on Electronic Arts was held jointly with the 16th International Image Festival in Manizales, Colombia. The University of Caldas has organized the Festival for twenty years and we are proud to organize this year the Symposium. Additionally, 2017 is the France-Colombia year and the event had a significant participation of French artists and authors.

Planning the event has been an exciting, we believe that the conversation between the ISEA community and Latin-American artists and designers will be heightened from this year. The event consisted of two days of workshops and tutorials and five days of academic presentations, keynotes, artistic exhibitions and talks, and other special events. In the first day of workshops, the Leonardo 50th anniversary celebration kick-off was held, which was a space to foresee the next fifty years of transdisciplinary collaborative explorations in art, science, and technology.

This proceedings book is the collection of accepted papers, posters, panels and roundtables that describe current creative research in electronic art, design, science, and technology. We thank the academic chairs Andrés Burbano and Julián Jaramillo for their tireless and persistent work, the authors, and the IPC members. We also thank Cristina Sabogal, Mónica Arango, Paula López, Camila Hurtado, Mariana Valencia, and the members of the organizing committee and volunteers that made possible the academic program.

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Felipe C. Londoño, Director ISEA2017
G. Mauricio Mejía, Deputy director ISEA2017

Preface

This Proceedings presents the results of the Academic Call of ISEA2017, which received 151 submissions for papers, panels, posters and roundtables by 260 authors from 4 continents. All the submitted works were reviewed by at least two members of the International Program Committee (IPC), through a double-blind evaluation process that achieved 295 reviews. There is an expressive representation of 120 Latin-American researchers, 60 of which come from Colombia, 27 from Brazil, 21 from Mexico and others who come from countries such as Argentina, Chile, Costa Rica, Ecuador, Peru, and Uruguay. It draws a complete picture of the activities concerning arts and technology in the region that, we hope, will have a substantial impact.

The Academic Call proposed an intellectual and creative engagement with unusual fields in the framework of the negotiations between the arts and the technologies that have characterized previous venues in the area. The two main conceptual tracks of ISEA2017 are Bio Creation and Peace, and they are divided into six sub-themes: “Bio Creation and Data,” “The Cultural Dimensions of Bio-creation and Peace,” “Interdisciplinary Platforms for Coexistence,” “Critical Perspectives on the Use of Technology for Peace,” “Media Art, Landscape, and Heritage,” and “Design, Art, Science, and Technology”.

The inclusion of novel topics in the academic symposium unveils the breadth of the area, which shows that such thematic expansion is necessary to accommodate and translate the needs and interests of the Colombian society within the core of the Post-Globalization landscape in which we live today. In times challenged by unanticipated turns of events, when “alternative-facts” and “post-truth” media negate the conceptual world-views of people, when structures of power deny environmental changes, and when old and new conflicts arise as leitmotifs of human civilization, there is clear need for a profound exploration of this two notions: Bio Creation and Peace. Academic and artistic events such as the International Symposium on Electronic Arts should seriously assume the reflection and action on these fields exploring the implications for our local and global societies.

The reflection around Bio Creation can thoughtfully articulate the questions about biology, computation, nature, and ecology as an integral part of contemporary endeavors in the arts and technology. This is a task that could be done paying attention to the recent theoretical reflections; for instance, to the Green Studies debate led by intellectuals such as Jens Hauser or pointing to the ethical remarks related to the bio media discussed in Joanna Zylińska’s work. The other main component, the reflection around Peace is crucial for our socio-cultural context. As the reader probably knows, there is an unprecedented Peace process happening in Colombia that is attempting to solve a struggle that has upset Colombian society for more than a half of a Century. This process that is well advanced has had a meaningful impact on the current Colombian political configuration; however, it still needs substantial elaboration to contribute to the construction of a post-conflict society. This condition is one of the reasons why is vital that the next ISEA will be hosted in Durban, South Africa, nation that is a permanent reference.

The selection of papers and presentations of the Academic Track offers an extraordinary variety of proposals articulating the thematic concepts proposed with a battery of classical questions that are part of the foundations of the questions addressed in ISEA since its inception; for instance, the importance of technological media, the role of digital technologies, the value of data, and the significance interactive processes.

Before closing we would like to thank the IPC members for their valuable help reviewing the proposals, many thanks to the people who applied, thanks to the ones who came to Manizales. We present in front of you, our gratitude and respect for your work and contribution.

Andrés Burbano & Julián Jaramillo Arango
ISEA2017 Academic Chairs

SUB-THEMES

Bio creation & Data

Data is becoming pervasive in our daily lives. Scientists have used data and biological processes to create products and systems, while artists explore the aesthetics of technology, data and biology. How do artists integrate data and biological phenomenon in the creative process? In what ways do designers take advantage of large amounts of data to make decisions that affect sustainability and biodiversity?

Critical perspectives on the use of Technology for Peace

Technology is a potential tool that supports peace process and conflict resolution. What is the role of art and design in defining the use of technology to support peace and conflict resolution? Are there cultural identity tensions catalyzed by technologies? How can technology promote intercultural dialogues and peace construction?

Media Art, Landscape and Heritage

ISEA2017 will take place in a region in Colombia known as the Coffee Cultural Landscape, declared as a world heritage site by UNESCO. We invite work that reflects on the conflict between media and heritage. How do artists and designers include heritage in their critical thinking and aesthetic decisions? How could media art help disseminate cultural values around peace? Does media art have the capacity to preserve heritage? Does conservation or cultural transformation generate conflict?

Interdisciplinary Platforms for Coexistence

Transdisciplinary teams collaborate to generate social and political content and debates. Artists, designers and scientists have tried to work together and get citizens involved with interactive technologies and media. Are these platforms showing paths for social coexistence? How transdisciplinary collaborations can generate social benefits? How can biological process be used as source of inspiration and the generation of social possibilities for living in peace?

The Cultural Dimensions of Bio-creation and Peace

In recent times, pockets of peace across our planet have emerged and Colombia is one example. Does the idea of peace have a larger role to play than simply resolving conflict? In what ways could indigenous awareness contribute to our understanding of peace? What bridges in thought and action are needed to achieve global peace across cultural and transdisciplinary boundaries? Is bio-creation in conflict with, or in accord with, indigenous awareness of living organisms?

Design, Art, Science, and Technology

This subtheme is to open up participation for other authors that want to submit works to ISEA2017 and include a broad interdisciplinary discussion and showcase about interrelations among design, art, science and technology.

Felipe C. Londoño, Director ISEA2017

G. Mauricio Mejía, Deputy director ISEA2017

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**The Cultural Dimensions of
Bio-creation and Peace**
Papers

Fostering Care and Peaceful Multispecies Coexistence with Agential Provotypes

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Abstract

Human societies are deeply entangled with biotic and abiotic entities that constitute and sustain our life-world, consequently to address peaceful coexistence within and between human societies, necessitates addressing a much broader issue: peaceful multispecies coexistence and the end of environmental violence. Key to this is a change of the present dominant neoliberalist ontology, which is wreaking havoc on the planet, socially and ecologically. This paper introduces agential provotyping as a catalyst to prompt a dialectic process of reflection of the assumptions and beliefs, which constitute the foundation of our present exploitative and human-centered value system. Agential provotypes are tools of subversive design practice, which are readily accessible design artifacts aimed at a broad heterogeneous public that reveal the taken-for-granted elements of the human life-world through playful interaction and aesthetic experience. The paper starts by explicating the relationship with provotyping as emerging from systems design and positions agential provotypes in relation to critical design. It thereafter demonstrates agential provotyping on the basis of an interactive installation consisting of digital artifacts and plants; finally it discusses the impact of the agential provotype on interactants' beliefs and assumptions and their development of empathy towards other lifeforms in their environment.

Keywords

Agential provotyping, Subversive design, Emotional design, Empathy, Interactive installation, Public space, Ecology, Ontology, Plant sentience, interactive artifacts.

Introduction

This paper introduces the notion of agential provotypes as a tool to foster respectful multispecies coexistence. Originating in systems design, provotypes are prototypes used at the front-end of a design process to reveal hidden tensions in a given design context. They do so by provoking experiences of phenomena, which under normal circumstances are presumed and so remain hidden (Mogensen, 1992). This paper suggests an extended form of provotyping, *agential provotyping*,

where the provotypes are deployed to reveal invisible, yet paramount aspects of reality thereby encouraging a re-evaluation of current practices and ontologies.

The significance of a certain system of resource management lies in its conceptual foundation: whether natural resources are overexploited, conserved or used sustainably, is an ecological expression of socially and politically defined institutions, norms, values and structures (Dove & Kammen, 1997; Pretty, 2003; Rist & Dahdouh-Guebas, 2006; Veeman & Politylo, 2003).

Humans are not discreet beings. As individuals we are immersed in a more extensive micro-biome, consisting of multiple entities outnumbering the number of cells within the human body itself and without which, life could not be sustained (Sender, Fuchs, & Milo, 2016). Correspondingly, humans as a species are deeply entangled with and dependent on both the biotic and abiotic entities that constitute our life-world. In consequence, to address peaceful coexistence within and between human societies needs the addressing a much larger issue: ending environmental violence and cultivate respectful multispecies coexistence.

Structure of Paper and Research Approach

After a short introduction to the currently dominant ideological system, neoliberalism, this paper presents an agential provotype, an interactive artifact co-created by the author, deployed for public engagement and interaction with plants, whose activities are imperceptible to humans. The presented agential provotype, Flora Luma, utilizes sensing technology to harvest environmental data, which is then presented visually to captivate spectators' interest by its aesthetic quality. Only as a second step is the meta-layer at the core of the installation revealed. The intent of this approach, which we call tactics of aesthetics, is to promote biodiversity and champion the notion of multispecies coexistence

in a playful and enticing manner. The notion, *tactics of aesthetics*, promotes the idea that engagement through experiential beauty is a powerful tool with which to foster empathy and care. These being the foundations of conservation and will be farther elaborated in this paper.

The paper positions agential provotyping as a type of subversive design and discusses it in relation to critical design.

Finally the paper shows how the encounter between humans and plants, facilitated by the agential provotype challenges the present perception of a clear separation between nature and culture. It draws on the observations and conversations which occurred at a large-scale public exhibition. The paper demonstrates how the presented agential provotype sparks a re-evaluation of set beliefs and human-centered ontologies.

Questioning Ontologies

The aim of the agential provotype presented in this paper is to initiate a dialectic process between ontologies. As a global society, we are deeply vested into a neoliberal ideology, which has dominated global politics since the late twentieth century. Poignantly expressed by Margaret Thatcher's slogan: "There Is No Alternative," neoliberalist ideology claims that global capitalism is inevitable and represents the only realistic system for a modern society. This ideology has become so pervasively entrenched into everyday life that it has become "easier to imagine the end of the world than it is to imagine the end of capitalism" (Fisher, 2009; Jameson, 2003). By announcing "the end of history", Francis Fukuyama, at the end of the Cold War, describes the victory of the neoliberalist West as "the end point of mankind's ideological evolution and the universalization of western liberal democracy as the final form of human government" (Fukuyama, 1989). In this post-ideological age, capitalism is presented as the natural order of things, an inevitable fact as indisputable as the evolution of species or the earth's orbit of the sun. However, neoliberalism's naturalization of values as facts is nothing but the installation of a "business ontology, in which it is simply obvious that everything in society, including healthcare and education, should be run as a business" (Fisher, 2009). Yet ontologies are not facts, they are systems of beliefs and values, which can - and should! - be challenged, especially when these beliefs are becoming increasingly violent, oppressive and destructive both socially and environmentally.

As Karen Barad clearly illustrates in *Meeting The*

Universe Halfway, reality is agential and defined by the apparatus through which we 'choose' to look. The apparatus is not merely a technological set-up, but signifies the entire social, epistemological and ontological framework, in which the technology is embedded. The positioning of the technology creates an 'agential cut', which determines our experience of reality (Barad, 2007). Art, and the critical and subversive branches of design can be, and frequently are, deployed as cultural apparatuses, challenging the status quo. Straddling technology, science and design practice, agential provotypes can reveal the discrepancy in the 'factual reality' of separation within which we assume to live, and the intricate relationships with entities in the world, which are intangible. This revealed, it acts as a spark to ignite questioning and re-evaluation of an ontology based on separation and exploitation, which guides and justifies violent acts against fellow kin, human as well as nonhuman.

Agential Provotyping

Provotypes originate from systems design in the early 1990s and are used at the front-end of an innovation process to understand how people experience phenomena to which they are habituated. They are introduced to provoke and 'bring-forth' discrepancies in current practices which are not perceived as problematic, but as a point of departure and resource for change (Mogensen, 1992). The provotyping approach builds on Activity Theory, which states that instruments which mediate everyday activity, become 'invisible' or 'taken-for-granted' when in use (Engeström, 1987).

Agential provotyping, extends the idea of provotypes as design artifacts that can reveal the unconscious elements of human existence and question predominant values, beliefs and assumptions. The presented agential provotype discussed in this paper intends to foster respectful multispecies coexistence. This concept can be equally applied to other agendas.

Agential provotyping is a tool of a subversive design practice, which may initially appear to exhibit similarities to critical design. However, agential provotyping differs on several accounts in application, approach and intent:

1) Broad appeal: As a form of constructive design research, critical design is a critical theory approach, whereby the intention of the design becomes a medium with which to reflect on the cultural, social

and ethical impact of technology (Bardzell, Bardzell, Forlizzi, Zimmerman, & Antanitis, 2012; Dunne, 2008). The artifacts emerging from critical design are often provocative, ambiguous and foreign as a means to encourage reflection of our society in context. The artifacts produced and applied by critical designers are pregnant with meanings, assumptions and theoretical perspectives which rely on viewers' broad understanding of art, design, culture and theory of interpretation (Koskinen, Zimmerman, Binder, Redstrom, & Wensveen, 2011). Critical design thus often remains unintelligible to the broader public, who lack the visual literacy, the theoretical information and discursive backgrounds necessary for decoding the artifacts. In contrast, agential provotyping aims for appeal to a broader public and views the artifact as a means of enticement and engagement, resulting in delivering of a message, which should be readily understood. Framed as tactics of aesthetics, the design is developed to be aesthetically pleasing, inviting and, borrowing from interaction design and user experience design: user friendly.

There are several reasons for this approach:

- a) Designing for change, whether social, political or ecological, needs to be inclusive. Appealing merely to academic and artistic minorities will not have the necessary impact to successfully address current social and ecological concerns. In this regard it is the role of the designer to convey the intended message so that it is intelligible and attractive to a broader public.
- b) Pleasant experiences induce a positive emotional state, which several studies have proven to increase motivation and positively influence an array of cognitive processes, such as the processing of information, negotiations, decision-making, categorization and creative problem-solving (Erez & Isen, 2002; Isen, 1987; Konradt, Filip, & Hoffmann, 2003). Being in a positive and relaxed state of mind, renders people open-minded and willing to engage with information that otherwise could be dismissed as too odd and challenging (Norman, 2005).
- c) The key to change is to cultivate empathic behavior and thought, that can comprehend the intricate entanglements of the myriad relationships which make

up the life-sustaining forces on our planet (Rifkin, 2009). Taking utmost care not to alienate the audience in the process is hereby of paramount importance. Most activist practices rely on campaigns, which call for subtractive actions, i.e. restriction, reduction and prohibition. These campaigns have failed to engage with sections of the general public, who often perceive them as condescending and lecturing. The large number of 'climate skeptics' and the constantly increasing consumption of resources and emissions of green house gasses illustrate this. Agential provotyping takes a different approach by providing additive experiences and so enlarge and enrich the life-world of the engaging audience.

2) Agent of change: agential provotyping is not a critique of design practice, but applies design as an agent of change. Agential provotyping is a form of application and is as such not limited to any particular part of design practice but will use whichever approach, tool, technology and medium appropriate in a given context.

The Flora Luma Installation

The agential provotype Flora Luma was developed as an interactive installation for use in public space. Flora Luma was inspired by the remarkable research emerging from botanical studies, revealing plants to be more aware of their environment than previously assumed. Plants are highly sentient (Karban, 2015), they recognize kin and adjust their behavior accordingly (Dudley, Murphy, File, & Robinson, 2013); they communicate with other plants as well as with animals (Karban, 2015); they actively optimize their living conditions (Brenner et al., 2006); they learn and remember past experience (Gagliano, Renton, Depczynski, & Mancuso, 2014). They also communicate and share nutrients via subterranean mycorrhizal networks, also referred to as the 'wood-wide-web', within their communal population (Helgason, Daniell, Husband, Fitter & Young, 1998).

The installation comprises 3 objects, fashioned from self-illuminating hand-woven fabric made from fiber-optics and cotton (Fig. 1.). The color of the fabric is controlled by a programmable micro-controller. Each object is connected to a plant with an electromyography (EMG) sensor which measures the electrical activity of the plant. The data collected from the plants depend on

abiotic environmental factors, for example temperature, luminosity, humidity and seasonality. Haptic stimulations are also of major importance. Each object runs a simple repeated loop from red through green to blue and back to red. Due to the positioning of the attached LEDs the colors blend inside the fabric, creating a wide and nuanced coloring (Fig. 2.-3.).The color changes are controlled by the intrinsic state of the plants, as measured by the EMG sensor, i.e. the velocity of the color-change and the color emitted depends on the internal electrical activity of the plants. Due to the plants'



Figure 1. The Flora Luma installation. ©Author.

sensibility to haptic stimulation, touching it provokes a rapid and striking reaction, so that an interactant can influence the visual output of the luminous objects in conjunction with the plant and elicit immediate visual feedback of the interaction (Fig. 4.). The emerging stories, mediated and facilitated by the artifact, are reminiscent of ancient tales and fables, which recognize the animate nature of all living beings, in addition to the deeply entangled nature of the relationships between humans and nonhumans which is still informing First Nations' non-anthropocentric ontologies, in an experiential, subjective perspective.



Figure 2. Self-illuminating fabric on the loom. Plant with attached EMG sensor in the background. ©Author.

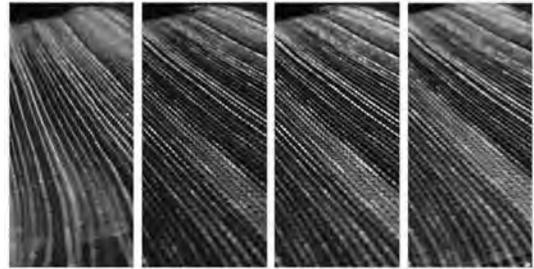


Figure 3. Red to green colour change. @ Author.

Agential Provotyping in Public Space

The installation was exhibited at the Luminale16 in Frankfurt, Germany (Fig. 5.0 - 6.1), which took place every evening over a period of five days in March 2016. The Luminale is a biannual event, a 'Festival of Light', which takes place in conjunction with the Light + Building Fair, biggest of it's kind, worldwide. It has approximately 200 light-events scattered around the city and attracts around 200.000 people. The patrons are a heterogeneous assemblage of Germans, the majority being locals from Frankfurt and the surrounding areas, and internationals of all ages, genders and professional backgrounds, who

come specifically to experience the Luminale.

The Flora Luma exhibit was situated in Nizza Park, a quiet and lush area on the bank of the river Main. The trees and shrubs fitted the ethereal quality of the installation perfectly and stood in stark contrast to the intense and high powered activity of the busy city streets, many displaying multistoried, big budget installations sponsored by major corporations.

We intended to conduct a number of interviews over the course of the event but the large aggregation of people who were permanently present at the site, held us so deeply and continuously engaged in conversation, that the opportunity for interviews were limited to a few hours on one less busy evening. We therefore adjusted our approach to a few semi-structured interviews, which were recorded and later transcribed. These interviews together with our observations from conversations with the groups of 20-40 perpetually changing visitors at each of the three objects, taking place over a period of several hours each evening and supported by observations of their behavior, and conversations between the visitors themselves, provide the basis of the presented outcome.

In spite of the somewhat hidden location the installation received a lot of attention. We did not have the means to monitor the number of visitors but an educated estimation would be that of several thousand people over the course of the event, comprised of 50 % local residents, 25% Germans from out of town and another 25% international visitors.

Intrigued by the ethereal quality of the installation, often described as reminiscent of fen lights, the movie 'Avatar' or bioluminescent aquatic life-forms, visitors would spend a prolonged time examining the objects and observing the patterns of changing colors. Eventually, on discovering the sensor pads and wires connecting each object to the adjoining plant; they would enquire about the purpose of the apparatus. We would then explain the underlying science and technology of the complete installation, to visitors amazement and occasional disbelief. Dispelling doubts was generally achieved by a blend of demonstration and authority

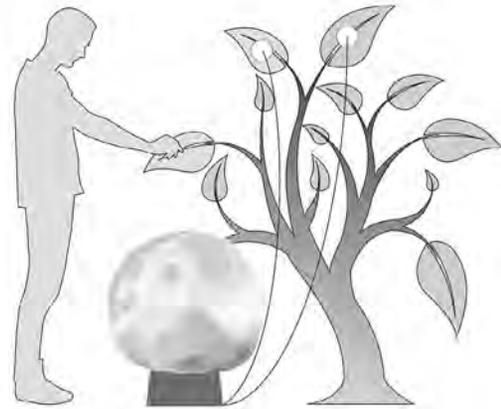


Figure 4. Project sketch. ©Author.

1) Demonstration: Touching the leaves of the plant causes an immediate response, an action potential in the plant. This response is instantly reflected in the appearance of the luminous object, allowing visitors to directly engage and interact with the plant, receiving immediate visual feedback.



Figure 5.0 Installation site at the Luminale. Photo 1. ©Author.



Figure 5.1 Installation site at the Luminale. Photo 2. ©Author.



Figure 5.2 Installation site at the Luminale. Photo 3. ©Author.



Figure 6.0. The Flora Luma artifact. Close - up 1. ©Author.



Figure 6.1. The Flora Luma artifact. Close - up 2. ©Author.

2) Authority: An important factor for the credibility of the installation was the conveyance of the corresponding science and underlying technology. It was of importance to communicate using terminology of language to a layman audience, whilst at the same time project scientific confidence, i.e. having the ability to refer to publications and studies for verification of a thorough understanding of the subject-matter by the presenter.

Visitor responses were very positive; many stayed for extended periods, interacting with the plants and engaging in conversations about the perceptive and responsive capabilities of plants with us, the researcher-designers, and amongst each other. For many the installations provided a highlight to the event, as one of the interviewees noted: “At first we just came for the beauty of it. It’s a very otherworldly scene, with the delicate lights under the trees, but now that I know what lies behind it, it is absolutely phenomenal, much better than those lit-up high-rises”. Another remarked: “This is our first evening at the Luminale and we have been walking around for two hours now and this is beyond comparison the most interesting thing so far” As the event progressed through the week we noted that some visitors approached the installation resolutely, moving directly to examine and interact with the plants. They then sought us out with questions. We discovered these new visitors had been urged to investigate the installation by previous visitors to the site.

Reflections

Engaging with the installation provided a challenge to visitors’ assumptions of the vegetal environment, where plants are seen as passive automatons simply carrying

out a genetic program. Discovering plants as sentient beings through a first-hand experience provoked visitors to reappraise their perception of their life-world.

One visitor remarked: “It’s incredibly interesting. I’m kind of a little bit of a science person and I’ve never heard of anything like it. I’ve never before heard that signals from plants are studied. It is completely new to me and it is apparent [from the installation], that there is even feedback from the plants. I will have to go home and read up about it.”.

Interacting with the agential provotype allowed the visitors to experience a hidden phenomenon and exposed them to a concealed discrepancy in their existing ontology – zoo-centrism, i.e. that only animals have sentience and awareness, and are responsive to their environment.

Evident from repeat visitors, it appeared that this experience, in several instances served to catalyze a development of increased empathy, as one visitor expressed: “It makes me think about how negligibly one moves about in nature and not thinking about what kind of signals a plant sends, I mean that she can signal anything at all. Mowing the lawn, hacking down flowers, without any thought about what a plant perceives or what that flower is capable of doing, after all, it’s just a flower, I’ll just tear it off”.

The aesthetic quality of the exhibit served as an entry-point for the visitors, and facilitated the transfer of challenging academic niche-knowledge gaining a considerable amount of interest and traction. Visitors experienced the interaction and the ensuing conversations sparked by the installation as providing them with an expansion to their life-world, and not as lecturing or moralizing. Numerous visitors remarked that the installation constituted a definite highlight to the event due to its accessibility and revealing second layer of information, beyond its visual display. Their perceptions were that, whereas the other installations were aesthetically appealing, they were predominantly visual spectacles.

Conclusion

The goal of this paper has been to present evidence that the notion of provotyping, if applied agentially in public, ensures the creation of awareness in a broad and heterogeneous audience of the obscure relationships that exist within our life-world; this being in general, knowledge recognized by a select,

perhaps exclusive group within academia.

The paper presented an agential provotype which facilitates reciprocal encounters between human and vegetal interactants, to expose plants as being sentient. Plants, a vital life-sustaining force on our planet, are historically overlooked and underappreciated. The installation reveals the perceptive and responsive nature of vegetal life and thereby questions the present human-centric ontologies in a tangible and accessible way to a wide- ranging audience. The discussed encounters with the agential provotype installation herein, demonstrated its ability to foster empathy towards plants and it is therefore anticipated, to engender caring and respectful behavior towards vegetal life in the visitors’ futures. In this way the encounter with the agential provotype hints at the potential ability of the layman to accept a reality in accordance with First World Nations’ ontologies, which recognize the animate nature of all beings in addition to the deeply entangled symbiotic relationships between humans and nonhumans.

Due to the brief interaction with the visitors to the installation it is not possible to determine whether the experience, facilitated by the agential provotype, actually resulted in any long-term behavioral changes. It would be beneficial to implement studies of longer duration, utilizing permanently deployed agential provotypes, to acquire information of the long-term impact on the local citizenry encountering the installation; including a devised method of engaging visitors in a follow-up study. However, we could clearly observe that the agential provotype installation facilitated a profound attitude improvement at the installation itself and initiated both curiosity and a willingness to learn in the engaging visitors.

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Mental Maps of Traditional Fishermen in the Caribbean Sea

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Abstract

Traditional fishermen of Old Providence, Taganga and La Boquilla, Colombia rely on mental maps as a tool to identify the best locations to fish. Fishermen read natural signs and use geometry, arithmetic and images in the mind to create mental navigation maps for fishing in the Caribbean Sea. Life experiences provide the empirical knowledge to create oral stories and life histories in the development of mental paths in the minds ideological patrimony of the fishermen. These mental paths, revealed by the researcher-artist through drawings visualized, form a metalanguage that has its own visual codes, a visual alphabet and a glossary of images.

Keywords

Traditional fishermen; Fishermen of Old Providence, Taganga and La Boquilla; Colombian Caribbean Sea, Mental maps; Natural Signs, Empirical knowledge, Oral Histories, Paths, Ideological patrimony, Drawings, Metalanguage, Marks/Points; Sensory Image.

Introduction

This investigation is from the perspective of a visual artist, understanding and interpreting how mental maps contribute to the creation of mental navigation maps upon which the traditional fishermen of Old Providence, Taganga and La Boquilla depend, to locate optimal fishing.

The fishermen read natural signs by identifying ocean currents and the color of the sea, analyzing wind direction, the moon cycle, solar position, and even how flying birds approach the beach. Paths are made in the sea by using three fixed reference points on the shore. Geometry, arithmetic and image are often unknowingly applied as the fishermen navigate the Caribbean Sea using empirical knowledge to help them identify the optimum places to fish. This knowledge and ability, stored only in the minds of traditional fishermen, is passed down orally from generation to generation and is not recorded in any literature.

Revealing the fishermen's mental maps, two questions arise: How can information be extracted from a fisherman's mind and how can that information be communicated in the form of images?

One of the problems is the lack of previous literature on the creation of mental navigation. There are no traditional fisherman's maps and very little information on how image, arithmetic and geometry are utilized to mentally navigate the sea. Multiple areas of study (ethnographic study, social studies, biology, math, image theories, and art) are used to attain the results of this investigation.

The process used to extract the mental maps is incremental, including the ethnographic study of the fishermen's villages, oral histories, environmental problems and life experiences.

Making the mental maps visible is another challenge. The solution is to implement image ethnography which generates new knowledge: creating a visual language using a visual alphabet and visual codes that create a metalanguage through drawings.

Drawings of fishermen's mental maps are created and used in a visual dialogue with the fishermen. To present the mental drawings or maps of the fishermen as empirical knowledge, it is imperative to show that the visual drawings reflect the mental maps, describing the location of the best fishing places and the oral histories of the fishermen. These relationships and connections are verified by the Colombian Caribbean fishermen themselves.

The visual drawings as empirical knowledge reveal the 'ideological patrimony' which is "the human emotion of being or doing, individually or as a group, including natural expressions, thoughts, and a deep desire to develop social groups," (Cruz Coutiño, *Las Ciencias Sociales en el siglo XXI. Perspectivas de los estudios regionales*, 2009) expressed orally. "Including the beliefs that man

has about himself and the social world, biological and physical, in which he lives, and the beliefs about his relationships with his neighbors, within society and nature, and with other entities and strengths, discovered, accepted or conjured” (Chinoy, 1961).

Context

The Greater Caribbean, located in the American tropics in the transition zone between equatorial wetlands and dry wetlands in the Tropic of Cancer, with an average climate between 25° and 35°C, influenced by the northeast trade winds with reefs and transparent blue and green water, is a place where many oral stories are woven.

Per Gerhard, “the Caribbean space has been one of conflicts, in which interests of territorial politics, economic politics and military strategies of distant powers express themselves” (Sandner, 2003). One of the predominate problems across the villages studied is the discrimination against traditional fishermen for being afro-descendants, notwithstanding their contributions to the development of the port cities where they live and to the economy of the area through what they extract from the sea.

The fishermen relate mental images of fragmentation and isolation, the relationship of the Caribbean with the environment, the stories-songs they create the sights around them and their way of earning a living. Their unique ability to locate “offshore fishing,” as the fishermen say, has been passed down from generation to generation, developed over a long time through the creation of mental maps and practice in time and space.

Each of the three fishing villages studied in the Colombian Caribbean has a unique geography that lends itself to varied activities for the traditional fishermen, such as ecotourism.

Old Providence

The island of Old Providence is 7 km long and 4 km wide. It is located 90 km north of the island of San Andrés and 220 km from Nicaragua. Providencia is considered one of the most beautiful islands in Colombia. Before ecotourism, the island was a quiet place. Today, both diving and snorkeling are popular attractions due to colorful coral reefs, rich marine flora and fauna and the transparent water (Ministerio de Comercio, 2014).

A cultural and commercial activity, traditional fishing provides the daily sustenance of the Raizals. Due to the islands and keys of the Colombian Sea in and around

Old Providence, the Raizals must use canoes, boats, and other transportation as a mode of communication, traveling through the sea using the same empirical knowledge (mental maps) that is used for fishing to navigate from one island to another without GPS. The fishermen of Old Providence are recognized by other groups of fishermen as the “wolves of the sea,” because of their extraordinary mental mapping ability.

Taganga

A fishing village near Santa Marta in the department of Magdalena on the shores of the Caribbean Sea, Taganga is surrounded by mountains covered with desert vegetation and small trees. Known for its landscape and scenery, it has a population of approximately 3,000. The term Taganga, per some researchers, can have origins from two meanings: the first is that it could mean “serrania of snakes” derived from the indigenous words ta-gunmy where “ta” means ‘hill’ and “gunmy” ‘serpent or cobra.’ This is because in the hills that surround it, many animals of this species abound. The second would have to do with the etymology of the indigenous word where “ta” is an entry and “ganga” is the sea, which would mean ‘location where the sea enters.’

La Boquilla

Located in the north sector of the department of Bolivar on the shore of the Caribbean Sea, its northern border is the town of Manzanillo; southern side is the neighborhood of Crespo and the airport; eastern side is the Swamp of the Virgin; and western border is the Occidental Sea. Tourists are attracted by cultural activities as well as fishing. The name, La Boquilla (small mouth), comes from being the smallest of the channels that exist between Boca Grande and Boca Chica.

La Boquilla, before the arrival of Europeans, was inhabited by the tribe Calamari. “When the city of Cartagena was completely fortified, both the Corsairs and pirates entered through La Boquilla in small boats, crossed the Swamp and besieged the city from the northeastern side. For this reason, batteries (that today lie buried) were built at the entrance to the mouth. Later this area was populated by some families from villages such as San Onofre (Sucre), Villanueva (Bolívar) and Rocha. They settled in bahareque ranches, since they saw that it was a productive land for the development of fishing” (Edwin, 2009).

Mental Drawings or Maps Used for Knowledge and Location in the Caribbean Sea

Mental Drawings

The term “mental drawings” is composed of two words, defined in the article “Drawing as a location tool for fishing in the Colombian Caribbean,” written by the author of this paper. “Mental is an adjective that refers to the mind (a dimension of thinking or reasoning ability).” “Drawing is a form of graphic expression, putting images on a flat space... is considered a universal graphic language that has been used by humanity to communicate ideas, projects and, in a broader sense, humanity’s ideas, customs and culture” (Leotteau, *El dibujo como herramienta de ubicación para la pesca en el Caribe colombiano*, 2015). The idea of a drawing as a representation of objects and words leads us to the visualization and materialization of spiritual and cultural elements.

Mental drawings or mental maps show the relationship between the elements of nature and man. In the case of the fishermen, mental maps and show the relationship between science and art. Furthermore, the interpreted drawing exemplifies the visualization of the experience found in the mind.

The mental maps created in the fisherman’s mind are based on life experiences. Ideological patrimony in the world of traditional fishermen is revealed in the images. That is, they show how the traditional fishermen experience their lives and the illusion and fantasy that exist in their world, both on the surface and in the depths of the sea.

During the interviews with the researcher-artist, the traditional fishermen’s responses to questions are accompanied by expressive gestures and motions often using the hands as an expressive map upon which an image in their minds can be displayed.

For example, when a traditional fisherman from La Boquilla, Santa Pri, discloses information about a good fishing location to the researcher -artist, the first thing he does is to show its location using his hand: identifying the places he has observed using his own names for them. He shares that “light red” is a good fishing area in the sea. “Light red” is an area of sandbar that is not visible from a distance. When one arrives by boat, at the bottom of the sea through the crystal-clear water, the sand can be seen and at the end of the white sandbar area, a red spot can be observed. Santa Pri tells the story that at one time, a big ship with a red bottom ran aground and left the stain of its color behind. He calls this area

the “light red.” To locate this place, he finds three fixed points on the beach of La Boquilla. The point at the end of a rocky mountain beside the sea, he calls “yellow tip.” On the other side, a white building can be seen, hence “white point.” With those two points as references he draws an imaginary line. A third fixed point is located between both on the beach, a taller building he calls “the branch” to complete a triangulation. As the boat moves toward the open sea, he is always looking at those points. He does this mentally; does not write it down nor does he tell any other fisherman. Santa Pri keeps these coordinates guarded in his memory.

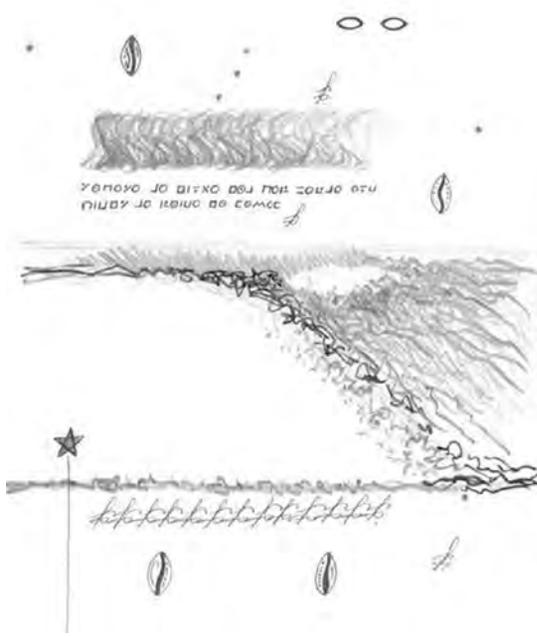
Each fisherman with this ability locates his own fishing places and identifies his own marks for triangulation, location and movement over and of the sea. Mental location with points is hereditary knowledge, passed down from parent to child, so that those in the lineage learn to locate and not get lost in the open sea. Not every fisherman possesses this ability.

The methodology of the internal narrative as seen through these drawings is shown by Sara Pink in her analysis of image and the use of visual data is found in the qualitative research of Marcus Banks (Banks, 2015). These methodologies support the visual analysis of a narration. When Santa Pri narrates his oral history of the “light red,” the researcher-artist analyzes and recreates the image on paper as he listens. The fisherman then endorses the drawing created and makes his own image with his finger in the sand to confirm with the researcher-artist the location of the “light red.”

This research project yielded two chapters relating to the visualization of the images. One chapter is dedicated to the interpretation of the image and the other to the visualization of those images created by the researcher-artist. The oral image is transferred to the visual image through the creation of new visual codes, where those images become visible. The following drawing, figure No. 1, “Remembering Cindy’s Dream” is an example of the visual image of Santa Pri’s memory of his wife’s dream.

In Cindy’s dream, the sea goddess spoke to Santa Pri telling him to untangle his anchor that had gotten caught on the bottom but also to be careful of a big fish. Santa Pri tells the story that one day when he was at sea, his anchor became tangled and he quickly dove into the water to untangle it. As he began to work the anchor, he became frightened when he noticed a huge fish nearby and remembered the dream his wife had told him some

time before. He was truly frightened because he had never seen such an enormous fish.



Drawing N ° 7

Artist: Fabian Leotteau

Title: "Remembering Cindy's Dream"

Technique: Graphite and ink on paper

Dimension: 21.59 cm x 27.94 cm

This drawing represents the feelings of Santa Pri in his encounter with the huge fish, and the emotions and feelings he experienced related to his memory of his wife Cindy's dream.

The research for this project was conducted on twelve weekend visits to two villages and three trips to Old Providence, due to budget limits. The reduced number of visits to the last village did not affect the results of the interviews because the fishermen from the third village were previously known to the researchers so relationships and trust were already formed.

Before beginning the study, the researchers assembled a list of questions to present to the fishermen. In the villages, which were initially unfamiliar to the

researchers, the project began by approaching a person who was close to the community's fishermen. The research project and its objectives were explained and the community was asked if they were interested in being a part of the endeavor.

The researcher took the time to get to know the people. The process of developing trust and creating relationships began the following weekend. The fishermen were invited to the home of their leader for a 'sancocho' or feast. While video recorders were recording and stories were being preserved, each fisherman was asked to say his/her name and to share a personal fishing feat. Some drawings by the researcher-artist were also shared with the intent to start conversations concerning the project. Heitor Alvelos, this thesis' advisor from the Oporto University, Portugal, recommended that at this point in the process, the social methodology which relies on these primary introductions as a sort of "false interview" be used, because normally memories are not shared with newcomers. In addition, behaviors and social relationships were identified within the community to identify it as a social laboratory, as did Robert E. Park of the School of Chicago of the University of Chicago.

On a subsequent weekend visit, under the shade of a mango tree, as videos were being taken, each person introduced him/herself again. The fishermen were more comfortable by this time and as they joked, they used many nicknames for each other.

Extracting mental images or drawings from a fisherman's mind is accomplished by first identifying who has the ability to geo locate because not every fisherman has the same ability. After that, the mental image of his exploits or experiences is mapped. The first mental map drawing extracts the ideas as well as the verbal and gestural expression of the fisherman.

On another visit, while the researcher-artist was meeting with Santa Pri on the shore, he suddenly exclaimed to his fishermen friends who were near, "Look, look at the lebranche! Tomorrow a school of them are coming and I will organize a fishing trip." The researcher-artist looked into the waves, but only saw the foam of the waves and did not see any fish. Later, when he sat down with Santa Pri and asked him what he saw and how he saw it, he was told that Santa Pri had seen flashes of bright lights in the waves and that these were signs of the lebranche. The researcher-artist asked for an explanation of what the bright lights were. Santa Pri sat quietly, joined his fingertips in the form

of stars, closed his eyes, and puckered his lips into a whistle, all this to explain the flash of light. Through more investigation, it is discovered that the image in his memory is accompanied by that expression. Again, Santa Pri proclaims, “Look at the waves, there they are!” The researcher-artist looks into the surf but he sees no fish.

Analyzing the images, the first mental drawing is of oral and gestural expression, the second is of the memory of the fisherman, the third drawing is a contextual image and the fourth an analysis of the videos, voice recordings and photographs. The researcher-artist classifies these images and creates visual codes that he has identified during the interviews to generate new knowledge about the ideological heritage of fishermen. To verify these images and the information that appears in the drawings, new ones are created to show the fishermen. The drawings must be verified and confirmed by the fishermen to validate them.

As the researcher-artist creates the drawings, beginning with the interrelation of the images found, similarities of the images and the way of articulating them are used to identify verifiable information in the creation of the mental maps in each of the villages. Then, in each village, the convergences of fishing activities and the creation of navigation maps and fishing exploits are sought. A new image is drawn and it is shown to the fishermen for verification. These drawings are a creative process that goes from the fishermen’s mind through different supports of the image and then generates a new drawing as another support.

Energy and decisive action is evident in the creation of the drawings of the mental images. In this sense, we rely on Antonio Rabazas when he declares, “three concepts seem fundamental to us in art: matter, energy and information. An artist injects energy into the material to create information” (Rabazas, 2004). The drawings by the researcher-artist represent matter, energy and information interwoven in the brain creating an image. The energy from the stories from the fisherman’s memories is captured and applied in the images. The image is taken to the visual, not imitating what the fisherman says, but recreating visual codes extracted from the fisherman’s mind. There would be no value to visualize what the fisherman says literally. Where would the creativity, matter, energy and transfigured information be?

The art of this researcher-artist gives a new meaning to natural signs of the Colombian Caribbean.

The Ethnography of the Sensory Image

This research is developed incrementally and is based on ethnography through field work in three traditional fishing villages in the Colombian Caribbean. Spending time with the fishermen of these villages, the researcher-artist and cameraman earned their trust with the goal of collecting relevant information providing the primary source in this study. The traditional fishermen share their knowledge through the spoken word in interviews recorded in video and audio. The recordings of the oral histories and life stories of the fishermen are analyzed for understanding. The ethnographic process allows images from the brains of traditional fishermen to be extracted so they are visible. Moving from the spoken word to the visual image, drawings are created by the researcher-artist.

The traditional fishermen’s mental maps have meaning, which is understood initially, but in order to record these images it is necessary to rely on a new means to visualize them. To gain even more clarity and understanding, the researcher-artist then creates different images with visual codes and a metalanguage. The sensory ethnography of the image is then supported by means of photo elicitation as in Sara Pink’s book (Pink, *Doing Sensory Ethnographic*, 2012). This enables the fishermen themselves to recognize, validate and verify the same images they had previously narrated to the artist.

Empirical knowledge is possessed by those who fish. Humberto Maturana discusses “the biology of knowledge... If someone says something, I hear something, but what is said is determined in me. He who listens determines what he hears, not he who speaks. This is very important because it defines what you hear. One would have to listen to the other when he says something, if he honestly wants to be heard when working together, because one can say something in a fourth domain, and be heard in another domain. The other must do the same if he wants to collaborate” (Maturana, 1996). Maturana’s “biology of knowledge” demonstrates the importance of knowing how to listen and how to have patience, virtues vital to this study. Another skill relied upon for this research is listening with the intent to analyze. Careful listening and much patience is required to identify how fishermen locate the marks on the shore, making mental lines as on navigation maps, the mental paths used to move through the Caribbean Sea. Referring to images and the way

images are interpreted, Paul Klee proclaims, “art does not reproduce what is visible, rather it makes it visible” (Chaplin, 2002). The images visualized from the minds of fishermen have codes that go beyond what is observed with the naked eye, including interpretation of emotions (ethnography of the sensory image) elicited during the act of fishing and how these experiences and feelings are related to the visual images, which lead us to see beyond the visual codes.

As the researcher-artist showed the fishermen the videos of their own interviews, the emotions and feelings expressed gave to the artist more depth and a clearer understanding of the ideas documented in the images being put on paper.

Visualization of the Drawings Created by the Researcher-Artist

The world of the traditional fisherman is full of emotion, imagery, symbolism and fantasy. The act of drawing brings forth the interpreted image, containing many symbols and revealing sensations and actions as an integral part of the story told by the fisherman. In turn, the researcher-artist offers the images to each fisherman for his reflection of how he sees his world.



Drawing N ° 25 Artist: Fabian Leotteau

Title: “Dance with Feathers”

Technique: Graphite and ink on paper

Dimension: 21.59 cm x 27.94 cm

The complexity of drawing enables a meaning to be derived from life experiences. Drawing opens a door to cultural identity. “Ideas will gain in expressiveness only by elaboration through mental processes. For Arnheim the basis of thought is the human capacity for abstraction. In addition, he distinguishes two types of expressive thinking: the intellectual and the intuitive. The latter is based on the productive - that is, the creative - thinking of the sciences, the arts and design” (Bürdeck, 1994). Consequently, the fishermen’s capacity of intuitive mental map making shows the capacity of humans for abstract thought.

WJ Mitchell comments, “To derive a model of pictorial self-reference from art or language I want to experiment with the ideas that the images can reflect on themselves, capable of providing a second order discourse that tells us - or at least shows us - something about the images. So, my procedure will be

of ekphrasis. That is, I will only try to offer to make faithful descriptions of a series of images that, in their own way, seem to be self-referenced. This poses an obvious problem for the pretense implicit in the concept of “meta-image,” which suggests an attempt to construct a second-order discourse on images, without going into language, without acquiring eclecticism” (Mitchell W., 1994). Therefore, the artist’s drawings of the fishermen’s mental maps, are the product of the analysis of the images, from both video and audio. The images created are a new metalanguage, through points and lines of graphite and ink, of visual dialogue. New interpretations are generated from lines and points in the new drawings generating a ‘meta -image’ which are later converted into visual dialogue known as “ekphrasis or ephrasis, from the Greek for the description of a work of art produced as a rhetorical exercise, often used in the adjectival form ekphratic, is a graphic, often dramatic, verbal description of a visual work of art, either real or imagined. In ancient times, it referred to a description of anything, person, or experience (Harrap, 1993), a system that was created to better understand works of art.

The mental maps correspond to the fishermen’s knowledge and mental navigation charts for successful voyages through the Caribbean Sea to the best fishing places. These mental navigation maps are instruments of empirical and intuitive navigation. As Julio César Goyes maintains: “...and without the oral and written navigation charts the hypertext navigator cannot go to any part of it” and further states that “hypertext is the desired freedom and that the author can be autonomous and creative” (Goyes, 2003). In this sense the mental navigation charts of traditional fishermen are not visible but without them the fishermen cannot successfully sail the Caribbean Sea. Fishermen determine their fixed points on land, identified as central axis of location as if they were coordinates to move through the sea, and to identify where they leave the fishing traps. This process requires that the fishermen locate two fixed points (x, y, y z), and the boat (a), also known as triangulation, that moves in one direction through a moving plane, the Caribbean Sea. Therefore, it can be observed that fishermen are empirically and intuitively resourceful. They visualize marks or points on shore and keep them in memory, to keep from getting lost at sea.

The fishermen create their own symbolic world from their experiences based on where they live, using marine and social images, converging in imaginaries

(subjective expressions of group self-conception) (Salmeron, 2011). As Salmeron says, “In this way, to look, to act, to ‘behave,’ to identify oneself or to value socially have their place in these imaginaries, those that are in permanent process of formation and change, and specifically the transformations experienced through optic technology, as well as in the chemistry of the physiological processes. Hence the imagination also creates a sort of bridge between the subjective and the social, within an intricate set of symbols and actions. Thus, the type of gaze, the tastes, the formulation of the aesthetically “correct” and the representation of all this sociocultural environment, the same as the artistic manifestations, that in the field of psychology, that of biology, physics or optics or other disciplines and in all types of sensory perception of humans” (Salmeron, 2011). It is noteworthy that the analysis of moving images begins to awaken a series of sensations about the representations of the sea floor by color, optics and how to see in that dreamlike reality felt when analyzing images of the depth of the sea.

The drawings created by the researcher-artist are the extraction of the experiences and mental maps of traditional fishermen during the investigation, revealing the ideological patrimony of those fishermen. The system of ekphrasis helps the viewer to comprehend the drawings created by the researcher-artist better, describing each drawing in terms of internal structures, technique and concept with a goal of greater understanding.

The drawings are presented as visual interpretations to two fishermen, to verify each drawing’s accuracy concerning the stories told and fishing practices pictured. One fisherman, Ricardo Amilcar Avendaño a past student of Fine Arts, possesses an understanding of the process of drawing. He is a vital resource that strengthens the research due to his knowledge and experience in both fishing and drawing.

The drawings, or visual interpretations, are integral to allowing the viewer to see the results of the investigation. The analysis of the drawings of movement is a creative process that truly enriches the information collected. As often occurs, the creative progression generates resemblance, convergence and new images in visual thought where the word does not exist, as alluded to by David Bohn in his book, *On Creativity* (Bohn, 2002). These new images generate new ways to observe the location marks, experience the exploits and attain greater understanding of skills and tools used by

traditional fishermen. The results of this investigation produce new knowledge and reveal the ideological patrimony of traditional fishermen.

In the drawings two important aspects are observable. The first can be identified as presentation and visual support: expressions that the fishermen themselves identify in the drawings, visual systems with autonomy full of signs and symbolism which evoke a dialogue with the viewer.

Presentation manifests through the intensity of the line, the movement in the sketch, the sequence and the continuity of line, dots and spots or stains of color, executed with the technique of graphite in its different intensities and colored inks, applied to paper 21.59 cm x 27.94 cm. The second observable aspect is visual dialogue: the results are revealed through a visual dialogue the researcher-artist communicates concerning the results of the investigation extracted through visual codes in a metalanguage. The drawings not only identify fishing locations but also how the fishing exploits are verbally expressed, with emotion and energy, containing information that only exists in the memory of the fishermen. These stories sometimes reflect fantasy versions from the memories of the fishermen themselves. Retold, during daily tasks, and embellished each time with imaginings of the fishing world, the imagery of the villages studied becomes somehow more significant as repeated and often fueled by the emotions and feelings which are displayed as the stories are shared. As the audio and video images are being analyzed, notes are taken as drawings. The stories are decoded and then coded again visually, moving from the oral story to the visual image.

The lines, dots and spots of color create a metalanguage in the new image, so the message conveyed displays the mental maps of the traditional fishermen. From the notes of the researcher-artist the analysis of images is observed. A glossary of images is then created, defining the relationship between words and images in visual codes through a metalanguage that result in a visual dialogue.

It can be said that mental maps focus on the space-time schemes in the cultural context of the fishermen as well as on the exchange of symbolic worlds initiated in their own reality. The researcher-artist is interested in establishing visual codes to make these images visible within the consideration of what represents art and what does not.

Fishermen rely on memory to create paths or mental maps with points of location to find the best fishing. It is fascinating to observe that when the fishermen decide to meet to go fishing, they already know where they are going. In fact, the empirical experience of this knowledge possessed by fishermen allows a reflection on the articulation, divergences and similarities in the creation of these mental maps and their function for the benefit of the community.

There are several components that contribute to the complexity of the mental map including the social sciences study of emotions and feelings, recognition of site geography (water currents and wind direction), the depths of the sea, the displacement of an object (the boat (a)), on a plane (x, y, y z axis diagram), in constant movement (the sea), and the color of the sea and its behavior (characteristics). All this information makes the mental map stronger and more complex.

The fishermen's mental maps are complex but their purpose is clearly the location of outstanding fishing. Mental maps are tools of knowledge including all the components previously mentioned, but also containing individual visual codes and symbols specific to each fisherman and therefore non-transferable from one fisherman to another. A fisherman, in his own mind and imagination, creates mental maps to locate himself on a moving plane. These empirical resources are what make traditional fishermen's mental maps truly complex and unique.



Drawing N° 3

Artist: Fabian Leotteau

Title: "Lakari's world"

Technique: Graphite and ink on paper

Dimension: 21.59 cm x 27.94 cm

This drawing is the interpretation of Santa Pri's description of his mental images. This image shows a fight between the aviary and marine worlds where many small fish (lebranche mullet) are being brought in by the waves and a heron is diving into the waves to eat them. Due to his knowledge and experience, Santa Pri immediately encourages his friends to join him on a fishing trip the next day, because he predicts that the next day they will find many of these fish in the sea. Indeed, the next day, when the community goes out to fish, they bring in a large catch. The sequence of images or mental maps can be visualized as follows: The first drawing is the fisherman's location map. The second drawing is the fishing experience. The third drawing is the fisherman's oral and gestural story. In each image the emotions and feelings of the story are visualized. The

researcher-artist then analyzes the images using visual codes that have been identified from the fishermen to create a final drawing. The last drawing is then taken back to the fishermen for them to validate it.

In conclusion, fishermen's stories begin on the water. To keep from being lost at sea, and to return to the best fishing places, certain fishermen have the ability to create mental maps using their own marks or points as exemplified in this paper by Santa Pri. These mental paths, revealed by the researcher-artist through drawings visualized, form a metalanguage that has its own visual codes, a visual alphabet and a glossary of images. Here, the ideological patrimony originating with and confirmed by traditional fishermen is recreated by the researcher-artist.

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Applying Interaction design for building mediated experiences by Technology to Foster the Ancestral Culture of Colombia. Case: Kosmos Astronomical Museum.

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Abstract

This work develops an applied research that engages methodologies from the Interaction design field (IxD) and user-center design (UCD) methods for building an interactive installation in the astronomical observatory and museum, Kosmos, located in Villa de Leyva, Colombia. Taking as a starting point the construction of an artifact that could efficiently adapt itself to the environment of Kosmos Museum and its surroundings. We construct an artifact that motivates the user to interact with it, promotes cultural identity dialogues and usage of technology on first hand.

The result is the construction of an interacting intervention as the enhancer of dialogues and guidance about a prehispanic megalithic monument, transcendental for the creation of mental imaginaries about the Colombian ancestral cultures. The design concept manages to express itself in an artifact consistent with digital and analogous elements which act as an information processing container by which the museum guides and the visitors can generate dialogue around this chosen topic. Being a source of an attractive and active experience around the topic of the ancestral astronomical observatory built by the Muisca pre-Hispanic culture, 2200 year ago. User to interact with it, promotes cultural identity dialogues and usage of technology on first hand.

Keywords

Cultural Identity, Ancestral Culture, Technology for Peace, Man-Machine Interaction, Interdisciplinary, Museography, Astronomical Observatory, Interaction Design, User-Centered Design

Introduction

The purpose of all the work was to develop a multimedia system, which would allow the implementation of interactive exhibition procedures for the communication, explanation and dissemination of elements related to the Museum and astronomical observatory Kosmos. We applied methodologies Known as User-Centered Design and Design Thinking, in order to create an own methodology that would be adapted to the project. Its main objective was to highlight the most typical

aspects of the context, highlighting the ancestral cultural identity of the region, to explore the environmental and social factors and to work on an artisanal, analogue and mechanical-technology point of view. This methodology was divided in 8 phases for its execution, which focused on: Customer and environment recognition, user definition, requirements definition and analysis, system design and ideation, prototyping and testing system and finally the implementation process.

The context

The astronomical observatory and museum Kosmos is located in Santa Sofia town at 8 miles away from Villa de Leyva in the department of Boyacá Colombia. It has an educational program with the objective of taking astronomy to the farthest rural schools in Boyacá, where kids and teens can use a telescope and learn about spatial science, astronomy, physics and chemistry by different programs developed on the museum.

The observatory has a telescope of great coverage and other instruments that serve to observe stellar objects. The museum team offers tourists and amateurs, a program that includes: Introductory talks, astronomical observations guided by experts, management of celestial charts, recognition of constellations and visible celestial objects (the moon, planets, nebulae, galaxies, Comets, among others), Observing the Sun through specialized telescopes, Practical astronomy workshops, Hydraulic rocketry workshops and the 'Kosmos Space Museum'.

The museum also promotes to the public an Ancestral Muisca observatory which is still object of research. This Muisca Megalithic monument is located near Kosmos in the "Parque arqueológico de Zaquencipa", a property of the government located 4 miles away from Kosmos Museum.

The museum handles different topics such as spatial exploration, extraterrestrial live (history and

documentation), even the history of the project “Hermes, el Ratonauta” an own initiative with the objective of sending a rocket crewed by a mouse trained to activate its own parachute.

The Design Problem

The museum and astronomical observatory “Kosmos” has two exhibition spaces: The observatory, with telescopes and instruments for celestial navigation, mainly offering a practical and experimental knowledge; and the Kosmos museum, a place where knowledge about astronomy, archaeoastronomy of the region, rocketry and exobiology is deepened, developing through discourse the interrelation of these topics in order to broaden the understanding regarding this field.

The museum is the space that should have more relevance, due to the ideological importance it represents. This way a digital multimedia structure was implemented, as an artifact which contributes with the activities developed within the museum for the user’s, implementing a flashy and innovative mechanism in place.

It was evident the problematic with respect to the little use of modern digital media, which would make easier the work of the museum as a divulger entity of scientific contents. Through the interactive tool, it is achieved to modernize some of the everyday activities developed by the museum team and also motivate the viewer with the use of didactic means.

The research problem of the project, as well as its main motive of action, focused on the development of the three following aspects as fundamental pillars.

Social and Environmental Aspects

The main ideological vision of the Kosmos Museum Project and the Elkeve Foundation, while being immersed in a rural community, remote but prosperous in the Colombian context, is to generate a positive impact on the diffusion of knowledge in themes that can expand the ideas of the students, children, youth and adults who lives in the small rural populations in the sector. Making them participants in an exploratory different space and culturally nourishing.

The rural socioeconomic stratum carries a great number of limitations as to resources and means available for them. Their response has been to generate pro-activity in terms of alternative means of sustainability, from the construction of installations and artifacts in a craft way to the use of clean energy through solar panels.

The project contributes to this vision and lifestyle, not only with an interactive and multimedia experience of knowledge but also:

- Implementing a final product adapted to the social and environmental context of the place.
 - Making a viable resource use for the museum.
- Designing an installation that doesn’t interfere with the artisan landscape, nor with the countryside experience that is lived in the museum.

Interdisciplinary Aspect

Aspect that refers to the development of a project of collaborative nature, which mainly integrated the disciplines of Graphic Communication Design and Multimedia Engineering as part of a single core of work, on par and together with other areas of knowledge backed by the Team of the Kosmos Museum such as Psychology and Social Communication.

Technological Aspect

This aspect refers to the importance of re-interpretation and exploration of existing technologies, both from the stage of ideation and conception of a development idea and in the subsequent prototype processes, experimenting with modern and alternative devices, both digital and analog.

Theoretical Framework

The Design and the Interaction as Common Territory between Two Disciplines

“Design is the conscious and intuitive effort to impose a meaningful order” (Papanek, 1984, p.4).

From a general framework, the concept of design is approached in different fields and disciplines as an activity focused on the planning, configuration or generation of project strategies aimed at solving specific problems whose nature varies depending on the field of study, application and pursued purpose. However, its basic features and methodologies are still maintained in distant disciplines such as business, marketing, engineering or graphic design. The universal design process represents the continuous and systematic iteration, in where research, prototyping and evaluation techniques are retaken in order to achieve a specific development purpose. Actions adjacent to design processes are linked with the collection and analysis of data, identification, and understanding of associated problems, decantation of alternatives and evaluation of

solutions with the purpose to make assertive decision making, taking into account factors such as the context, the user and the resources.

The design process, seen from the field of engineering, focuses on the resolution of practical problems applied to mankind benefit, in where any natural or artificial resource is seized in favor of generating potential developments for the economic use of human society.

“Mathematicians, physicists, chemists and other scientists seek unique solutions to the problems that they investigate. In other words, each of these problems has a one-of-a-kind solution. In contrast, engineers focus on problems of which there are many practical solutions; they seek the best solution from among these many alternatives... To perform this task in an effective and efficient manner, engineers often follow a procedure known as the engineering design process” (Volland, 2004, p.5)

The multimedia engineering, being a hybrid field between the principles that rule the engineering and the products of the informatics and electronic branch related to the development of new media that facilitate channels of communication and information, takes care of the progress in the use of digital and technological systems, that transmit information in a visual, auditory, tactile, textual and interactive way using design processes focused on the user experience.

From the Graphical Communication, the concept of design is assumed to be the process of conceiving, scheduling, projecting, coordinating, selecting and organizing a series of factors and elements-usually textual and visual-with a purpose of the materialization of products designed to produce visual communications. (Frascara, 2006). Ergo, the design for graphic communication focuses on the configuration of content as messages, using visual and symbolic codes that are transmitted through one or more. Likewise, the design of the graphic communication has its own methodology according to the same principles and foundations that rule the process of universal design. Bruno Munari, one of the most important authors in the field, has conceptualized this process as a “project design methodology” (Munari, 2013) which summarizes the process by which a creation concept is materialized in an organized and systematic way to effectively solve the components of a design problem.

The culture around innovation in both industry and current's society is what makes it possible the dialogue

between disciplines and areas of knowledge in order to achieve more products that are increasingly better adapted to the needs of human society, from a general sustainability perspective. Authors such as Francesc Aragall and Jordi Montana raise in their book *Universal Design* (Aragall, 2012), design strategies that modify traditional business models where, when implementing their “Design for all” method, they introduce the understanding and adaptation of products and services to the user, taking into account the human diversity and applying design strategies on transversal way in the different areas of the company.

“Design for All can be applied in each and every area within a Company, from the purchasing department to human resources or customer support to the finance department or production.” (Aragall, 2012, p.20).

In the field of interaction converges a great variety of disciplines focused on the effective design of products, environments, systems and services aimed at human use and the diversity of contexts and social or individual factors.

“We view interaction design as fundamental to all disciplines, fields, and approaches that are concerned with researching and designing computer-based systems for people” (Interaction Design: Beyond Human-Computer Interaction, 2007, p.11).

The Interaction Design

“Interaction design as a discipline is tricky to define. In part, this is the result of its interdisciplinary roots: in industrial and communication design, human factors and human-computer interaction. It's also because a lot of interaction design is invisible, functioning behind the scenes” (Interaction Design: Beyond human-computer interaction, 2007, p.11)

When it comes to defining the design of interaction there is a wide variety of schools and trends both research and development that bring different points of view. At the same time a great number of methods and methodologies arise to deal with the problems of the field. Among the different schools, there are 3 main aspects from which the interaction design is assumed according to author Dan Saffer. The Technology-Centered View, The Behaviorist View, and The Social Interaction Design View (Saffer, 2010, p.5). The Technology-Centered View is based on making technology, particularly digital, useful, usable and enjoyable to use. The Behaviorist View is based on defining the behavior of artifacts,

environments and systems according to functionality and feedback and The Social Interaction Design View, the third and broadest perspective of interaction design, is based on the concept of facilitating and enhancing human communication through the products that it uses, in this aspect any object or artifact can be used to make a connection between people.

This last perspective, also known as Social Interaction Design is the philosophy that was considered most pertinent to the development of the project, being the branch that allows a process of experimentation through different tools and technologies to design a product with a social benefit that strengthens human communication, and in this particular case, enhance learning experiences.

One of the most famous methods of user-centered innovation is the design thinking process that is based on combining design sensitivity with problem-solving methods and applying it to any context, regardless of the nature of the problem (Lockwood, 2009, p.6). Actions such as understand, observe, conceptualize, validate and implement are the methodological approach of Design thinking for the development of products.

From these two work perspectives a perfect integration between project thought, focus on the user and problem solving is achieved. Fundamental factors for developing a project in interaction design.

“Designing isn’t about choosing among multiple options – It’s about creating options, finding a ‘third option’ instead of choosing between two undesirable ones” (Saffer, 2010, p.6).

Interaction Design for Museography

Information design is defined as the art and science of preparing information to be used by humans efficiently and effectively. Its main objectives are: First, the development of comprehensive, fast and aptly memorable documents that can be easily translated into effective actions; second, design interactions with instruments that are easy, natural, and as enjoyable as possible. This involves solving many problems in the design of human-machine interfaces; and third, enable people to find their way into three-dimensional spaces with ease and comfort (Jacobson, 2000, p.15).

The psychology of learning, attention and human behavior provide important implications for the design of signage, thematic exhibitions and self-learning

support in public spaces. In this way, one of the most important challenges in the application of information design is the purpose of communicating knowledge, ideas, and concepts in public spaces such as museums, zoos, science centers, botanical gardens or shopping centers. (Jacobson, 2000, p.15).

Messages transmitted in such spaces require the willing cooperation of potential recipients of information while surrounded by options and distractions. Visitors are not required to pay attention, ignore or distort the messages being communicated. In such cases, it is immensely important to design information systems that not only reflect the needs and characteristics of the audience but also attract and maintain their attention (Jacobson, 2000, p.15).

In this project, the use of technology is focused on the objective of attracting and maintaining the attention of visiting users to the museography space, also collaborating on the development of a thematic concept that collaborates in processes of instruction, motivation, memory, perception, and other social factors.

If the objective of implementing a thematic concept is to provide a learning experience or recognition of a specific knowledge, it is important to maintain a visual language with the high use of images at high levels of abstraction, in order to enhance memorization and understandings through Schemes in moving images. This, since the figurative expression, can complicate the message which is tried to be transmitted clearly and evidently.

Methodological Process

The realization of this project took into account the applicative purpose of the final product. The methodology implemented was based on 2 research methods that facilitated the workflow for the Design and Development processes. The first one: User-Centered Design (UCD) which raises the understanding of the context and its relationship with the user, contains within its methodology the application of good practices in product development and also allows to generate a clear and evident information structure of the evolutionary process of the project.

The second is the methodology of Design Thinking, which allows visualizing, in an efficient and agile way, the best solution alternatives, focusing on the interaction with the end user. These methods revolve around feedback, planning, and data collection techniques.

In the first phase, a client brief was carried out, in which the testimonies of the people in charge of the museum were collected to define a document of first-hand requirements: A durable installation was required, information about their target market, the visitors to the museum; As well as answers to open-ended questions related to the recognition of the roles they played, their tastes, their experiences, etc.

In the second phase, an ethnography of the place was carried out through survey and interview with a representative sample of 24 people. In order to perform a better understanding of the environmental variables such as the origin of visitors, their identity data, the perceptions of the museum, the learning experiences at the museum etc. It also included a deep data collection of the museum and its surroundings in a social and cultural level to understand relevant influences taking place at the context.

From this analysis, two types of user actors were defined: user type A (visitors) which comes from different areas of the country and worldwide defined mostly by tourist adults and companions. Type B users who are specifically the guides of the museum, they are both client and system administrator's users in which they enter a direct interaction and decision making for the product.

Once the user types and their characteristics were defined, it continued with the criteria definition that were classified as functional requirements (requirements that are essential and directly affect the interaction of the system) and non-functional (requirements that emphasize the form of how the system should be, that do not affect the interaction or experience of the system). These requirements were essential for the idea approach and the definition of the implemented product design.

Prioritization of Requirement	Description	Category Research Origin	Type
1. Context adaptation.	The system should not cause interference with the visual environment in which it is located.	Actors Category	NFR

2. Use of metaphors for analogic practices.	The system must provide a practical and tangible experience to the user.	Actors Category	FR
3. Development of the Muisca Observatory as the main thematic.	The system must fulfill the function of explaining the thematic of the Muisca observatory from the three moments of the discourse from the museography script.	Actors Category	NFR
4. Provide an experience of knowledge and learning.	The system should not be a distraction of the thematic guidance. Appeal for clarity and understanding.	Actors Category	NFR
5. Provide a Living Experience.	The system should use multimedia content that stimulates the 3 senses (touch, sight and sound) but privileging the visual language and scene performance.	Actors Category	FR
6. Product usefulness, long life.	The system must be durable for up to 2 to 5 years.	The Client	FR
7. The system must be intuitive and have a manual mode.	The system should improve the capacity of attention for a greater density of visitors by route.	The Client	NFR
8. Use of a referential public as the end user of the system.	The user tests will be directed to the most frequently visitors.	Actors Category	NFR
9. Use of alternative resources offline	Appeal to the use of alternative and environmentally friendly resources that satisfactorily adapt to the rural environment and the rustic style.	Ethnography	NFR

10. The contents must have a formal tone and develop the importance of the ancestral Muisca legacy	To contribute to the mission of the museum on improving the public's perception of the Muisca Civilization.	Ethnography	FR
11. Resistant structure.	Due to the environmental conditions and the frequent presence of children, the device must be firm and resistant.	Ethnography	FR

Table 1: Functional and non-functional requirements

In the ideation phase were made the possible solutions or ideas for development. A brainstorming process was carried out in which 16 alternatives were proposed with their respective experiences, as well as a process to select the best alternative solution for implementation. For this purpose, the AHP (Analytic Hierarchy Process) proposed by professor Saaty in 1980. The method was used to quantify the value of each solution with each requirement and the general objective of the project.

Of the 16 evaluated ideas by the AHP method, each one received a weighting that equals the weight of the idea respect to the more accurate compliance with each requirement.

The selected idea was The Interactive Wood Fire, a museography exhibition whose design concept is to re-create the environment in which stories are told around a campfire, as also in the ancient indigenous oral tradition. The rural atmosphere and darkness present in the Kosmos Museum represent the perfect environment to carry out this type of interactive experience.

It is a tool where through a holographic module and a control command a staging is performed through an artificial bonfire, the system is ignited through a sensor of fire that gives rise to the holographic contents starting with the holographic projection of a bonfire following animated infographics around the contents that the guide is explaining and controlling trough the control command. That's how the dialogue on the megalithic indigenous monument The Muisca Astronomical Observatory start.

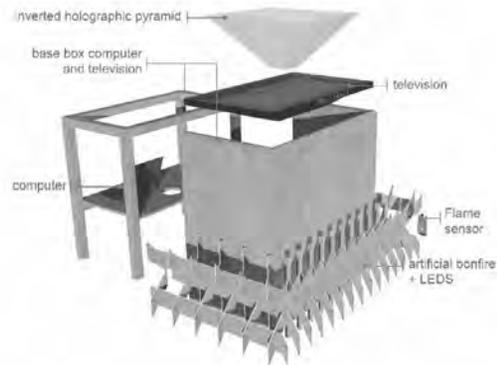


Figure 1. Explosion diagram, artificial bonfire

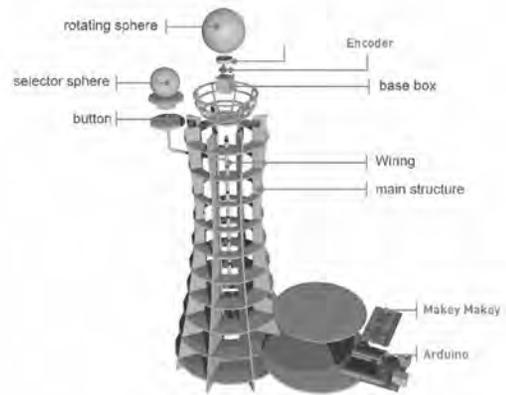


Figure 2. Explosion diagram, control command.

The flame sensor, upon detecting fire, lights the Arduino and the LED's of the campfire, unfolding the interface. To select a content between the options, the rotation is triggered on the control knob, and to select the content, press the selector button beside controlled by the Makey Makey.

On phase 7, Prototyping and Testing, prototypes were used to represent specific functions to evaluate the experience, as well as sample contents to receive feedback from users (specifically type B users). Each prototype was intended to test each experience designed in the previous phase and see what errors, changes or improving could be made. A total of 2 functional prototypes were made for the system (Test visualization and operation of sensors) and a pre-visualization of contents.

And in phase 8 was done the implementation process of the final product, taking into account the feedbacks of the functional prototypes made in the previous phase, and making respective modifications. The final construction entails the structure, the final software, and the contents.



Figure 3. Final Product

Conclusions

Successful Diagnosis of the Context

The successful diagnosis of the expository processes and the available technologies existing in the museum generated all the necessary information about resources for the system construction. Crucial information was collected through the research techniques ethnography and interview, which helped to create design criteria to achieve the implementation of a new environment in the museography scenario without affecting the essential conditions of the context. The factors took into account thanks to the diagnosis were:

- Propound a development strategy with low-cost materials and technology so that the museum could afford the investment.
- Successfully adapt modern digital technologies to the rural area without generating dissonance in the

analogous and country style widely valued by the visitors of the museum.

- Find the strengths and weaknesses pivots of the explanations generated by the museum to enhance the strategies to be implemented in an interactive learning experience at the place.

- Develop a valuable and important thematic for the project that at the same time constitutes a real interest for the museum and its visitors at the same time.

Thanks to the process of analysis of collected information, it was possible to identify aspects that gave value to the museum, rescuing its value as a place that being separated from the urban area could locate the visitors in a different environment from their daily life, the museum appropriates and takes advantage of the artisan landscape to envelop the visitor with the concepts they want to transmit.

An Interactive Installation of morphological and semantic characteristics designed for Interaction with the user was designed including a visual treatment according to the context of implementation and the functional requirements found during the diagnosis.

One of the main conclusions of the implementation of the project was the use of this rural, analog, quiet, secluded, rustic and artisanal environment to envelop the user in a learning experience that attracts and manages to maintain their attention. The installation takes advantage, for example, of the deep darkness present in the place to develop a lights show that at a first sight impacts and works as a curiosity incentive to the visitors, this in order to propitiate the learning experience according to the strategy from the interaction design.

Marks in the Social and Environmental Aspect

It was made the first development of an interactive multimedia system in a museum for the region of Santa Sofia, Villa de Leyva, being the Kosmos Museum a leading entity for the local community and the public educational entities of the region, this project contains a large scale an intrinsic value related to create a positive impact on a rural community such as the sector of Santo-Ecce homo, specific location the project development.

The Kosmos Museum project is an example to follow being the type of initiatives that the country needs to achieve positive cultural transformations

and social evolution, facilitating the explanation of topics like astronomy and regional archeology to the rural zones, introducing science topics missing in the public educational framework of the country. The implementation of this interactive installation has collaborated widely as its main tool available for the explanation and dissemination of information about the ancestral legacy of the Muisca culture, a historical item for the region.

Currently, the implementation phase has been carried out effectively and in a sustainable way for Kosmos museum. It is worth to highlight the usage of recycled materials for the construction of the installation in coherence with the eco-sustainable perspective of the Museum proactive on this subject.

The installation is constituted as an entity that facilitates processes of dialogue and connection between people around a topic that directly intervenes with the social imaginary about the ancestral culture of the country and that experience is capable of strengthening processes of social and cultural identity.

Reinterpretation of technology.

The experimental process and investigation of new accessible and novel technological resources whose main functions have been reinterpreted and reused for the configuration of a new system that also mixes analogic artifacts and any type of object that could be used to enhance the design and development of a product in the field of interaction design and user experience.

This was how a conceptual and personalized multimedia system was created to meet the needs of a local context in a rural community in Colombia, using various types of technological resources from different sources to give life to a design concept, they were used different media available in the market such as MIT inventions like “Makey Makey”, or materialized 3d designs with lace techniques for structural purposes and an acrylic pyramid used to create holographic optical illusions.

More about this project on: www.interactivewoodfire.co

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Urban Mesh: Exploring Data, Biological Processes and Immersion in the Salmon People

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Figure 1. *Salmon People*, 2015. Surrey Art Gallery's UrbanScreen. Andreyev and Overstall Press shots used with permission of the artist.

Abstract

Information systems are continually recontextualizing data, migration patterns, biological components and processes, between life and code. As Geographer Eugene Thacker states, these systems can be scientific, or many things, with lasting effects that are cultural, social, and political. As these systems evolve and grow, so to do the artworks created in the afterglow, becoming vital reflections of our contemporary algorithmically soaked culture. This paper examines these ideas alongside the *Salmon People*, a video and sound installation thematically concerned with the shared dark ecologies of nonhuman and human animals. Like information flowing through high tech super highways, sockeye salmon deftly negotiate seen and unseen geographies, technologies, politics, and cultures. In order to understand the artworks content, sequences and layout, as well as the logic of the shot selections, we conducted a close reading analysis of the installation. We suggest that the work is generative and claim that the projections are made up of 9 videos playing concurrently in 3 large vertical panels. This paper examines these ideas, asking the questions: What role does the screen play in the design of this artwork? What are the types of audience immersion and interaction? Finally, we address the work on three levels: the structural, the narrative, and the immersive. The structural level identifies the key frames, and any overlapping frames. The narrative level investigates the 3 vertical panels in relation to story parameters such as plot and story world. The immersive level considers how the audience oscillates between a heightened state of immediacy and hypermediation.

Keywords

Biomedial, Immersion, Experience, Generative, Projection, Dark

Ecology, Narrative, Research Creation, Data Technology, Algorithm, Hypermediation.

Introduction

Consciously or not, we participate every minute of everyday in the transfer of data along the global information highway. This highway is comprised of a plethora of network cables hidden often beneath our feet, laying in sinkholes, and sprawled along the ocean floors (Starosielski, 2015). These cables send data into the skies and back down to the earth again. This infrastructure carries and connects us all virtually into the transoceanic internet traffic filled superhighway. As writer Susan Buck-Morss describes, we are all implicated in this exchange of power, integrating technology into our daily life practices as tools and as weapons that extend the human relationship, whilst “at the same time intensifying the vulnerability of what [Walter] Benjamin called the tiny, fragile human body” (Buck-Morss, 1992, p. 33). Thus, data systems are everywhere, part of the air we breathe, part of our bodies, part of our urban and wild cultural ecologies.

Drawing inspiration from these ideas, we introduce the *Salmon People* (2014), a video and sound installation by Canadian artists Julie Andreyev and Simon Lysander Overstall. The piece presents audiences with glimpses of spawning sockeye salmon migrating across urban landscapes. This artwork alludes to information systems, making the invisible a visible part of our everyday. The sockeye are projected onto surfaces to showcase salmon swimming around our information highways, deftly defying consciousness, time and space, as we understand it. Likewise, as Eugene Thacker suggests art and life are inseparable, a form of Biomedial. Biomedial can present us with a “unique instance in which biological life itself is at once the tool and the object, the product and the production process” (Hansen, 2010, 127). The fruit of

what Thacker is revealing to us is outlined in these two statements: Biomedica is life working upon life; biology and technology are inseparable. Drawing further inspiration from these ideas, we discuss the foundational poetics on which the artwork presents itself, describe the primary modes of observing the installation through fast, and onsite viewings. Followed by a discussion of work in relation to contemporary installation and projection practices; a form that was first introduced by magic lantern artists in the 1700's.

We present a series of analysis, beginning with several key authors in the fields of narrative, immersive and interactive aesthetics. We examine how the audience oscillates between a heightened state of immediacy and hypermediation. In particular, how the piece offers the audience a chance to witness sockeye salmon swimming through oceans often back-dropped by urban cityscapes.

Andreyev and Overstall's *Salmon People* is a dynamic artwork using data and biological phenomenon. Our contribution lies in the investigation of the artwork, to illustrate how experimentation, exhibition and fieldwork can be more valued and widely disseminated through deep analysis. We suggest that the work is an important addition to the ISEA community because it provides a unique viewpoint about the interrelations among art, design, biological processes and technology. We believe that technology systems and data formations can often be intrusive to biological systems like sockeye salmon. This artwork is a source of inspiration, bringing awareness to fish, on a peace keeping missive, moving through human and nonhuman landscapes, cultures, and media politics.

Terminology

In this paper we introduce several important terms that we use to frame our discussion of the artwork *Salmon People*. These terms are: Triptych, Mesh and Dark Ecology, Biomedica and Vitalism. Each of these terms has a unique history. We do not attempt a comprehensive overview here, as this is not our aim. Instead, we build a framework that overlaps and references foundational thinkers.

Triptych

A Triptych is a work of art that is divided into three parts. In historical works such as paintings, the middle panel is often larger than the two other sections. However, in contemporary practices such as video installations, artists tend to use equalized panels (Gardner and

Kleiner, 2009).

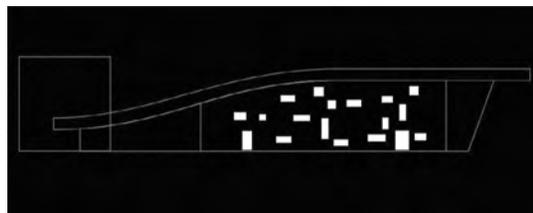


Figure 2. *Salmon People*, 2015. Surrey Art Gallery's Urban-Screen. Installation View.

Biomedica

Biomedica can be defined as the recontextualization of information, biological components and processes, between life and code (Hansen, 2010, 122-123). Biomedica can be scientific, or many things, with effects that are cultural, social, and political (Hansen, 2010, 123). Geographer Eugene Thacker suggests that biomedica is "the ability to create conditions in which biological life itself is understood as being informational and yet not necessarily immaterial" (Hansen, 2010, 124). Further, as information systems and algorithms evolve and grow, they are increasingly seen as vital and adaptable (Hansen, 2010, 117).

Ecology/ Mesh / Dark Ecology

Simply put, Ecology refers to the interactions organisms have with each other, other organisms, and with chemicals of their environment (O'Neill et al., 1986). We have borrowed both the terms Mesh and Dark Ecology from author Timothy Morton. Mesh is closely related to Dark Ecology. Mesh refers to the interconnectedness of all living and nonliving things that consists of infinite connections and disconnections (Morton, 2010). Dark Ecology refers to the horror, ugliness, and irony of ecology (Morton, 2010).

Vitalism

Vitalism means that "living organisms are different from non-living entities because they contain non-physical elements/ governed by different principles than are inanimate things" (Bechtel and Richardson, 1998, Web).

The Installation: Salmon People

Salmon People was showcased at the Surrey Art Gallery's UrbanScreen, Surrey BC. Artists Julie Andreyev and Simon Lysander Overstall created a kind of triptych

installation using projections that show a “below the water point of view” of surviving spawning salmon onto the surface of a building (<http://julieandreyev.com>). The installation was located on the west wall of the Chuck Bailey Recreation Centre near the city center. The building’s roof was built intentionally slanted (see fig. 2). The projections follow the curve of the roof. The videos are projected using two large 2 HD projectors. The projectors use a proprietary software program to map and merge the videos onto one architectural surface (see fig. 3). The piece is displayed in 3 vertical sections, with 9 videos playing concurrently in the 3 vertical sections. Each panel has a Fraser Valley skyline on the top, a salmon shot on the bottom, and an ocean video in the middle section to merge the 3 panels together.

Salmon People was previously shown at two other media events. Firstly, at Interactive Futures 2014: More-Than- Human Worlds at Emily Carr University of Art + Design. Here, the artwork was shown on a single, vertically oriented screen (see fig. 4). This iteration highlighted both sound and video. The video consisted of 3 vertical layers. The first layer was of a Vancouver city skyline on the top, a salmon shot on the bottom and an ocean video in the middle section. The conference explored alternative conceptions of human relations with other animals and the environment using new media.

Secondly, the piece was exhibited at Videographe Gallery in Montreal, Quebec. In this rendition, the scale of the projections was very different from the other exhibitions. The work was shown as part of a festival. Three videos were projected onto the inside of 3 small exterior windows, using 3 separate projectors (see figure 5). Each projection had a Vancouver city skyline on the top, a salmon shot on the bottom and an ocean video in the middle section. The audience was able to witness the work from the street or sidewalk after dark. Notably, there was also an accompanying soundtrack that consisted of water, nonhuman and human synthesized and found textures.

Artistic Context

The projection as an artistic tool has informed many artists including Michael Naimark’s *Displacements* and Ron Arad’s *720 Degrees* to name but a few. *Salmon People* draws from a rich history of environmental/ installation art in public spaces such as Joseph Beuys’ *7000 Oaks*, Christian Moeller’s *Hands*, and Jean-Paul Riopelle’s *La Joute*. The first large scale projectors were

built at the beginning of the 20th century. They were first used to create background ambience and support performances in opera houses and theatres. Large format projectors have also served as inspiration to artists such as Schneider-Siemmsen and Herbert von Karajan (*The Cosmic Space of Gunther Schneider-Seimssen*, Website). Large Format Projections have also been an inspiration for contemporary cinema and by artists who desire an extremely powerful video or film output (Suzanne, 1995). The rapid advancement of projector technology over the past 15 years has enabled artists and filmmakers to portray seemingly ineffable gestures with a facility and immediacy that was not possible only a short time ago (Cadena, 2006). Also the variety of these artistic forms and genres demonstrate the elastic potential of the projector to generate innovative aesthetic fragments and ethereal visual landscapes. It is not surprising that artists such as Andreyev and Overstall have taken up these new consumer grade technologies for artistic production.



Figure 3. *Salmon People*, 2015. Surrey Art Gallery’s Urban- Screen. Installation views.

Audience Engagement

Audiences are currently able to view the piece in the evenings, from dusk to midnight. During the daylight hours, the work exists only online, in print and in our memories. The viewer can choose to engage with the piece in many ways: via a Skytrain ride, sitting in a car or bus, or on foot. We chose to do a close reading of the *Salmon People* using all of these options. Each viewing offered us a unique opportunity to experience the work in a new way. We discovered that no two viewings are the same.

Fast Viewing: Skytrain

Observing the *Salmon People* required multiple viewings, over many days, from varied angles. One approach we used was by frequent evening Skytrain trips on route to and from Simon Fraser University's Surrey Campus. The viewings provided me with a general knowledge base of the location, geographical context and scale of the installation. During our trips, we took photographs and observed the installation from a distance, noticing any changes in lighting, projections and pedestrian movement or participation (see fig. 6). We noticed that the train tracks did not veer left or right of the grounds. Instead, the train appears to move in an arch around buildings and has a constant flow. Perhaps, reminiscent of a body of water, flowing across distance. Or possibly like Andreyev and Overstall's schools of salmon swimming around rocks, buildings, boats, and bridges etc.

OnSite Viewing: UrbanScreen

Another approach we used to observe the work was by multiple onsite viewings. Two viewings were in our car, 1 in a taxi cab, 1 on foot. Each viewing offered a closer reading of the work. We took photographs and video (see fig.7). We tried to reverse engineer the 3 vertical sections. We noted any transitions, repeating imagery, and found no identifiable loop existed. We noticed that the location did not provide monitors or surround speakers for the accompanying soundtrack (listed on press material). We also took notes on details such as where the projections came from, the ideal spot to witness the piece, and how often the Skytrain passed by the location. Other observations included: the projection depth, architectural structures such as the community centre, parking lot, skate park, artificial turf, grass hill, closed off seating area, road, skytrain, and tracks etc. We noticed muffled sounds of the Skytrain passing, cars, skateboarding, and sometimes people playing soccer on the adjacent artificial turf field. We observed that the live soundtrack comprised of water, human and nonhuman synthesized textures is not presented in this version of the installation. Being able to listen to the soundtrack would arguably, create a deeper immersive experience. These details became a constant backdrop while watching the video sections unfold.

Analysis

Upon analyzing the work a few questions arise. What role does the screen play in the design of this work? What are the types of audience immersion and interaction? In the following section we analyze the *Salmon People* on three levels: the structural, the narrative, and the immersive. The structural level identifies the key frames, and any overlapping frames. The narrative level investigates the 3 vertical panels in relation to story parameters such as plot and story world. The immersive level considers how the audience oscillates between a heightened state of immediacy and hypermediation. Finally, we locate the work in the contemporary art context and analyze the work alongside foundational authors in the field of new media.

Structural Level

Salmon People appears to be a large-scale triptych at first. Further analysis reveals multiple videos, and overlapping key frames. The screen consists of 3 vertical sections, with 9 videos playing concurrently in the 3 vertical sections. Each panel has a Fraser Valley skyline on the top (city skyline or river skyline, an intersection of river and the industrial city, almost wastelands), a salmon shot on the bottom and an ocean video in the middle section to merge the 3 panels together (see fig. 8). The middle section serves an important role: to merge together the bottom and the top video frame. Sometimes the middle images blur for a moment to display faint reflections of grass or trees. The 3 vertical sections continuously play until one section fades out and another appears in its place. The overall panel imagery consists of sockeye salmon, ocean views, industrial cranes, paddle boats, tugboats, logs, barges, birds, bridges, trees, skylines, and cityscapes. There is no discernable



Figure 4. *Salmon People*, 2014. IF2014: Emily Carr University of Art + Design. Process photo used with permission of the artist.

loop. The video footage is layered, with nonrepeating patterns. Certain elements are mirrored more than once such as bridges or boats moving along the water or images of birds. However, each video contains a slightly varied frame, or sequence of the same location. The middle section seems to shift slowly over time; the water line rises higher and lowers as the piece moves through different segments. The work is site-specific in one way. The top video panel shows skyline footage from the Fraser Valley landscape and surrounding oceans. This is different than earlier *Salmon People* renditions shown at Emily Carr University of Art+ Design and Videographe Gallery.

Audiences engage with artistic works in many ways and with many different, oscillating perspectives. Philosopher Umberto Eco in his *The Poetics of The Open Work*, suggests that artworks can be both open and closed (Eco, 1989, p. 4). On a structural level, *Salmon People* is both an open and a closed work. The piece offers audiences diverse ways to engage with the material. The viewer can choose to engage with the work in many ways: a Skytrain ride, sitting in a car or bus, on foot, online, in print, casually, intentionally, and accidentally, and through conversations of collective memories.

A work of art, therefore, is a complete and closed form in its uniqueness as a balanced organic whole...Hence, every reception of a work of art is both an interpretation and a performance of it, because in every reception the work takes on a fresh perspective for itself (Eco, 1989, p. 4). Here Umberto Eco suggests that there are many ways to view an artwork. Thus, each viewing of an artwork is a unique, creative experience. Interestingly, Eco suggests that each viewing of an open work provides an audience with a richer interpretation. Alternatively, he also suggests that viewing a closed work will result in a limited number of interpretations. Therefore, a successful work will have multiple interpretations, which in turn increases its “aesthetic validity” (Eco, 1989, p. 3) and transforms our perception of a space.

Narrative Level

Salmon People is a series of visual abstractions. The piece is divided up into 3 vertical panels showing sockeye salmon migrating across the Fraser River. The story is simple, yet complex in its design. Firstly, the title *Salmon People* is taken from a first nation’s narrative (Tom Jay) about salmon that live in houses under the sea. In the story the salmon return home each year and are welcomed in human homes as guests (Andreyev, Website). Secondly, the work appears to be a straightforward triptych but is in fact a 9-panel piece. Each panel additionally portrays an aspect of the overall story. The plot is advanced only when a frame changes such as when a single fish becomes a school of salmon, and then continues on their mutual journey.

Salmon People is thematically concerned with the shared ecologies of nonhuman and human animals. The piece pushes the audience to consider our shared ecologies. Philosopher Timothy Morton in his *The Ecological Thought*, argues of a dark ecology and the irony of our interactions with nature. These concepts provide a pivotal lens to view the artwork, where we can no longer continue to romanticize our mutual existence (Morton, 2010, p. 8-15). The fish shown in the video clips are survivors of the salmon cycle of life. The salmon mesh and interconnect with all living and nonliving things that share the Fraser River such as boats, log booms and bridges (Morton, 2010, 20). Thus, the piece signals an important message to the audience about the importance of our mutually intertwined worlds.

Salmon People is a bi-product of postmodernism. Theorist Lev Manovich in his *The Language of*

New Media, describes one of the key effects of “postmodernism” as that of spatialization-privileging space over time, flattening historical time, refusing grand narratives (Manovich, 2001, p.78). The artwork intentionally flatten(s) historical time and urban space: compositing...superimposing a number of elements... within a single space (Manovich, 2001, p.159). *Salmon People* could fall under several of Manovich’s five principles of new media: Numerical presentation, modularity, automation, variability and transcoding, in particular variability and transcoding, which are useful frameworks to create a complex narrative.

Author Henry Jenkins considers narrative a little differently. In his *Game Design as Narrative Architecture*, he suggests that “spatial stories are held together by broadly defined goals and conflicts” and that plot gets pushed forward by the “character’s movement across the map” (Jenkins, 2004, p.239-240). *Salmon People* relies heavily on this type of “environmental storytelling” whereby the “staging ground” is set and surviving salmon migrate across the screens (Jenkins, 2004, p. 239-240).



Figure 5. *Salmon People*, 2015. Surrey Art Gallery’s Urban-Screen. Press photo used with permission of the artist.

Theorist Janet Murray delves further into how we can actively participate in a visual work. In her *Hamlet on the Holodeck: The Future of Narrative in Cyberspace*, she suggests that some digital works provoke the “active creation of belief” and this function of immersion is reinforced by agency” (Murray, 2012). Here Murray states that a media work or detailed story world can encourage viewers to believe in it (Murray, 2012). Complimenting Murray’s ideas, author Marie-Laure Ryan in her *Will New Media Produce New Narratives* defines narrative as:

[O]ne that brings a world to the mind (setting) and populates it with intelligent agents (characters). These

agents participate in actions and happenings (events, plot), which cause global changes in the narrative world. Narrative is thus a mental representation of casually connected states and events that captures a segment in the history of a world and its members (Ryan, 2004, p. 337).

Ryan’s definition suggests that members who actively participate in their world believe in their world. Thus a digital media world or work of art has the thematic potential to be “affected by historical, cultural, and medical factors” (Ryan, 2004. p. 337). *Salmon People* offers the viewer an open work, devoid of distinct cues, yet organized and orchestrated with sequenced digital images that merge with a certain flow-like state. Authors Laura Ermi and Frans Mäyrä in their *Fundamental Components of the Gameplay*

Experience: Analysing Immersion, describe Csikszentmihalyi’s “flow state” (Ermi and Mäyrä, 2005, p. 2) which resonates significantly with *Salmon People*. The thematic “flow state” of content is accessible and maintains what Ermi and Mäyrä describe as a “particular successful balance...regardless of the skills of the person” (Ermi and Mäyrä, 2005, p. 2) viewing the work.

Immersive Level

Salmon People attempts a type of minimalistic totality – its scale is meant to capture the importance of the salmon’s travels, but its temporality is fleeting. There are many types of immersion. Immersion is the state of consciousness, or perception whereby the user’s feels physically, mentally, emotionally or sensory immersed (Adams, 2004). Immersion can also be defined as when the user feels that the simulated world feels like it is real. Again, in Janet Murray’s *Hamlet on the Holodeck: The Future of Narrative in Cyberspace*, she defines concepts of immersion, agency and transformation. Murray’s description of immersion is especially relevant to this discussion. She writes:

The experience of being transported to an elaborately simulated place is pleasurable in itself, regardless of the fantasy content...Immersion is a metaphorical term derived from the physical experience of being submerged in water...We seek...the sensation of being surrounded by a completely other reality, as different as water is from air, that takes over all our attention, our whole perceptual apparatus (Murray, 1997, p. 98).

Here Murray suggests that audiences can participate and enjoy the experience of learning to swim, and

similarly learning to embrace the participatory activity of exploring new environments or digital artworks (Murray, 1997, p. 99). In Murray's remediated version *Humanistic Design for an Emerging Medium Glossary*, she further defines immersion as:

[The] experience of the interactor, a sense of being contained within a space or state of mind that is separate from ordinary experience, more focused and absorbing, and requiring different assumptions and actions (like swimming when immersed in water). Immersive experiences are disrupted by inconsistency and incompleteness of the environment, and reinforced by encyclopedic detail and a sense of vast spaces within clearly marked boundaries. Immersion is further reinforced in digital environments by the active creation of belief, by which the interactor is cued to explore and to take actions within the immersive world and is rewarded for the actions with appropriate responses. Immersion and interactivity are characteristic pleasures of digital environments (Murray, 2011). *Salmon People* transports audiences into a fantastical space, which is "separate from ordinary experience," where fish are seen below and above water moving through human and nonhuman landscapes. The piece pushes the audience to be "more focused and absorbing" (Murray, 2011) even though a viewer's immersive experiences can be "disrupted by inconsistency and incompleteness of the environment" (Murray, 2011). Here we are referencing the fact that the installation is outside, in a public space, and viewers do not have the same luxuries or comforts of an interior space or contained gallery. Nor is the artist able to dictate and control things such as sound, lighting or weather patterns. However, the artists do have the ability to use technologies such as projectors and mapping software to create works outdoors.



Figure 6. *Salmon People*, 2015. Surrey Art Gallery's Urban-Screen. Taken from a moving train.

Complimenting Murray's articulation, Ermi and Mäyrä suggest a three-part model of immersion: sensory,

challenge-based and imaginative (Ermi and Mäyrä, 2005, p. 1). They state that they approach immersion as one of the key components of the digital experience. Evermore, that "[I]t is often taken for granted that a bigger screen and a better quality of audio equal greater immersion (Ermi and Mäyrä, 2005, p.4)." In the *Salmon People*, the screen is impressively large. The digital experience of "cinema...now becom[es] the cultural interface, a toolbox for all cultural communication, overtaking the printed word (Manovich, 2001, p. 85). *Salmon People* is also a "work in movement" as no two-on-site viewings are the same (Zimmerman, 2004, p. 158-159). Game designer and scholar Eric Zimmerman in his *Narrative, Interactivity, Play, and Games: Four Naughty Concepts in Need of Discipline*, suggests four levels of interactivity: cognitive interactivity, functional interactivity, cultural interactivity, and explicit interactivity (Zimmerman, 2004, p.158-159). He argues that cognitive interactivity is the "psychological, hermeneutic, semiotic reader-response" (Zimmerman, 2004, p.158). Here Zimmerman extends Eco's thought on open and closed works, whereby the audience can choose to view or interact with a media work several times. Further to this, he suggests that an audience can continually shift perspectives with each viewing as our memories can alter our perception of an artwork. For example a person can "reread a book after several years have passed and...find it's completely different than the book [they] remember" (Zimmerman, 2004, p.158).

Memories can be a tricky thing to recreate, capture, and translate into an art form. Moreover, exhibiting a contemporary artwork can be a challenging affair, no matter the medium. There are also many modes and styles of presentation. A work can choose to be interactive or immersive. In fact, the artist creating the work, whether digital or not, can choose to build characters without any individual personality. Author Tom Gunning in his *The Cinema of Attractions*, claims that "cinemas of attractions directly solicit spectator attention" and in doing so the "energy moves towards an acknowledged spectator rather than inward towards the character-based situations essential to classical narrative" (Gunning, 1950, p.58-59). Interestingly, in filmmaker Jim Bizzocchi's *The Fragmented Frame: The Poetics of the Split-Screen*, he discusses how the splitscreen has an under-theorized history in moving image (Bizzocchi, 2009, p. 1-3). He states, "contemporary domestic media technologies privilege the pleasure of complex moving

image narratives and visual constructions” (Bizzocchi, 2009, p.1). While Gunning and Bizzocchi’s ideas are similar, they relate to different aspects of immersion. The mediating qualities of *Salmon People* are an interesting site of contemporary thematic tensions, which “directly solicit spectator attention” (Gunning, 1950, p.58). And, if indeed the split-screen is under theorized, *Salmon People* represents a unique space wherein to further explore because of the intersection of scale, location, economy and history.

In the *Salmon People* the audience can clearly see that the technologies of the built city (skytrains, roads, parking lots, towers etc.) are meant to disappear when viewing the work. Theorists Bolter and Grusin in their *Immediacy, Hypermediacy, and Remediation*, describe remediation as the process by which media “digest” or adopt other media technologies (Bolter and Grusin, 1999). Here, the salmon flows that once dominated the culture of the regions (Fraser Valley History, Website), have been momentarily subsumed by the larger than life representation of both the distant present and the near past. The salmon are not gone. But they are not here, either. They have been remediated into another form of representation only, projected onto a concrete building.

In theorist Marshall McLuhan’s *The Playboy Interview*, he argues that media can be cool and hot. He suggests that in a cool medium many details are left for the viewer to fill in, whereas in a hot medium the details are complete and there is little room left for audience engagement in other ways (McLuhan, 1998, p.246). McLuhan’s ideas are particularly relevant to this discussion on immersion. Using McLuhan’s notions, *Salmon People* is both a cool and a hot work of art. The audience starts off first as a passive recipient, and then becomes active participants, filling in details, constructing meaning, immersing themselves into the artwork. Lev Manovich’s ideas are similar to McLuhan, Zimmerman and Eco’s as they relate to the design of an artwork. However, Manovich’s concerns are primarily with the viewer engaging with a work on many levels and through different pathways. For example, he suggests that oscillations can happen between the user and the screen (Manovich, 2001, p.92). Further to this Manovich states:

[I]n the simulation tradition, the spectator exists in a single coherent space—the physical space and the virtual space that continues it—in the representational

tradition, the spectator has a double identity. She simultaneously exists in physical space and in the space of representation.” (Manovich, 2001, p.113).

Here Manovich argues that audiences continually flip between immersion and engagement. Additionally, in the phrase “[we] simultaneously exists in physical space and in the space of representation,” Manovich poetically describes a complex set of relations that can also be emulated in the design. Manovich argues that the user can exist simultaneously in a physical and virtual space (Manovich, 2001). When it comes to *Salmon People*, this could not be more evident. The audience cannot help but be enthralled with the overwhelming history that has been subsumed, and yet also be pulled into the notable silences that emerge. For example, the silences occur in the layered videos, frames, sequences and images. The piece engages viewers in an artistic discourse, full of “classical, and even more so modern, art [that] is “interactive” in a number of ways (Manovich, 2001, p.56).

Conclusion

Salmon People transports audiences into a fantastical space, separate from ordinary experience, where fish are seen as for their vitalism, below and above water moving through human and nonhuman landscapes. To understand the content, sequences and layout, as well as the logic of the shot selections of the artwork, we conducted a close reading. We introduced the installation and outlined the foundational poetics on which the site-specific piece presents itself. Like ideas and information highways, sockeye salmon are biological, self-organizing structures, deliberately negotiating geographies, technologies, politics, and cultures. To understand these systems, we explored the primary modes of observing the installation through fast, and onsite viewings. We suggest that the work is generative, comprised of 9 videos playing concurrently in 3 large vertical panels using 2 HD large format projectors. There is no discernable loop; video footage is layered, mirrored, varied, sequential, with no repeating patterns. The fish shown in the video clips are survivors of the salmon cycle of life. The salmon mesh and interconnect with all living and nonliving things in the Fraser River such as birds, animals, boats, log booms and bridges. The piece challenges the audience to consider our mutually intertwined worlds. Finally, by surrendering pre-conceived intentions and allowing the poetics of the

installation to lead us into the work, we have arrived at a new challenge: “How can the scale of an installation provoke immediacy?” “Can an experience of immediacy on a large scale bring consciousness to indigenous and biological issues?”

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Interdisciplinary Platforms for Coexistence
Papers

Art and Interaction: Language and Meaning Production

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Abstract

This study seeks to deepen the understanding of interactive processes in the field of technological art. For such, it will search in the studies of Mark Johnson and George Lakoff the necessary elements for the production of a perspective able to offer a deeper understanding of the processes that involve the production of meaning and aesthetic experience.

Keywords

Art, Interaction, Language, Technology, Evolution

Introduction

It does not go unnoticed that we experienced an unprecedented phenomenon in the history of culture. The dilution of the limits between some activities in the field of the studios and critical arts is evident and has constituted a challenge for scholars and crisis. Hybridization between before well-defined forms of artistic expression characterizes contemporary art and these interborder transgressions puts complex conceptual issues, which some critics believe that art today is beyond the historical determination, conceptual definition and critical judgment (Rebentisch, 2011; p. 219). Flores (2011), aware of this challenge, seems to search for new perspectives to face her to wonder if photography and painting are, in fact, two different means.

Contemporary culture would be better understood if it was considered beyond just from the diversity of its products among which we must include those arising from the art. Recent advances in the neuroscience point the aesthetic experience as central aspect in the cognitive effect generated by the products proceeding from the artistic sphere of the culture, and that this originates in the sensorial stimulations that the concreteness of these products can produce. The aesthetic in art “relates to what is perceived as beautiful and rewarding,”

it is the conclusion reached by Ishizu and Zeki when they talk about the inadequacy of the idea of “significance of the form” proposed by art historian Clive Bell (1914). According to Bell, the visual beauty guesses some quality common and peculiar to aesthetic objects. What Ishizu and Zeki realized is that the aesthetic experience is a cognitive phenomenon of subjective nature, independently from particular properties of objects and includes those constituted inside and outside the formal beauty standards. It is known from these studies that there is an objective form to understand and to measure the conscientious and aesthetic experience through the observation of the state of excitement of the neurons situated in a cortical structure of the brain called medial orbito-frontal cortex (mOFC) (Ishizu and Zeki, 2011) From a different bias, however convergent, the philosopher Juliane Rebentisch argues that it is advantageous to consider the contemporary art from two main aspects: the blurring of limits or “boundary-crossing” and the experience. For the author, these are more adjusted notions for the task to understand the contemporary art and to consider its production than the “post-history” or “culture of the spectacle”. Such categories are important, as they point to fundamental changes in the artistic theory and practice, changes of which are equally fundamental for the understanding of the contemporary art. However, for Rebentisch, these are not the best categories to describe this change.

Boundary-crossing as a very general title for an artistic development that has called into question the unity of art and the arts (for the last three decades ‘boundary-crossing’ in fact was one of the most popular keywords in the international discourse on contemporary art); ‘experience’ as a central category of an aesthetic theory – partly motivated by this artistic development –, which no longer tries to conceptualize the truth content of art works in the framework of a philosophical system (for the last three or four decades the notion of ‘experience’ in fact was the

focal point of debate in philosophical aesthetics at least in Germany) (Rebentisch, 2011; p.220).

The “dislimitation” of the traditional concept of artistic work through some forms of blur of borders and the methodological change in direction to the category of experience had challenged the modernist narratives and with them the critical judgments on the art, the philosophy and of the history of the art. The productions carried through from the decade of 1960 dissolved the limits between the artistic genders established by the modernist project supported in a homogeneous and contiguous historical development. To consider the contemporary art from this new point of view implies potentially in critics to the modernist idea of an objective determination of the art work, opening this question for potential conflicting readings (Rebentisch, 2011 p. 221). These choices are motivated by the complex characteristics of the contemporary artistic production, impenetrable to the classic critical approaches, which compels to the abandonment of the normative and historical speech to consider the art from the conscious experience as central category for the aesthetic theory.

Now, as I see it, this neither the end of history nor it is the end to art’s conceptual determination or critical judgment as such – is just the end of a certain problematically objectivist notion of history, art, and critique. Both the ‘boundary-crossing’ phenomena in art and the philosophical turn toward a concept of aesthetic experience respond to the same problem of modernist objectivism. Thus I believe that when contemporary art dissolves basic convictions of high modernist art theory this should be understood as a movement of aesthetic enlightenment, of progress if you so will (Rebentisch, 2011 p.221).

Fabbrini (2012), when reflecting on the end of the artistic vanguards, glimpses in the diversity of the contemporary production a movement of opposition to the universalist and standardized bias of the modernist vanguards:

It is necessary not to consider, in first place, the art of this instrument as a pure heterogeneity (of codes, languages or means), for a random difference whose effectiveness would be impossible to assess. To the contrary, it is necessary to sharpen our sensitivity for the differences and to strengthen our capacity to support the plethora of the particularities, to configure a landscape, in great measure, still unknown. From this decentralized and sprayed production, of activation of the differences, one form of reaction to the universalist and standardized bias of the ar-

tistic vanguards, we highlight three languages: the painting, the technological art and the collective ones, while symptoms of post-vanguardist artistic imaginary (Fabbrini, 2012).

The author reflects on the contemporary art from a scene capable of allowing him to trace a way to distinguish in the “decentralized, sprayed production, of activation of the differences”, a conceptual alternative for the art. For him, it seems to be possible, beyond necessary, to find coherences in the contemporary complex production that can base a reflection on the transition of the modern for the contemporary. When considering painting, technological art and collective production, the author evidences some structures, indications of order and coherent flows.

In compliance with the scholars of the contemporary art, this study also searches to find new fundamentals for the contemporary art in special for the production that Fabbrini calls Technological Art. This, characterized by the sensible technological aggregate construction, places challenges that demand for the systematic reflection on the interactive processes, as well as the technologies and its expressive potentials, its essence and purposes. The objective in this instrument is to find alternatives to recognize and to give continuity to the reflection on the contemporary production of the art, to find new scenes in the search for the senses of this multiple and diversified activity.

Art and Evolution

Another aspect that deserves attention in the contemporary production of the art, mainly in the scope of the technological arts, is the fact of that much of its narratives are organized in the form of installations. In its many forms, the installations constitute the most excellent form of contemporary art since 1960, not only because it concerns the contextual sensitivity of the interior and exterior space in which it is shown, but also for the social structures that influence the reception of the art in general (Rebentisch, 2011; p. 222).

Brown and Dissanayake (2009, pp.43 – 57) contributes for the advance in the agreement that the contemporary art from a perspective given for theory of the evolution of Darwin, calling the attention for a fact systematically forgotten: That the human beings evolved throughout millennia from simpler forms. For the authors, the recovery of the ideas of Darwin in century XXI can expand the scope of the humanities when including in the horizon of the events the humanity, the

life, the mind, and works of people in all the historical societies and periods, including the pre-history. This magnification implies in understanding the evolutionary history of the human species and its psychology in particular. In this context, the interesting point is to consider that the development of the arts is integral part of our evolutionary history, and it may be considered as part of adaptative strategies to the environment. The adoption of this perspective implies that our evolutionary traces had emerged to allow the individual survival and of the species since our existence in ancestral environments.

When considering the evolutionary approach, Brown and Dissanayake (2009) lists a vast roll of contributions of this field of the knowledge constructing, from them, a synthetic list that shall be presented here in simplified form for the concision of this reflection and with the perspective that the original text could be read in its completeness from the references in the end of the work. The arguments in favor of the adaptive hypothesis of the art are described as follows:

- Improves cognitive mechanisms: the arts contribute to the resolution of problems and for better adaptive choices.
- Articulates social interactions: the arts are used to manipulate, deceive, indoctrinate or control others.
- Allows demonstration of reproductive potentiality: the arts promote mating opportunity through display of desirable qualities (eg, physical beauty, intelligence, creativity, prestige) that denote adaptability.
- Reinforces social ties: the arts reinforce cooperation and contribute to social development, its cohesion and continuity.

Brown and Dissanayake (2009; p.45) consider, from an evolutionary point of view, that when we look at the context for the production of arts in pre-modern societies (traditional Aboriginal) around the world and over time, we find that they are remarkably practiced in ritual ceremonies. These, according to the authors, constitute art collections, conceived as behaviors transformed in art. Despite the great cultural variability, different ritual ceremonies, such as behavioral manifestations of cognitive systems of beliefs about how the world works, they have some characteristics in common. They are realized in uncertain times perceived, when individuals and groups want to influence the results of the circumstances that they perceive as vital to their livelihoods and survival (Brown and Dissanayake, 2009; p.48). You see here the art assuming an important role in materializing the

knowledge in narrative structures in order to allow that models of reality of the social group can be shared between individuals, ensuring the possibility of a coherent action on the environment, a relevant aspect in search for advantageous alternatives for the organized action of the group in the environment.

These art manifestations are typically multimodal, combining singing, percussion instruments, dance, literary language, dramatic spectacle and decoration of bodies, surroundings, and accoutrements. It dissolves the distinction between creators and viewers; even when the public observes “experts” in their performances, they collaborate clapping, moving, shouting, singing, and so on.

As John Chernoff, a scholar of West African remarked: “the most fundamental aesthetic in Africa is that without participation, there is no meaning. The arts in ceremonial contexts offer a multitude of critical social functions for small and large cultures, including historiographical functions related to a company of ancestry and identity; discursive functions related to the justification and feasibility of planned projects; functions related to the marking of time (eg, ritual calendars [crops], life cycle rituals [weddings, funerals, births]); communication with deities; relieve of anxiety and stress; social coordination, to name a few. The main objective of the arts activities is to promote cooperation in collective support of enterprises, such as hunting, foraging, resistance to enemies, infrastructure construction, and the like. The arts are also the main means for maintaining social harmony and minimize conflicts within groups (Brown and Dissanayake, 2009; p.45).

Bring to this discussion the evolutionary approach to art aims to put into question the scope of the concept of art that Brown and Dissanayake wish to expand beyond the Eurocentric notions of the eighteenth century. In considering the question of aesthetic experience from the research of Ishizu and Zeki (2011), which seems in line with these ideas, it opens the way to include in the field of aesthetic experience the artistic production constituted beyond the formal beauty requirements. It can be considered art all manifestation capable to conduct the production of an aesthetic experience. This, as we have seen, correlates the neurocortical activations in cognitive processes of valuation, desire, beauty to positive judgments as reward and pleasure in connection with the activation of other cortical areas (caudate nucleus) that in other scientific studies, were correlated to cortical response to romantic love (Ishizu and Zeki, 2011). These findings indicate that there should be specializations in

the brain to the development of the experience of beauty and ugliness, understood here as a negative and aversive emotional experience. It was found that negative experiences are treated differently from the more confined way in the amygdala and somatosensory cortex, whereas the beauty recruits a much larger number of brain cortices. These studies also revealed that there is a correlation between the intensity observed in cortical activation and declared by the subjects studied, which makes it possible to objectively measure the experience of the beauty. Another consequence of the research of Ishizu and Zeki is the finding that the experience of the beauty is absolutely individual and subjective. The activation of mOFC occurs in any individual regardless of ethnicity, culture or race. However, it is very important to consider that culture is the arena of actuation of the individual in his environment and constitutes a powerful filter in the construction of aesthetic experience and his consciousness. In other words, the emotional response of the individual depends on his ontogeny. New experiences shall always be collated with the previous one, stored in the establishment of the scenario in which they shall be evaluated. This fact seems to be on the minds of the authors when they mention individuals who think rock and roll more “rewarding” than the work of Richard Wagner (Ishizu and Zeki, 2011).

Another aspect that we seek to consider is that contemporary art rescues, through the artistic installations, ancestral functions and values forgotten in the eighteenth century, having in perspective an observer model no longer appropriate, given the rapid technological developments, especially those who provided new possibilities for visual experiences such as systems of production of images generated by computer (Crary, 1990). In the 1990s, such systems announced the deployment of radically different visual spaces made of mimetic capabilities of film, photography and television (Crary, 1990; p.1). Technological advances, such as those from the Computer Photography, brought new and more intense interactive possibilities for photography, opening space for a real reconfiguration in the way you can interact with “photographic” narratives. Photography in its emerging interactive forms, provides new ways of narrative construction, and consequently production of visual experiences that now include the decisive action of the body and constitutive “properties” of space around the interactor.

In addition to the technological advances, those sci-

entific, specifically the neurosciences, have changed the concept of the human body itself, paving the way for the notion of the interactor to expand that of the observer. For Gibbs (1007; p. 1 – 13), the separation that is established in the traditional philosophy of body and mind imposes severe limits to academic studies of mental life. Plato saw the body as a source of distraction in the intellectual life that needed to be eradicated in the practice of philosophy. This same perspective can be found in Christian writings, when St. Augustine in the fifth century, referred to the body as the source of sin and spiritual weakness. The separation between mind and body and the hierarchical organization having the mind over the body haunts the history of Western philosophy from Plato, Aristotle and St. Augustine to Descartes and Kant.” (Cray, 2007 p 3). Antonio Damasio (1996) will refer to the Cartesian dualism and the need to overcome it in the face of scientific evidences that showed where, in the brain, takes place the emotional thought and its important influence on reason

The importance of interactive processes is also considered when Kaptelinin and Nardi (2006) in the search for building an integrative theoretical field for studies on human machine relation and the question of interactivity, discuss the unity of consciousness and activity. For the authors, the Activity Theory can be defined as follows:

Activity theory seeks to understand the unity of consciousness and activity. It is a social theory of human consciousness, interpreting consciousness as the product of the interaction of the individual with people and objects in the context of everyday practical activity. Consciousness is like the enactment of our ability to attention, intention, memory, learning, reasoning, language, thought and imagination. It is through the exercise of these skills in everyday activities that we develop, in fact this is the basis of our existence (Kaptelinin and Nardi, 2006; p. 8).

Interactivity is the core of the Activity Theory that can be synthesized by the “intentional interaction of the subject in the world, a process in which mutual transformations between subject-object poles are produced” (Kaptelinin and Nardi, 2006; p.31). Based on the concepts from the Russian school of psychology, especially in Vygotsky’s ideas, the authors shall define the concept of the human mind as:

Intrinsically related to the whole concept of interaction between humans and the world, a special type of body, emerging and developing to make the interaction with the well successful world (Kaptelin and Nardi, 2006; p. 37).

From these considerations, it can be concluded that consciousness emerges from the interactive experiences that we carry out on the environment. The idea that the body and mind are inextricable are not only at the heart of contemporary philosophy, as seen above, but also in the theories of language. Feldman, considering the neural basis for language, searches in the subjective experience the idea that language originates in concrete experience. To the author, the thought is structured in neural activity and the language “is inextricable to thought and experience” (Feldman, 2006 p. 3). At this point we could connect to important aspects of Technological Art: Interactivity and language. These ideas give opportunity to consider narrative, as abstract thinking supported by language, gaining materiality through technology allowing interactive processes and conscious experiences, especially the aesthetic ones.

Language and Technology

In the thought of Gilbert Simondon, technical reality has human reality and “to fulfill its role completely, the culture should incorporate technical beings as a form of knowledge and sense of values” (Simondon, 2007 p.31). Simondon offers an advantageous point to understand better the role of the form of technology that shall become evident its integrating character between individuals and the environment, rather than be a slavish and reducing strength of human potentialities. Such an approach could also offer an alternative to establish a very close relationship to another important element of the Culture, the Language. This would allow us to design a converged conceptual scenario able to reflect the already much debated technological convergence. The possibility for this conception comes from the fact that, in all its cultural spectrum, the languages, through their stories, express subjective experiences, whose purpose is to connect enunciators and receptors (Feldman, 2006, p.330). We see here an important convergence between the concept of art and language. This is a key aspect in establishing social connections, learning and sharing of reality models. Personal or subjective, phenomenological experience, as the philosophers prefer, *qualia*, is the underlying purpose of the design subjacent to the action of the narratives. The link that connects the languages lies in the conscious subjective experience of translated narrator, coded and materially concretized through the available technologies to produce sensory stimuli with the aim of producing a subjective experience (aesthetics in the case of production in the field of art) conscious

in individuals (readers, audience, interactors, etc.) exposed to it. The ability to perceive in the subjective experience a common aspect in the narratives of different natures is perhaps the best alternative to establish a critical judgment to contemporary production in the field of art.

Art as a Phenomenon of Language

During the evolutionary process, the human species suffered mutations that have given rise to a plethora of behaviors. Cultural processes in human species are beginning around 40,000 years ago with the emergence of what Merlin Donald calls “visual graphic inventions” (Donald, 1993). The author considers that we must add technological aspects to biological when you want to understand the processes involved in the evolution of the human species. Our species not only developed larger brains, expanded memory, lexicons, capacity for speech; developed complex systems for the representation of reality. Images and texts written in various media constitute the cultural repository, knowledge of the human species. Such records built and maintained by successive generations as symbolic systems are fundamentally dependent on external representation to the brain, extrasomatic to a cultural strategy to expand somatic or internal memory, stored in our brains and bodies. Depending on the level of technological development of human society, the support used for the external memory ranged from rock walls in the Paleolithic to modern optical discs and the silicon memories (Fogliano, 2008). Such developments have initiated an accelerated evolutionary process in which the culture shifts the biology of the protagonism in the evolutionary process. The emergence of the language subjacent to this cultural explosion is the driving force for developments related to the artistic and scientific work, responsible for an unprecedented cultural acceleration process in the history of humanity, which emerged new behaviors and languages in a cyclic process of evolution and complexity.

In the context of the Neural Theory of Language (Feldman, 2006), the subjective experience is the basis from which technical words, abstract, and concepts arise. Neurons and body are central to this process: people, and their neural systems, understand abstract ideas because these concepts are mapped and activated in brain circuits involved in the production of meaning of this experience.

Metaphor, Language and Concrete Experience

The metaphor for Lakoff and Johnson (1980) is not just a linguistic trick or cultural figuration. Typically seen as a feature of language only, it can now be understood more broadly as an integral aspect of thought and action. The conceptual systems that are, in their nature, fundamentally metaphorical (Lakoff and Johnson, 1980 p.3). The discourse on metaphor and culture gave way to a paradigm shift in what concerns our understanding of creativity and acquisition of knowledge. Synthetically defined, the metaphor involves cognitive processes of understanding in a field of information in terms of another domain. Important in this process is the fact that concepts can be categorized into levels of abstraction. Those who are in a more basic level are those most closely derived from actual experience. An example of the organization of concepts can be obtained with the words chair and furniture. You can get a mental image of a chair, but not a generic piece of furniture. According to Feldman, “our concept of chair is related to our ability to sit that, in turn, is closely linked with our bodies. It is fundamentally an incarnated concept” (Feldman, 2006 p.186) The most basic conceptual level is one that characterizes the mental images, gestalt, motor schemes of a category. Superordinate categories, or higher, such as furniture, have aspects of tangible scenario in common, but are more abstract.

It is within the process of interdomain mapping that the new meaning is generated. The process of mapping is important to understand how metaphors create new concepts and meanings. Lakoff and Johnson define “conventional” metaphors or “primary” as those that have evolved within the literal language, by the common use and familiarity. With this analysis, they brought the cognitive linguistic evidence that much of our concepts and metaphorical language representations of the world come from our bodily, interactive experiences with the environment (Cox, 2006 p.90). These are so intertwined in our culture that we literally interpret its meaning.

Creative thinking, according to Lakoff and Johnson (1999 p.90), arises from the invention of metaphors which they termed as “innovative”. Such metaphors allow new inferences about existing mappings. Creative thinking can be considered, therefore, according to the innovation of the metaphor used. In this sense, it can be considered metaphors, being a continuum in which one extreme lies the conventional or primary, and on the other, those innovative. According to this perspective, the artistic work is related to

the production of innovative metaphors. Artistic works can then be considered from the concept of metaphor that is by conceptual maps in various fields that originate in the concrete experience of the body. We know today that the abstract thought comes from these experiences. This expansion is the driving force for the evolution of culture and mind and implies increased sensitivity of the eyes to perceive before unnoticeable, subtleties of reality (Sogabe and Fogliano, 2010 p. 338-345), interpret them and examine them in the light of the productions of presence.

For Lakoff and Johnson, most of our conceptual system is structured metaphorically, which implies that concepts are partially included in terms of other concepts³⁸. This statement leads to consideration of the fundamentals of our conceptual system. For the authors, the foundation of the concepts originates in what they call “direct physical experience”. This, however, can never be considered without taking into account that every experience is a vast landscape of cultural presuppositions. It would be more correct to say that the whole experience is completely cultural, we experience our world in such a way that our culture is already present in the experience (Lakoff and Johnson, 1980; p.56).

Two aspects that concern us here: that culture is where our experiences are constituted; and experiences are based on direct physical experience. In some situations, some experiences may be “more physical” and others more cultural. There are systematic correlates between our emotions and our sensorimotor experience; these form the basis of metaphorical concepts that Lakoff and Johnson call supervisors. Such metaphors allow us to conceptualize our emotions in well-defined terms and also relate them to other semantically close concepts.

As we have seen, for example, the metaphor VISUAL FIELD IS A “CONTAINER” relies on the correlation between what is seen and a delimited space. The metaphor TIME IS AN OBJECT IN MOTION is based on a correlation between a moving object in our direction and the time it takes to it to approach us (Lakoff and Johnson, 1999 p.58).

You can then carry these ideas into the context of art installations, observing now that the space of the work is the arena for direct physical experience. In this context, cultural elements such as images and texts can be the elements of direct physical experience. Therefore, it is possible to imagine a network of sensory stimuli in the physical space. These, cultural objects from other languages, produce a complex network that shall result in an “emerging metaphor or emerging concept” (Lakoff and Johnson, 1990 p.58).

The prospect given above can help us better understand the Dewey's ideas when he says that art objects are many languages and each have their environment, their vehicle and that the vehicle is suitable for a given type of communication (Dewey, 2010 p.215). Installations can be considered complex sensitive aggregates which are physical spaces designed to sensory experiences capable of producing emotional states resulting from an aesthetic experience that the interactor can experience.

Languages and technologies were at the heart of the production of Art, Science and Technology throughout the history of culture. In this sense, we can see how the concept of conscious experience is important for reflections on contemporary cultural production. The concepts discussed here can provide the converged scenario necessary for it to be considered the contemporary artistic and cultural production in all its diversity. They offer us an alternative to the understanding of how language, thought, culture and technology build the paths of culture and new ways to access to reality.

Brian Boyd (2009) brings interesting contributions when he points the art of the evolutionary scenario where also are on the scene cognitive sciences. For the author, evolutionary understanding of human nature began to reformulate various disciplines of knowledge such as psychology, anthropology, philosophy, economics, history, political studies, law and religion. This list can include art and the human mind.

A biocultural approach to literature invites the return of the wealth of texts and the multi-faceted human nature that they evoke. But it also implies that we cannot simply return to the literary texts without assimilating what science has discovered about human nature, minds and behavior over the past fifty years, and considering that these findings may offer a comprehensive literary theory (Boyd, 2009 p.4).

From this perspective, art can be considered a behavior, a strategic game designed to engage human attention through their appeal to our preference for inferentially rich information standards (Boyd, 2009 p. 85). It is important to note that attention is one of the aspects of consciousness and that in this sense, we can consider that the game referred to by Boyd is ultimately a strategy to provoke conscious experiences. This game takes place in a complex environment to allow socially developed minds, especially human minds, to access larger networks of modules of abstract or concrete knowledge (tools). Access that enables facing the new contexts, the assessment of information and the production of inferences and scenarios for decision making. This process is

supported by emotional systems, as described by Damasio in his book *The error of Descartes*. Such systems are the consciousness that also has its evolutionary history in which the emergence of language is a decisive role. In this evolutionary process, the more complex does not supplant the simplest, but integrates it in new ways creating new contexts, or levels of complexity, which favor the development of new functions. This may well serve as a definition for the emergence phenomena and applies in the same way to the definition of metaphor. Art as a mechanism to co-opt the group's attention, offers an interesting aspect in the understanding of Art and as a producer of social cohesion.

To explain the art, we must consider the attention. Art dies without it, how people from Aristotle noted, both inside and outside the evolutionary explanation. The art alters our minds because it engages and reengages our attention from the corners of nursery to the distracted humming. However, art was never considered to have evolved to take on the role of being a stimulator of attention in the human lives (Lakoff and Johnson, 1980 p. 235).

Lakoff and Johnson consider that you can expand to other forms of engagement with the environment, the concepts that underlie the language (Lakoff and Johnson, 1980 p.235). From the point of view of aesthetic experience, the metaphor gives an understanding of a kind of experience in terms of another and may involve all dimensions of experience including aspects of our sensory experiences such as color, shape, texture, sounds, etc. Western culture greatly appreciated the value of the word and the art was never considered seriously as an essential mode of engagement with the world. It is proposed, therefore, to bring to the field of language all forms of artistic engagement. This assumption allows us to consider the theory of language as an integrative scenario for studies of languages not only of words, but the sounds, movements and all other forms of narrative expression such as photography, film, music, theater, design in all its aspects. In the visual arts, images and patterns, qualities, colors and rhythms are carriers of meaning, construct narratives and are mechanisms to produce an experience that produces and transforms consciousness.

Final Comments

It is important to find nexuses between the technological advancements, culture, science and art and the construction of reality itself. The field of art is considered here as production of knowledge. The Technological

Arts are becoming a space of experimentation with new technologies and languages and important insights to offer new alternatives to depleted paradigms. The production in this field of art rescues, as we have seen, essential aspects of art, forgotten under the Eurocentric culture from the eighteenth century. Reengender the role of science, technology and contemporary art. This study aimed to find in the theories of language the way for the construction of a conceptual approach needed to enable a new way of perceiving the fabric of the culture. To establish a sensitive scenario emerging structures of society, without which we would end up coming across to the art or, as stated by Flores, seeing artists and critics cling to surpassed conventions, as in the case of Contemporary Photography, which takes refuge in the proposal of Objective Vision, “incarnating the paradoxical persistence of conventions of twenty centuries of naturalness and duality of the observer and the world” (Flores, 2011 p. 85)

It is considered here that the contemporary way to produce the art is not different than it did over time in relation to the pursuit of material resources, knowledge and mastery, seeking to understand their technical and expressive possibilities for implementation of narratives. What we have today is the complexity of available materials ranging from computers, projection systems and a multitude of languages both conventional artistic and emerging and computer. Contemporary art, especially Technological Art, explores the simondonian way to see in the automatism of technical objects the opportunity to explore the creative possibilities of open systems. Consequently, all around the artist can be considered raw material, as it was already considered in the context of conceptual art. Whether complete devices or their electronic fragments, mechanical or computer code, it can literally be suitable for the materialization of the artistic project. Evidently, there were not outside the list of those materials classically used by artists such as brushes and paint, marble, various metals, etc.

When considering the opening of technical objects, Simondon places them in the universe emergency, creativity, unpredictability and inexhaustible innovation, these features of their own culture. As open systems, technical objects are inherently creative, and their relationship with humans and other technical objects will lead to the emergence of new networks of relations with other technical objects. This characteristic approaches the simondonian concept of individuation that “ap-

proximates them from this notion of individual present in biology, where each individual is a set of articulated device forming a separate body” (Campos e Chagas, 2008). The concept of individuation of Simondon can be compared with the linguistic metaphor in which new concepts or words are created from the appropriation of existing words. In short, the vision of processes of automation brought by Simondon allows us to migrate from flusserian field of finitude of the possibilities and the mere operation of the machines to the field of evolution. In the latter, creativity is limited by environmental links, shifting the point of view of reflection on art and technology to language and darwinian adaptation.

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egy linked to the production of knowledge, art and design. His major research interests involve experimenting and reflecting on contemporary production in contemporary art in the context of aesthetic experience within the framework of scientific paradigms offered by Neurosciences and Complexity Theories.

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Representing Peace in Colombia through Interactive and Transmedia Non-Fiction Narrative

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Abstract

Over the years the emergence of interactive digital communication has added new narrative structures to the audiovisual media ecosystem. Dividing this ecosystem into fictional and non-fictional narratives, the evolution of the representation of reality has led to a new area called “interactive non-fiction”. Colombia is an interesting example of the use of this new area for two main reasons: it is one of the South American countries that has invested most in the development of digital projects in recent years, and it is now in a historical moment in which it is deciding which direction peace could take. This article would like to promote debate and discussion on how producers and audience could benefit from the non-fiction interactive formats and genres to promote peace in Colombia in the forthcoming years. To explore the potential of certain narratives combining with interactive media and the peace process, we will focus on four main forms of non-fiction according to their importance and presence in the current media ecology: documentary, journalism, educational formats and museology.

Keywords

Non-Fiction, Interactive, Transmedia, Colombia, Peace Process, Documentary, Journalism, Education, Museums.

Introduction

Traditional media production has evolved in recent years, taking new directions to spread content. In the field of representation of reality, this new scenario has led to the emergence of a new area called “interactive non-fiction” or “interactive factual narratives”.

Roger Fidler (1998) defines the term “mediamorphosis” as the transformation of a media in the face of cultural changes and contact with new technologies, pointing out that when new forms of media emerge, “the oldest forms do not die, but they continue to evolve and adapt” (Fidler, 1998, p. 57). According to Fidler, throughout history we find three moments of great transformation of the forms of narrative expression that allow us to use the term “mediamorphosis”: The emergence of spoken language, the emergence of written language and the development

and emergence of new digital technologies. All analog media have had to evolve in recent years, which has led to their particular format adapting to the new discursive environments. Fidler holds that the birth of printing was a paradigm shift as profound as the digital revolution, which has invaded the entire spectrum of analog media, forcing them to adapt and reinvent themselves in order to not disappear in the resulting new environment.

Interactive non-fiction area

In the past, the media industry created two macro-genres in order to separate movies that were created based on imaginary events from those based on things that had happened in the real world. The term “non-fiction” was created in opposition to “fictional cinema” as a consequence of the great transformation of the culture industry, which needed its processes to be well defined in order to expand and break up into different categories. As film became more complex, developing its own language, the terms literary fiction and nonfiction began to be applied to cinema. The controversial but now widely applied term “non-fiction”, used by various film theorists (Barnouw, 1996; Meran Barsam, 1992; Nichols, 1991; Plantinga, 1997; Renov, 1993), is conceived as a large genre and a vast field containing documentary, journalism, film essays, scientific films, educational videos, nature and tourist travel films, etc.

The emergence of the interactive media field created new narrative structures, including the management of user actions, and forced non-fiction to undergo a new “mediamorphosis” in the last decades of the twentieth century. To explore the potential of certain narratives combining with interactive media and the present situation in Colombia, it is vital to look at four main narrative forms of the field of interactive and transmedia non-fiction: Documentary, journalism, educational formats and museology.

Representing Peace in Colombia through Interactive and Transmedia Non-Fiction Genres

Although it is still early days for the production of interactive and transmedia non-fiction projects in Colombia, the use of interactive non-fiction narrative would be beneficial for this country for several reasons:

It is currently going through a crucial historical period in which it is deciding about the future and peace of the country.

There's a need to tell stories as a collective catharsis in order to deal with the tragic events of the past.

It is one of the South American countries that has invested most in the development of experimental, artistic and digital projects in recent years.

If we combine these three dimensions, we come to the conclusion that factual narratives could be an expression form that could help and/or represent the peace process and reveal what happened in the past.

A crucial Historical Period

For the last half-century, the conservative and pro-capitalist Colombian State, with the highest rates of inequality in the region, has been engaged in an internal conflict, mainly with the FARC guerrillas, resulting in more than 7 million victims, which includes people who have been killed, displaced, kidnapped or have disappeared (Martínez, 2017).

There have been four attempts to reach a negotiated solution to the conflict. The most recent previous attempt was in 1999-2002, a time when Colombians were hopeful for a solution. The failure of this peace process was attributed to the actions of the FARC, who took advantage of the reduced national tensions to strengthen their military power. In 2010-2011, secret meetings with the FARC started in Colombia, and in February 2012, face -to-face negotiations between the warring parties began in Cuba, although still away from the public eye (Martínez, 2017).

Today Colombia is immersed in a complex political process and its society is divided between those who want to forgive and those who cannot forget. The dialogues/peace negotiations between the government of President Juan Manuel Santos and the Fuerzas Armadas Revolucionarias de Colombia (Revolutionary Armed Forces of Colombia - FARC), also known as the peace process in Colombia, lasted four intense years. These dialogues, which took place in Oslo and Havana, were aimed at ending the conflict with the rebel group.

A referendum determined by Congress was used as a tool to accept or deny the peace process that arose from the dialogues. The end result of the popular vote was a victory for not signing agreements with the insurgent group. This result opened a new phase of the dialogue process, in which the ability to adjust the agreements discussed and to consider the objections of the opponents to the current agreement, including former President Alvaro Uribe, are key factors.

The Need to Tell Stories to Remember the Past

Several fiction and non-fiction projects have been produced recently that deal with the conflict that has been going on for over 50 years. Like Colombian journalism and literature, the Colombian audiovisual industry has produced numerous works in many genres on the history of the armed conflict.

A recent sampling includes full-length fiction such as *Sumas y restas* (Victor Gaviria, 2005) and *Postales Colombianas* (Ricardo Coral Dorado, 2011); documentaries such as *La Sierra* (Scott Dalton & Margarita Martínez 2006), *Los hipopótamos de Pablo* (Antonio von Hildebrand, 2011), *When the Guns Go Silent* (Natalia Orozco, 2017); and television series such as *Rosario Tijeras* (2010, 60 chapters produced by Teleset), *Escobar, el patrón del mal* (Canal Caracol, 2009 -2012) and *Narcos* (2015, produced by Netflix); as well as works of interactive nonfiction such as *Cuentos de viejos* (Hierro Animación, Piaggiodematei and Señal Colombia, 2013) or *4 Ríos* (Elder Manuel Tobar, Orgánica Digital, ongoing).

Investment in Digital Projects

Colombia is one of the South American countries that has invested most in the development of digital projects in recent years. Grants and calls such as 'Crea Digital' (Ministry of Information and Communications Technology), 'Programa Nacional de Estímulos' (National Call for Incentives in Communications), the call for interactive documentary for the web (Ministry of Culture), Fondo de Desarrollo Cinematográfico (Fund Film Development, Pro-imágenes Colombia), and markets and festivals such as Colombia 3.0, Bogota Audiovisual Market, FICCI (Carta-gena Film Festival), MIDBO Bogota, DocsBarcelona+Medellin, Ambulante Colombia or Bogota Creative Commons Film Festival, among other events and grants, make Colombia one

of the leaders in Latin American production of new media narratives (Gifreu-Castells, 2015). It seems clear that nowadays, in Colombia and other Latin American countries, such as Argentina, Chile and Brazil, there is fertile ground for experimentation and innovation in new audiovisual and interactive narratives.

Canada and France were the pioneering leaders in the production of interactive non-fiction, but nowadays, on a small scale, there are other countries encouraging these types of productions (especially interactive documentaries). Latin countries are led by emotional perspectives and approaches, and in the end these need different codes and motivations to be used, which affects and determines how the narrative is constructed. Non-fiction platforms and narratives could be suitable then for a region like central and Latin America, which may be a reason why a country like Colombia is investing in this area (Gifreu-Castells, 2017).

A review of questions and productions

There is a consistent sample of works that deal in some way with the current conflict in Colombia. While some of them are focused entirely on the conflict, others dedicate just a part of the work to it. These projects are a compendium of memories and represent, according to the director's point of view, what has happened in the country over the last 50 years.

In order to quote and briefly analyze them, we present an initial corpus of projects as key examples of digital non-fiction projects dealing with the topic:

Documentary
▪ <i>Cuentos de viejos</i> (2013)
▪ <i>4 Ríos</i> (2011-ongoing)
▪ <i>En Modo P</i> (2016)

Figure 1. Documentary projects dealing with the conflict in Colombia

Cuentos de viejos is a transmedia experience that encompasses a series of animated documentaries, a collaborative web and participatory school projects. The main goal of the project is to rescue the oral relationship and dialogue between old and young people to develop a deep conversation from both sides. This work gives voice to the elderly, integrating their stories into contemporary media, and reflects on our history and our memory in order to stop it from disappearing (project website, 2017).



Figure 2. Frame of the work *Cuentos de viejos* (2013)

4 Ríos is a transmedia project that tells stories of the armed conflict in Colombia using various platforms: a short film, an interactive comic, a printed comic and an Augmented Reality application. The project aims to show the reconciliation processes, social articulation and the search for peace in the country, recognizing the lessons learned and formulating pacts of non-repetition of the violent actions that have generated so much damage in the civilian population (project website, 2017).



Figure 3. Frame of the work *4 Ríos* (2011-ongoing)

En Modo P was born in January 2016 as a platform that makes it possible to create high quality contents on the subjects that matter to Colombians. One of the first projects in development is around the Peace Agreement, creating a transmedia narrative composed by a participatory platform, documentaries, videos and interviews in various locations of Colombia and Ecuador.

The platform allows Colombians to include their voices in the Peace Process by giving them a minute to respond to questions about this process. The main objective is to capture the voices of the people who have something to say about the negotiation with the FARC and the outcome of the process, beyond what happened in the plebiscite (project website, 2017).

Figure 4. Frame of the work *En Modo P* (2016)

Journalism	
▪	<i>Detrás del camuflado</i> (2010)
▪	<i>La hoja sagrada</i> (2010)
▪	<i>Colombia refugiada</i> (2015)

Figure 5. Journalism projects dealing with conflict

Detrás del camuflado is an interactive report that explores the life of a Colombian soldier from different perspectives. In order to obtain the content, the production team spent seventy-two hours behind the soldier to share in the stories and sacrifices of the soldiers who live in the High Mountain Battalion (project website, 2017).

Figure 6. Frame of the work *Detrás del camuflado* (2010)

La hoja sagrada is a multimedia report that tells the story of the sacred coca leaf and the alternative uses of this plant that is rich in calcium, iron and phosphorus. Although the war against drugs has demonized the coca leaf and ignored the potential and qualities of this millennial plant, for some indigenous people from Andean and Amazonian cultures the coca leaf is a food,

has medicinal effects and is part of their culture (project website, 2017).

Figure 7. Frame of the work *La hoja sagrada* (2010)

Colombia refugiada is a production by the El Tiempo Newspaper that shows on a map where the displaced people from Colombia were living in 2013. According to 'UNHCR Global Trends report' (2015), three countries produce half the world's refugees: Syria at 4.9 million, Afghanistan at 2.7 million and Somalia at 1.1 million together accounted for more than half the refugees under UNHCR's mandate worldwide. Colombia at 6.9 million, Syria at 6.6 million and Iraq at 4.4 million had the largest numbers of internally displaced people.

Figure 8. Capture of the work *Colombia refugiada* (2015)

According to the study, "in Colombia, few internally displaced persons returned to their places of residence and the Government reported 113,700 new displaced persons" during 2015, when more than 65 million people were forcibly displaced in the world. 59.5 million people were recorded twelve months ago (UNHCR Global Trends report, 2015).

Education
<ul style="list-style-type: none"> ▪ <i>Plan Digital Teso</i> (2012-ongoing)

Figure 9. Educational projects dealing with the conflict

Plan Digital Teso is a socio-educational initiative of the Mayor of Itagüí in partnership with EAFIT University. TESO is an acronym for ‘Transformar la Educación para crear Sueños y Oportunidades’ [Transforming Education to create Dreams and Opportunities]. This is the great goal that began in 2012 as an ambitious plan in order to improve the quality of education and develop competencies and initiatives in students and their families, teachers and administrative officers, by integrating Information and Communication Technologies (ICT) into their learning environments (project website, 2017).



Figure 10. Frame of the work *Plan Digital Teso* (2012-ongoing)

Museums/Exhibition
<ul style="list-style-type: none"> ▪ <i>Cartofonías de San Nicolás. Estudios sobre la memoria sonora de la industria gráfica en Cali</i> (2015)

Figure 11. Museum/Exhibition projects dealing with the conflict

Cartofonías de San Nicolás. Estudios sobre la memoria sonora de la industria gráfica en Cali deals with the urban space as cultural heritage, creating a digital map to preserve the sound-space memory of the graphic arts industry in the San Nicolás neighborhood of Santiago de Cali over the period 1894-2013. The project was developed with the economic support of Colciencias.

The purpose of this and other projects on sound landscapes promoted in the Department of Humanities of Icesi University (Cali) is to create spaces for meeting and reflecting on the sounds that shape our daily life

(project website, 2017). The project, currently in production, is looking for other ways to expand into the city of Cali by creating exhibitions in museums and using sound in public performances.



Figure . 12. Capture of the work *Cartofonías de San Nicolás Estudios sobre la memoria sonora de la industria gráfica en Cali* (2015)

Taking the previous examples as case studies, we propose some questions that could stimulate debate:

-How has the “mediamorphosis” process shaped new media formats and genres in Colombia?

-How could the field of interactive non-fiction contribute to the peace process?

-Which representations of reality can influence decisively taking into account the importance of the current historical moment in the country?

-Which strategies and dynamics of each format and genre of interactive non-fiction could help build an imaginary of peace?

-How could the development and production of these types of narratives be promoted in Colombia and Latin America?

Case Study in Development: *The Negotiators* (working title)

After analyzing some representative works in some important areas of interactive and transmedia non-fiction that deal with the Colombian conflict, now we introduce our own project in development as a case study. Its working title is *The Negotiators*, and our aim to design and develop a transmedia documentary about the Colombian armed conflict and the peace process in Havana between 2012 and 2016 (Martinez & Gifreu-Castells, 2017).

In order to generate this narrative, we propose using multiple media and communicative platforms to present a non-fiction narrative, gradually and incrementally explaining the nature of the Colombian conflict from its origins to the present, including three unsuccessful attempts to reach peace, up to the present relative stability and a fourth agreement signed by both sides.

We propose to recount the history of the conflict beginning with a historical timeline from the earliest stage of the armed conflict in 1964 through the key events of following decades. Second, we envision a linear documentary of a little under two hours that follows the progress of the peace negotiations in Havana in 2012-2016. Third, an interactive documentary will allow for a conversation with the different parties to the conflict, provide content to users, and offer them a set of in-depth interviews regarding the most closely guarded secrets of the peace negotiations. Then, users will be invited to participate more actively through social networks where victims will contribute to a participatory forum. Finally, to increase visibility and raise consciousness about the Colombian experience, all the documentary content collected will be made available for classroom use in an educational project with guided viewings for groups all around Colombia (Martinez & Gifreu-Castells, 2017).

The following are the three key goals of the project:

- To offer current and future generations a realistic and even-handed transmedia narrative of the Colombian peace process promoted by President Santos.
- To produce an audiovisual and transmedia project that will help reinforce the peace process by educating viewers about the conflict's origins and evolution, the terrible suffering that it brought, efforts at reconciliation, and the participation of the warring parties in peace talks.
- To create a platform for an interactive conversation in which the voices of all who have been involved in the conflict and in its resolution can be heard and will feel represented.

The target audience of this project is aged 15 years and above. It is principally directed at young people as a tool to understand the peace process and what has happened in Colombia over the last several decades, but it is also directed at older people whose voices were silenced during that period of time and who may find in the project a useful way to be represented in the solution of the conflict, and may use it as an opportunity to add their testimony to the public record in the hope that such

tragic events will never be repeated.

The challenge now is to make the existence of this material known and have communities and organizations that consider it valuable request a 'guided tour' through the recent history of Colombia and its successful peace process. If there is demand, a physical space will be secured for an audiovisual installation (video projector, computer, and sound system) programmed to provide custom navigation through selected elements of the transmedia documentary (Martinez & Gifreu-Castells, 2017).

Conclusion

Non-fiction works encourage us to interact and deal with facts, so we can make an impact on reality, and even eventually shape and transform it. Producing non-fiction works in the digital age means that it is possible to include several forms of dialogue and integrate media to promote certain behaviors and simultaneous processes that can enrich and enhance the user experience of non-fiction formats and genres (watch, browse, play, learn, interact, share, etc.).

Like in the case of audiovisual genres, merging factual material with new interactive formats can have a deep impact and influence on audiences, and even finally affect and transform the real world, one of the highest social values of non-fiction in general: taking ideas and technology to use them for the better and to promote social change. Moreover, these works constitute a real testimony and contribute to the digital and cultural legacy of what happened in Colombia during several decades of armed conflict.

We believe that the material that has been generated in *The Negotiators*, the project in development introduced in this article, constitutes a unique and exemplary testimony regarding the Colombian conflict over the course of the last 50 years. This is one of very few projects that tell the four-year story of the peace negotiations in Havana using recorded images. It constitutes a valuable audiovisual and interactive resource for future generations and the country in general.

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Cognitive Beings: Brain Mechanisms Discussed in Cultural Studies

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Abstract

Cognitive science emerged from an interdisciplinary discussion of information theory, linguistics and psychology among many other disciplines. Since its emergence, it has not only been largely discussed in other disciplines but has also shaped our views and perception of the world. In this paper, I will examine how scholars in cultural studies and philosophers incorporate scientific theories about the brain into their work, and how they bridge scientific knowledge with immediate human experience. Through Katherine Hayle's notion of the cognisphere, this paper examines the impacts of informatization of human body and cognition within a pyramid of digital data flows between machines. This paper also takes the French philosopher, Catherine Malabou's observation of the scientific concept of brain activities – brain plasticity and synaptic connection - as a metaphor to identify what is needed in our social engagement.

Keywords

Cognitive Science, Cybernetics, Cognisphere, Brain Plasticity, Synapse, Posthumanism, Synaptic Self, Enactivism.

Introduction

As a scientific study of cognition concerns computational operating mechanisms in human perception as well as provides a foundation for the development of intelligent machines, cognitive science has been advanced along with digital information technology. The informatics theory in mathematics, studied by Claude Shannon and Donald MacKay among others, influenced the emergence of cognitive science. (Varela, 1991). Cybernetic movement in the late twentieth century largely discussed information theory, the neuronal functioning, and its implication in the relationship between humans and machines (Hayles, 1999). In this way, science, technology, and cultural studies have influenced each other, and especially cognitive science has emerged from the intersection of these interdisciplinary discussions. The information processing in the brain is linked and expanded into the sensory motor system in the body.

Therefore, the discussion of our cognitive activities should be extended into our engagement in the cultural and political domain, where the sensory motor embodies its phenomena.

In this text, I will discuss the role and impact of the evolution of cognitive science on cultural and media studies. Firstly, the early complementary relationship between information theory in engineering and the foundation of cognitive science in cybernetics has continued with changes over time, bringing about the new concepts of dynamic co-evolution with technology addressed by Katherine Hayles, who was largely influenced by Donna Haraway's thinking on cyborgs. Today, the domains of human and machine are hard to distinguish, and their interaction is so active and continuous that technologies we make affect who we are. Hayles recognizes the cognitivity of machine and globally interconnected human/machine cognitive systems. Also, Catherine Malabou discusses our identities in relation to the sociopolitical world based on scientific discovery and research in neurons and brain plasticity. In her work, brain mechanisms are a physiological metaphor for society, and she bridges discoveries of neuroscience to our daily experience to arouse "each individual's responsibility to know what he should do with himself," (Malabou, 2008 p. 10) and identifies what is being plastic – not to be confused with being flexible. Furthermore, Malabou seeks cultural meanings in a smaller scale of the brain, the synapse and its function, which makes the brain malleable. Her exploration on the cultural and political identity on the basis of scientific research of the brain urges us to reconsider our relationship to the central power – not only consciousness and body but also the economic/political power and our free will.

Co-Evolution of Posthumans and Technologies

In her article, "Unfinished Work: From Cyborg to Cognisphere," Hayles acknowledges the new scope of cog-

nitions embodied through both humans and technologies and the influence of the scientific study of cognition on the objective and subjective understanding of the reality. She claims that computation is a “relational process that can run in the brain” (Hayles, 2006, p 163) exemplified in some technological inventions such as intelligent machines, data processing and quantum computers. Considering the parallel mechanism between humans and machines, technologies are not merely cognitive and lively but they also construct collaboratively the interconnected cognitive system with and among people. The world is not split into human and non-human; rather, the organic and technical anymore, but human, animal and machine coevolve together in a complex system Hayle’s refers to as a “cognisphere.”

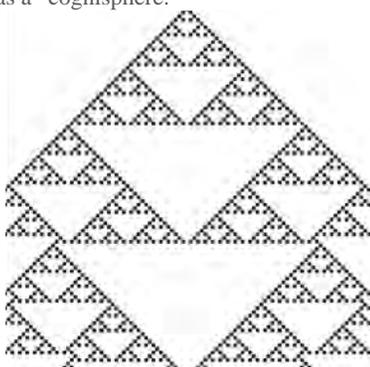


Figure 1. A complex evolutionary pattern generated with Cellular Automata. ©Stanford Encyclopedia of Philosophy

Together with the idea of “cellular automata” that suggests the universe is information (Kelly, 2002), the reduction of a human body into generic data in binary code reifies the concept of computational cognition and information processing in brains. To digitize natural phenomena is, in fact, to objectify the universe, even human experience. Although the stripped-down neuronal model is arguable in that it does not encompass the complexities of embodied experience, it disembodies objects like human bodies and machines as immaterial existences and shifts boundaries between traditionally separated beings. Their “substance is not essence but dynamic relationality” (Hayles, 2008, p.160). This idea supports Hayle’s claim that (post) humans are increasingly embedded in a pyramid of data flows, most of which occur between machines. Hayles writes, “cultural beliefs and practices are part of this co-evolutionary dynamic because they influence what

tools are made and how those tools are used, which in turn affects who we are as biological organisms, which then feeds back into the co-evolutionary spiral” (Hayles, 2008, p.164). We live in the era of the coevolution of tools and technology that we make and in a cognisphere where data flows between different substrates, such as the biological and mechanical, bits and atoms.

The philosophical question of the objective-subjective reality is also jointly reconsidered in cognitive science and cultural studies. Hayles refers to the book by Evan Thompson and Francisco J. Varela, *Why the Mind Isn’t in the Head: The Lived Body in Biology, Cognitive Science, and Human Experience* (2010), which argues that the subject-object split, institutionalized by the birth of modern science, is manifested strongly in cognitive science as explaining how reality is constructed in human minds on both the physical and psychological level. Furthermore, contemporary models of cognition dismantle the notion of a coherent self in response to dynamic external stimuli. Those concurring cognitive models of autopoiesis and enaction suggest that the self and cognition is not anymore a closed system, yet structured with “recurrent sensory-motor patterns,” and the nerves in our organic bodies are connected and flowing into the environment (Hayles, 1999). These scientific models subvert the notion of a unified self and the objectivity of the world’s existence, and take their interaction as a networked pattern rather than a discontinuous relationship. As Hayle’s writes, reality “is constantly enlarging as self-conscious (scientific) observers operate recursively on their representations to generate new representations and realizations” (Hayles, 1999, p.158) and the observer’s mind is “a disunified, heterogeneous, collection of processes” (Hayles, 1999, p.156). The discussion in cognitive science influences the advancement of technologies as well as affects our perception of reality and the self, and addresses our existence as one, which is a posthuman.

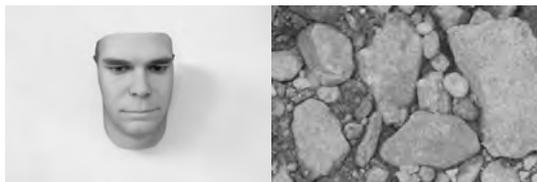


Figure 2. Stranger Visions by Heather Dewey-Hagborg. 3D print sculpture (left) from analyses of a generic material collected in public spaces (right) ©Heather Dewey-Hagborg artist website

Brain Plasticity as a Neuronal Metaphor

For Catherine Malabou, the scientific theory of brain plasticity works as a metaphor for our identities in a sociocultural environment, and the meaning of ‘plasticity’ is situated at two ironic extremes of determination and freedom, which nullifies the determination. By heightening the awareness of the brain mechanism and the scientific fact that the brain is plastic, that is, affected by our history, Malabou urges us in her book *What Should We Do with Our Brain?* (2008), to rethink how we should engage in social ideology, specifically to clarify the often-confused notion of plasticity and flexibility. Departing from the old model that brain and consciousness are separate entities, we should now start to establish discussions in philosophy, science and politics with a consciousness of the brain. The idea of a naturalization effect from *The New Spirit of Capitalism* (2007) by Luc Boltanski and Eve Chiapello strongly supports the idea of considering neuronal functioning and social functioning together. The natural effect means “neuronal functioning and social functioning interdetermine each other and mutually give each other form to the point where it is no longer possible to distinguish them” (Malabou, 2008, p.9). The brain mechanism becomes a neuronal metaphor rather than a neuronal ideology that implicates consciousness (Malabou, 2008).

As mistaking the plasticity as a cognate with ‘flexibility,’ the ideology expects us to accept a certain docility that disregards our own history. Being plastic means that we autonomously construct the brain with a capacity to annihilate existing forms based on our own experience to drive synaptic neurons. To ask the question “What should we do with our brain?” is to enlighten what potentials we have in our brains and what is natural to them (brains) and us (self), so that we explode against the cultural system of flexibility to be plastic.

Observing the scientific phenomenon of brain plasticity, we should be aware of the responsibility to form our

identities in society and acknowledge the close connection between neuronal and political/ideological selves.

Being a True ‘Synaptic Self’

The brain is not a simple organ, but the fundamental organic coherence of our personality. Malabou investigates the concept of the subject and self-discussed in contemporary neuroscience (Ibid), focusing on LeDoux’s notion of synaptic self and Damasia’s proto-self. Damasio explains, the “proto-self” or “primordial” self covers “the ensemble of brain devices which continuously and nonconsciously maintain the body within the narrow range and relative stability required for survival” (Malabou, 2008, p.58).

The fact that a synapse changes its form according to the subject’s personal history brings up political, economic and cultural questions. A personality is formed from the proto-self that is the general neuronal structure to the conscious level of an autobiographical self. Among numerous neurons in the subject’s unconsciousness, only the best, highest performing ones are selected and converted into the conscious image for a harmonious and mature personality, which can be seen as mental or psychological Darwinism. By pointing out that “only the most “useful” synaptic connections would be modulated or reinforced,” (Malabou, 2008, p.65) Malabou observes an ecological relation in neurons.

While looking at the brain as an image of the world, the transition between a proto-self and conscience, how the nonconscious neurons signal to consciousness, is not yet scientifically postulated. Therefore, it has constituted a philosophical or epistemological position (Malabou, 2008), and this discontinuity in scientific knowledge leaves a space for us to explicate consciousness rather than hinder our true liberation. Malabou suggests looking into the new plasticity called “intermediate plasticity” – in addition to developmental plasticity, modulational plasticity, and reparative plasticity – to include richness in our experience (Ibid). The nebulous transition between the neuronal to the psychical is where we can overcome the limitation of scientific knowledge and find answers to improve our “quality of life.”

As Nietzsche said, the sickness and suffering in life is caused from the lack of “resistance” (Malabou, 2008).

Self-fashioning, in which multiple lives and forms are contemporaneous together, means the capacity to resist and annihilate a form, and it is neither smooth nor continuous. Transitioning from the cerebral to the psychical as well as living in an autoconstruction entails a series

of leaps or gaps (which is referred to Malabou as the explosion). Malabou's philosophical perspective within scientific discovery is extended to creating resistance to neuronal ideology and liberates us from being flexible to determination.

Conclusion

A scientific discussion and approach in cognitive science shapes current views about the brain, and the brain and consciousness are the essential identity and personality being enacted and represented in cultural circumstances. Mental representations are coded again with a cultural understanding, and the analyzed symbol and code – both digitally and experientially – become a foundation to evaluate the adequacy of behaviors. The scientific research on cognition and the change of the socio-cultural perspective are inseparable and contribute to each other's development, and we develop self-recognition based on this knowledge.

Verela's enactivism in cognitive science expands, described extensively in his book *The Embodied Mind* (1991), the horizon of cognitive science by including both the meditative attention to experience in daily life and the scientific attention to mind, and helps us to understand the space between the self and the world in a scientific way without losing the richness derived from immediate experience. His alternative direction in cognitive science puts the focus on the "transition" and changes our understanding of objectivity in science. Philosophy and cultural studies were the foundation of the emergence of the cognitive science in the 1950s. Today, this interdisciplinary science that investigates how we recognize, understand and represent the world confirms, refreshes, and embodies our cultural view and understanding.

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The Aesthetic Experience of Augmented Reality Art

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Abstract

In the digital age, we create new technological forms and media artworks that define new relationships between the environment and us. Artists and actors are increasingly using their own mobile computing devices and AR to create artworks. When we experience an artwork in an “Augmented Space”, we can consider it as an interactive event. As a result, we can treat interaction, immersion and realization as three components of the events within augmented space. In this paper, by using the dynamic event concept and through analyses of famous mobile AR artworks, we reach three major conclusions of aesthetic experiences in AR artworks: the event of real time interaction is the aesthetic manner; the immanent event of the fuzzy boundary immersion is the aesthetic distance; and the immanent event of augmented realization is the aesthetic purpose.

Keywords

Aesthetic Experiences, Interaction, Event, Digital Art, AR, VR, Augmented Space.

Introduction

Because of the advancement of media development in the Twenty-first century, the new form of digital art created through Augmented Reality (AR) (Azuma, 1997) technology is impacting the traditional aesthetic principles. In aesthetics research, art has always been an important field for analyzing the essence of aesthetic activities through analyzing artistic works. Digital Aesthetics (Jensen, 2007) here are understood and analyzed as the mediation of an individual experience, which comes from mediated and unmediated social interaction (Jensen, 2007, p.7-24). Similarly, digital aesthetics of AR art (Geroimenko, 2014) focus on how we perceive our world while interacting with AR through augmented perceptions, then triggering our realizations.

Literature Review

As shown from Table 1. Bill Verplank, a pioneer in HCI design (Johnson, 1992), summarized the core issues for

interaction design, which are “Doing, Feeling and Knowing” (Verplank, 2003, p.6-10). Since these actions only relate to people, Timothy Barker proposed the event of interaction, that includes not only people, but also software and hardware (Barker, 2012, p.196). Katja Kwastek’s Interaction Aesthetic theory tells us that interaction in digital media occurs between “Distanced observation” and “Active Realization” (Kwastek, 2013, p.90). In addition, from the “4Is” theory introduced for explaining VR (Burdea, 2003), we can treat Kwastek’s “Distanced observation” as a result of Immersion. However, none of these theories are particularly accurate for explaining AR art, in that they refer to digital theory in general.

Theories	Perceptions		Realizations
Verplank (2003) Interaction Design Theory	Do	Feel	Know
Burdea, & Coiffet’s “4Is” theory for VR (Budea,2003)	Interaction	Immersion	Imagintaion Insight
Timothy Barker (Barker, 2012,p.109) “Interactive event”	“Connections are formed between the user, the machine, the software “(Barker, 2012, p.196)	N/A	N/A

Kwastek (2013) "Aesthetics of Interaction in Digital Art"	"Interaction is a process of feedback" (Kwastek, 2008, p.15-26)	"Distanced observation" (Kwastek, 2013, p.97)	"Active Realization" (Kwastek, 2013, p.97)
For this research	Event of Interaction (Between actor, mobile AR and physical environment)	Immanent Event of Immersion	Immanent Event of Realization

Table 1. Digital Theories

Research Methods

In this paper, we analyze the existing aesthetic theories for digital art in general, then choose the most suitable parts for examine the aesthetic experience in AR art. Literature review starts from Albert Einstein's "Theory of Special Relativity" (Einstein, 2015), A.N. Whitehead's "Process Philosophy" (Rescher, 1996, p.20) and Deleuze's 'Event' (Deleuze & Conley, 1992, p.76-82) thinking to provide this research with a dynamic analysis methodology. This research will use the event of interaction, immersion and realization as the basic research framework. This analysis is integrated with three case studies from AR artworks, which are "String" (<http://string.co./>, 2015), "erasAR" (<https://erasar.wordpress.com./>, 2015) and "ARART" (<http://arart.info./>, 2015). Because of the instability of the changing forms of digital information, we cannot divide the concept of time and space apart. Jack Burnham enlightens advises us to treat "*The entire environment*" (Burnham, 1968, p.30-35) as a whole work. It can be regarded as the "*Augmented Space*" (Manovich, 2006, p.223) that is generated by an AR artwork. In this research, we will only use the terminology of 'augmented space' instead of "augmented reality environment".

Digital Information Flow and Events in Augmented Space

According to Whitehead and his Process Philosophy, the event is every substantial thing that we encounter in our daily "*substance of nature*" (Whitehead, & Douchement, 1957, p.19). Einstein believes that the "*collection of space-time*" (Einstein, 2015, p.201) is an event. Both Whitehead and Einstein try to describe a dynamic space-time flow that uses the event as a fundamental unit.

Manovich's (2006) "*dynamically changing information*" concept, not only integrates the relationship between physical and digital, but includes a variable factor about time inside of this space model. This concept makes augmented space an event. Deleuze states that: "*The event is of a different regime than the actions and passions of the body, even if it results from them.*" (Badiou, 2007, p.38-39). The "actions and passions" in augmented space represent the actor's perceptions and realizations. Deleuze's event includes the 'power beyond the visible' among the 'truth' as a consequence. Deleuze shaped this event to "immanent event" (Patton, 2005, p.400-413). Here, perceptions are not the final purpose; instead, the point is beyond perceptions; the result of perceptions is realization.

In AR art, the visual and kinetic properties of the multi-space include two-dimensional and three-dimensional digital information flow into the temporal experience of interaction. Without space-time as the basic element to create an event, we are unable to assign any meaning to augmented space.

The Event of Multi-Space Real-Time Interaction as the 'Aesthetic Manner'

Barker describes interaction as "*event in digital encounter*" (Barker, 2012, p.49) meaning that an interaction comes in and out of from both sides between human and machine. Kwastek uses "active entities" (Kwastek, 2013, p.90), as a concept that upgrades Whitehead's idea of "actual entities" (Whitehead, 1957, p.95) that he used to explain 'event'. They both highlighted that the interaction involves both human and machine. However, the physical environment also plays a crucial role in interaction of AR. Therefore, we have to re-think this interactive relationship from 'Human-Computer Interaction (HCI) (Johnson, 1992)' to "'Actor'-'Mobile AR'-'Physical Environment'" Interaction.

The first case study, "*String*", shows how AR artworks rely heavily on the interaction with the actor. Three artworks were integrated into one application software, which is triggered by three different Identification paintings.



Figure 1. ‘AR walking monster’ © “String”, (<http://string.co./>, 2015)

The first one, as shown in Figure 1, ‘AR 3D painting’ provides the actor with a ‘3D sketchpad’, which exists in the three-dimensional augmented space; by moving and positioning their mobile phone, the actor can create their own three-dimensional paintings.



Figure 2. ‘AR 3D painting’ © “String” (<http://string.co./>, 2015)

The second one, as shown in Figure 2, ‘AR walking monster’ allows actors to manipulate a cartoon monster walking around in augmented space by interacting with their device’s screen



Figure 3. ‘AR sneakers’, © “String”, (<http://string.co./>, 2015)

The third one, as shown in Figure 3, actors can point, rotate and see a 3D shoe through ‘AR Sneakers’, and change its color by tapping the color toolbar.

Human	Actions (Sending)	→	Input Devices (Gathering)	Computer (VR)
	Perceptions (Receiving)	←	Output Devices (Sending)	

Table 2. Human Computer Interaction in VR

Actor	Actions (Sending)	→	Input Devices (Gathering)	Mobile computing device (AR)	Input Devices (Gathering location/Camera information)	Physical environment (Source) ←
	Perceptions (Receiving)	←	Output Devices (Sending augmented information)			
		←	Output Devices (Sending reality-based information)			

Table 3. ‘Actor-Mobile AR- Physical Environment’ Multi-space Interaction Circular in Augmented Space

Comparing Table 2 and Table 3, we can see that the actor, mobile AR and physical environment all play key roles both as the information sender and the receiver, influencing and being influenced at the same time. Inside each interaction event, the actor is not only a participant, but also the co-creator in establishing interactive experiences. Aesthetic experiences in mobile AR can only be created when an actor interacts in augmented space, meaning that interaction is the only manner to obtain those experiences.

In augmented space, mobile AR becomes an ‘event generator of multi-space interaction’ which includes five significance characteristics.

- 1) the diversification of interaction manner;
- 2) the mobility, expressed by the possibility of engaging with mobile AR in any location;
- 3) the real-time interactivity
- 4) the multi-directional interaction between actor, mobile computing device, and the physical environment.
- 5) the unique individual experiences.

In the aesthetic experience, we treat the event of multi-space real-time interaction as the aesthetic manner for obtaining aesthetic experiences in augmented space.

The Immanent Event of Fuzzy Boundaries Immersion as the ‘Aesthetics Distance’

For the immersion experiences, interaction plays a key role in both VR and AR. Nechvatal considers immersion in VR as a computer generated artificial environment with interaction, which can give people immersive experiences (Nechvatal, 2010, p.48-61).



Figure 4. ©Mark Skwarek, “erasAR”, New York city,(Nech-vatal, 2010, p.48-61)z



Figure 5. ©Mark Skwarek, “erasAR”, New York city (Nech-vatal, 2010, p.48-61)

AR Artwork “erasAR”, as shown in Figure 4 and Figure 5, the Statue of Liberty has been erased from the screen view of an actor in his/her mobile computing device. In AR, we experience an augmented type of reality through our perceptions. This type of mixed reality, which is made of artificial augmented reality and physical world reality, feels real, and the actor believes he/she exists in it.

Type	Film	VR (3D games)	Mobile AR (“erasAR”)	
Relationship with people	Passively watching	Interaction		
Storytelling manner	Linear structure	Virtual Environment	Augmented Space	
			Digital Information Layers	Physical Environment
Sensory perceptions	Visual, Auditory	Visual, Auditory, Tactile and Action	Visual, Auditory, Tactile and Synchronous Action of matching with physical world objects/ environment/ location	

Immersion experiences	“I do not see anything from the outside” (Béla, 1938, p.215)	VR “put you inside a computer world” (Kelly, 2009, p.150). The actor feels like they are part of the simulated world. Senses are under the control of the VR system, it brings actor into the virtual world	The actor has not totally cut off from the physical world, also not totally intoxicated in digital world, they maintain a “sense of being”(Brown & Cairns, 2004) between physical and digital world, which we call it ‘Fuzzy Boundaries Immersion’.
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Table 4. The immersion types between film, VR and AR

Through immersion, VR provides a relatively open virtual environment that an actor can interact with. Unlike film which brings the audience into a linear story, VR puts the actor’s perception into a completely digital virtual environment; instead, AR pulls the actor back in the middle between digital and physical reality. In “erasAR”, AR makes it hard to distinguish the reality of the augmented space from the physical world because it retains the connection between them by maintaining the real aspect while simulating digital conditions. Information can not only be added, but also subtracted.

We cannot simply say that immersion in VR is a complete immersion, or that AR is semi-immersion. In AR, immersion is not only created by digital information flows, but also by mixed information flows resulting from the integration of digital and geographic information from the physical environment.

“Immersion equally relates to a state of intellectual absorption in an action or condition.” (Palmer, 2007, p.1).

The event of real-time interaction brings actors into the immersive condition, which is the result of interaction from perception level. In Table 4, we can define the immersion in augmented space as ‘fuzzy boundaries immersion’. The immanent event of fuzzy boundaries immersion as a result of perceptions through the event of real-time interaction forms a condition while making a path to actors’ realization, which makes them experience the mixed reality in augmented space.

The Immanent Event of Augmented Realization as the ‘Aesthetic Purpose’

Through perceptions, interaction and immersion, the immanent event of realization, like the prior experience and imagination in AR artworks, raises up the aesthetic experience to the final purpose. Here, perception makes a bridge from interaction to immersion then reaches realization, from the event of interaction to the immanent events of immersion and realization.



Figure 6. “ARART – Animate paintings”, “Girl with a Pearl Ear-ring”, NTT-ICC, Tokyo, ©ARART.INFO. (<http://arartinfo./>, 2015).



Figure 7. “ARART – Animate paintings”, “Sunflowers”, NTT-ICC, Tokyo, © ARART.INFO. (<http://arart.info./>, 2015)

Another case study is the “ARART- Animate paintings” ([http://arart.info./](http://arart.info/), 2015). Artists use masterpieces like Johannes Vermeer’s “Girl with a Pearl Earring” in Figure 6, Van Gogh’s “Sunflowers” in Figure 7, and Leonardo da Vinci’s “Mona Lisa” in Figure 8 and bring them into the world of AR, it turns dreams and fantasies into an actor’s ‘real’ experiences. The virtual realization from AR digital and the realization from physical world are both necessary for this type of realization, that we can name “Augmented Realization”. It mixes and augments the realization that is not only based on reality but also goes beyond reality.

The immanent event of augmented realization is the aesthetic purpose for AR arts through the immanent event of prior experience and imagination. Also the immanent event of augmented realization relies on the event of multi-space real-time interaction and the immanent event of fuzzy boundary immersion as aesthetic distance.



Figure 8. “ARART – Animate paintings”, “Mona Lisa”, NTT-ICC, Tokyo, © ARART.INFO. ([http://arart.info./](http://arart.info/), 2015).

Conclusions

	Aesthetic Manner	Aesthetic Distance	Aesthetic Purpose
	Perception		Realization
Events	Events	Immanent events	

AR artworks	Multi-space real-time interaction			Fuzzy boundary immersion	
	Interactive methods	Locations	Multisensory		
“ARART”	Image (Painting) recognition	Anywhere with print images	Visual, auditory, kinetic, and actions	Strong relevance to original paintings	Imagination rely on the physical environment and 3D digital content
“String”				Strong relevance to physical environment	
“eras AR”	Location based service (LBS)	New York City, USA			Comparison between the physical environment and augmented space

Table 5. Aesthetic experiences in AR Artworks

As shown in Table 5. By comparing the AR artworks introduced in the paper, we can observe a multitude of details from their attributes. AR artworks combine visual, auditory and kinetic aspects. Some of the artworks require a specific location, while others can be experienced everywhere. We experience the augmented world by interacting with our mobile device and/or by moving it around. Some AR artworks allows us to image we are traveling through space and time. Our aesthetic experience of our environment is redefined through our perceptions and realizations with AR.

To conclude, three major conclusions can be drawn

about aesthetic experiences in AR artworks:

1. The event of multi-space real-time interaction is the aesthetic manner.
2. The immanent event of fuzzy boundary immersion is the aesthetic distance.
3. The immanent event of augmented realization is the aesthetic purpose.

These three distinguishing characteristics shape AR art and transform the media artist from someone who creates art-works to someone who creates experiences and events. It also turns the passive participator or audience from the past into an active ‘interactor’. AR art breaks the location limits, carries art out of art museums and cinemas, making it walk into public spaces with an individual and mobile view, which allows it to be experienced anywhere and at any time.

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Prototyping Puppets Beyond Borders

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Abstract

We report on an ongoing collaboration that uses puppetry as a shared cultural expression in educational workshop that inform intercultural exchange. Collaborators in Atlanta, USA and Medellín, Colombia work in tandem on the design and implementation of puppet-building workshops. These workshops use narrative framing, craft-based prototyping, and performance-based validation to teach students basic prototyping skills. They specifically encourage them to relate to their local culture and to inform an ongoing dialogue between the two cultural spheres.

Keywords

Narratives, Puppetry, STEM/STEAM, Participatory design, Co-creation and Collaboration, Craft, Intercultural exchange.

Introduction

The *Prototyping Puppets* project is a work in progress that grew out of a design collaboration between the authors. It combines local workshops in two different cultural spheres that use narrative scaffolding to combine craft and art in order to teach informal components for Science, Technology, Engineering, and Mathematics (STEM) education. Each workshop aims to facilitate aesthetic self-expression and encourages cultural interactions through the exchange of emerging results and new designs. The workshops originally target 10- 12 year -old students and follow the same basic structure: create a narrative for a short puppet performance, create the puppets for this play and include STEM prototyping components in these puppets, finally realize the play through these puppets. Workshop participants alter existent designs and adjust puppets to their narrative and particular performative needs. These modifications are swapped between different workshop instantiations to shape a creative exchange between the students as co-designers. Puppet designs emerge, stories reflect locale, and technology is adjusted to local needs. This collaboration has bridged researchers located in two distinct geographic and cultural locations: Atlanta, USA, and Medellín, Colombia.

Bridging differences in age, cultural background, levels of expertise, available technologies, or financial conditions has been a continuing challenge for creative design approaches, including Participatory Design (PD) (Muller & Druin, 2012). Adding to these challenges is the lack of colocation, leading to the field of Distributed Participatory Design (discussed in workshops at CHI 2006 and 2008 as well as PDC 2008). Distributed Participatory Design (DPD) actively deals with different locations and cultural conditions that affect a shared design process. It has been applied e.g. in software development, where Gumm et al. used a work-shop approach to connect different shareholders in the long-term software development (Gumm, Janneck, & Finck, 2006). But adjusting the processes and the designs to fit those different conditions is not always easy. Loebbecke and Powell argue, for example, that successful DPD entails inclusion of disciplines beyond PD (Loebbecke & Powell, 2009). *Prototyping Puppets* did not target a new theoretical framework for design but it emerged as a practice using shared approaches and is presented as a case for transnational collaboration through adjusting practices of “making” based on cultural diversity.

The goal was not to organize the processes toward a singular object or design but to use distributed co-creation itself as an educational tool in-between participants from different cultures and socio-economic conditions, while serving a global population in the development from STEM to STEAM (Science, Technology, Engineering, Arts, and Mathematics).

The emerging collaboration distributed the creative processes among the researchers and students. Maintaining such a balance between all parties is challenging, though (see also Fowles, 2000). In our case, this was introduced through a basic workshop structure that largely remained intact. It encourages participants to independently develop their own expressions and stories and create the responding objects, puppets,

and props for them. We provide a kit-like scaffolding to stimulate participants' own creative engagement in a play-based workshop setting. We designed tutorials with sample puppet characters but we consciously left the particular performance settings during a workshop open to the creativity of the participants. Participants are encouraged to perform their own stories and test their puppets at the same time. The workshops encourage personal expression first and deploy technology as a means in an accessible setting. Using traditional and familiar materials and combining those with a "combination of modelling with storytelling relativizes the quality of the model designed, and therefore levels out the modelling skills of experienced and inexperienced participants" (Schulz, Geithner, Woelfel & Krzywinski, 2015). Workshops close with informal reflections on the process.

Local interpretations are approached as opportunities for mutual learning through a form of asynchronous dialogue between culturally, and social-technologically distant partners. The project includes cultural differences as additive in a gradual discourse of the shared basic workshop structure. We found that puppetry stands out as a shared, yet culturally diverse form of expression that is particularly suited for this approach. While puppetry is an art form that can be found on every continent, its practices and local customs differ widely (Blumenthal, 2005). How such differences unfold in comparable workshop settings and how they are shared and affect each other is the story of the *Prototyping Puppets* project.

Project Design and Context

The Center for Puppetry Arts in Atlanta is an internationally renowned center for the education on and performance of puppetry. It features one of the largest puppet collections in the United States, a recently expanded museum, and its own educational programs on site as well as online. In addition, they offer own puppet-creation workshops featuring original puppet designs. During these workshops, children assemble their own puppets made of basic craft materials, such as paper, wood, strings, and various customization elements. These workshops are extremely accessible (the center supports a very diverse population of students and includes special events for special needs students) and successfully combine performance with craft exercises. Inspired by these workshops, a group of researchers from the Digital World and Image group at Georgia

Tech developed their own puppet designs to not only allow for mechanical construction but also include basic hardware prototyping elements. The goal was a STEM-based workshop allowing participants from different cultures to express themselves through a combination of craft and technology, making and performing. With this in mind, the Georgia Tech's team started a cooperation with the research group Hipertrópico, arts and technology in Universidad de Antioquia (UdeA), Medellín to test the workshop in a different cultural environment. Although Medellín does not have a big center for education on and performance of puppetry, it has small independent theatrical companies that explore puppetry as an artistic media. Traditions seem to merge, as Galeano and Arias suggest, elements of the passage objects used in the rituals of the aboriginal cultures with the European tradition of puppetry brought to the region during the Spanish colonization (Arias/Galeano 2015). Medellín has a varied culture of social and cultural uses of puppetry, especially for children audiences, that goes from theatrical to recreational covering private parties, public festivities and institutional events. Although this tradition uses puppetry as performance, there is a need to strength the possibilities of using active participation of children in the creation of puppets as object and in the creation of performances of narratives with puppets. This participation can not only support self-expression and collective active learning but also can expand children's design and creative engagement with technology. The goal is not to adapt one form of puppetry but to build on the differences between forms across borders.

Craft and STEAM

The workshop was designed following the considerations of a systemic learning process that authors such as Boy proposed as a way to expand the disciplinary teaching processes of many schools to an interdisciplinary teaching and learning processes that must include art. "Systems need to be investigated and tested as wholes, which requires a cross-disciplinary approach and new conceptual principles and tools. Consequently, schools cannot continue to only teach isolated disciplines based on simple reductionism. Science, Technology, Engineering, and Mathematics (STEM) should also be integrated together with the Arts to promote creativity together with rationalization, and move (back) to STEAM (with an "A" for Arts)" (Boy, 2013).

The current turn to "making" and the combination

of craft and electronics/digital media acknowledges this role of context and interdisciplinarity. But projects often lack the experiential aspect of the referenced craft materials. Not every “maker” project is designed with its cultural and material conditions in mind. This has been rightfully debated by proponents of a “critical making” approach who lament a “disconnect between conceptual understandings of technological objects and our material experiences with them” (Ratto, 2011). In contrast, craft-as-practice is deeply grounded in socio-cultural context and provides a critical counter argument. Here, Buechley’s combination of craft and computing (Buechley & Eisenberg, 2009) and related work on the use of soft circuits in education (Kuznetsov et al., 2011; Pepler & Glosson, 2013) are most relevant for our design, which combines basic prototyping technologies with traditional puppet making. Buechley’s initial work was an expansion of technologies. In her case, this included the development of the LilyPad prototyping board to which she later added the concept of the “kit-of-no-parts,” which leans directly on traditional craft materials (Perner-Wilson, Buechley & Satomi, 2011). Particularly this later approach mirrors *Prototyping Puppets*’ use of craft: to combine aesthetic self-expression, familiar materials, and electronics into a creative and interest-driven learning STEAM experience. Pepler (Pepler, Tekinbas, Gresalfi & Santo, 2014) explores this domain further and shows that familiar materials and practices lower the entry threshold for participating students and notably speak to female students. Others have shown the appeal of a hybrid craft approach with at-risk population (Kuznetsov et al., 2011). Pepler and Glosson conclude that “learning happens best when toolkits afford a sense of transparency by providing opportunities for concretizing knowledge through tinkering with the materials” (Pepler & Glosson, 2013). *Prototyping Puppets* builds on these approaches as it applies technologies that combine material construction and electronics. It further extends them to experiential performance/ use: Students engage with technology not only in the practice of making but also through their creative use in playful performance. Both steps are culturally grounded in the students’ own experiences and situations.

Role of Performance

Performance art presents a varied and ubiquitous form of personal and communal expression across all cultures.

Schechner introduces performances as a “continuum” of human actions (Schechner, 2002) that stretch across cultures as well as activities. Its local variations, personal relevance, and global appeal predestine performance arts as a powerful tool in STEM education. Because it is practice-based, it sets the stage for a form of experiential learning propagated by Piaget, Dewey, and others. Experiential learning has been used in education for adults as well as children and its potential “to erode traditional boundaries between knowledge and skills, vocational and academic learning” (Reeve & Gallacher, 1999) speaks to the transnational and transdisciplinary nature of the *Prototyping Puppets* project.

As in other areas, the digital revolution had a profound impact on performance art and re-shaped numerous performance practices. It questioned the very nature of the performance as mediated event (Auslander, 2008) and opened up new venues, such as “intermedia” (Chapple & Kattenbelt, 2006). At the same time, computer science and HCI adopted theatrical approaches such as Laurel’s work on an Aristotelian model for HCI (Laurel, 1991) or Mixed reality performance design in ubiquitous computing (Benford & Giannachi, 2011). A fractured lineage can be drawn from evolving performance practices to often experimental forms of interaction design. However, these cases largely apply one domain to further the other: either they adapt technology to further performance or apply performance practice to improve HCI. A combination of the two as equal pedagogical partners is far less developed.

Targeting Puppets

Puppetry, as a particular form of performance art, has been applied to digital media in various ways. These include storytelling, improvisation, and public engagement (Bottoni et al., 2008) as well as educational (Marshall, Rogers, & Scaife, 2004), and technological projects (Martin, Johnson, Murphey & Egerstedt, 2011). Puppetry inherently depends on forms of engineering and technology through the object of the mechanical puppet. Puppets, such as the ones Hand-spring Puppet designed for the theatrical show *War Horse* (2007-), are often technological and mechanical master-pieces. At the same time, they are objects optimized for artistic expression. Puppetry remains a relevant cultural phenomenon as different practices remain in place and beloved today all over the world. This combination makes puppetry readily applicable to STEM. It also

allows for distinct cultural framing.

Thanks to this widespread acceptance, puppetry continues to be used in formal and informal education as an effective platform for communication and creative production (Bernier & O’Hare, 2005). *Prototyping Puppets* builds on these proven strengths of puppetry to attract and engage new groups of students through self-expression for a STEAM workshop on basic prototyping.

Puppets have the appeal of whimsical and extremely familiar personal objects. At the same time, they are rich in expression and pose complex technical challenges in construction and operation. They are complex mechanisms with delicate engineering components as well as culture icons and familiar characters. They are effective tools for STEM education precisely because they embody the engineering materiality as well as the immaterial cultural reference in performance. *Prototyping Puppets* combines making and performing in the construction of the personal expression.

Both tiers of the project, craft and performance, are naturally integrated in this field of puppetry. It offers the necessary combination of local culture through narrative and performance as well as technology and prototyping in the designs of the educational workshops.

Workshops

The Atlanta Workshops

The project started as a workshop modeled after existent puppet-making workshops at the Center for Puppetry Arts (CPA) in Atlanta adding to this craft-based mechanical construction a basic prototyping component. First, the designers learnt from the puppeteers and educators at the CPA before they devised their own basic puppet-making-designs. Those included traditional materials (paper, wood, wool) as well as prototyping components (LEDs, conductive copper tape, batteries). The initial target was to create a scaffolding that would allow early middle school children (aged 11-12) to experiment with simple circuit building in a STEAM environment. Basic puppet templates were provided as teaching material and reference material for students. We created video and assembly documentation material for various puppet designs. Those designs were developed not as blue-prints to be followed but as guiding samples to be adjusted to any specific needs from the participants. It was important to leave these designs open enough to allow students to make the puppets themselves and accordingly to their design intentions – not to follow a singular step-by-step walkthrough.



Figure 1. Reference puppet design (left); example for realization of the design for a performance (Atlanta workshop) (right)

In connection with these technical designs, the workshops were developed around the three steps of narrative development, craft-based technical puppet construction, and validation through performance. The combination of the three-step approach with familiar materials in simple design references provided the targeted educational setting. Craft- as-practice is deeply grounded in socio- cultural context and provides a critical counter argument to an abstracted, somehow “general,” potentially culturally unaware process.

Following such a “turn to practice” the *Prototyping Puppets* project is set up as an sample educational approach to include “physical and mental activities of human bodies, the material environment, artifacts and their use, contexts, human capabilities, affinities and motivation” (Kuutti & Bannon, 2014). During the design phase, the researchers explored multiple puppet designs. One common element was that they grew out of the turn to craft and “making” outlined above. This means, they readily included specialized materials typical for this movement – such as self-adhesive conductive copper tape or conductive thread.

In practice, the designs included crafting paper, cloth pins, adhesive and conductive copper tape, LEDs, and various means of customization. Tools for assembly included basic craft tools, such as scissors, glue, and tape. The researchers provided the basic designs but these designs were quickly appropriated and changed (see fig. 1). The designs were pilot tested with significantly differing results depending on the setting. But the local differences are not the focus of this paper. It was more important to find that the work-shop design itself proved to be stable and the technology was feasible.

This work was conducted in a lab environment, thus the specific nature of chosen components (copper tape, conductive thread) or tools (multimeter) did not pose any restriction. This is typical for many craft-based

approaches emerging from university lab environments and – as we soon realized – it represents a detachment from the realities in the target audience’s environment.

The Medellín Workshops

The work in Medellín started with an adaptation of the tutorials. The first approach to testing the tutorials was pilot tested by Isabel Restrepo and another adult with elementary school children. Since they needed to incorporate recycling materials, the original materials, which included sturdy craft paper, was replaced by cardboard from a box. The use of this material allowed the creation of larger entities and led to a stage for the puppets. This was a creative decision of the children but also included complications for the construction process. For example, scissors were not the right tool to cut the cardboard and the adults needed to help the children by using a scalpel.



Figure 2. Creating a complete stage (Medellín workshop)

Another material that needed to be replaced was the conducting tape, giving that it was not available in the city. Instead, electrical wires from recycled material were used. To build the basic circuits for the puppets we had to use soldered-brass tools, so this task was primarily done by the adults. Dealing with materials at hand emerged as a key challenge as well as an opportunity: functional parts had to be replaced and inherently shaped the nature of the puppet.

The second test was done by some members of the research group Hipertrópico, from UdeA. After translating and studying the tutorials the team decided to test two of them with three main goals in mind:

- Understand the mechanism.
- Measure the possibilities of using the tutorials with children.
- Test the materials and tools.

The team found an alternative material for the conductive tape: aluminum foil coated with rubber adhesive. This material that generated further changes from the original Atlanta design. The adhesive tape covered a big part of the character and electrical wire was used to warranty conductivity between the battery and the aluminum adhesive. Once the puppet prototypes were done, the team created a narrative by using the surrealist methodology of the *Exquisite corpse* or *Cadavre exquis*. This strategy generated the need for designing extra props and a more elaborate stage including a rolling background. In this way, the team designed a kit-like scaffolding with all the needed elements to perform the piece as an introduction for the workshop with children.



Figure 3. Medellín flower-tree design with aluminum adhesive

After testing the tutorial, designing puppets, props and background, and rehearsing the performance, the team designed the methodology of a three session workshops based on a cooperative work between children and adult instructors (members of the team). During the first session, the team performed the piece to the children and provided technical and conceptual information. After dividing the group up into four teams, each team, was encouraged to create a story and to build the electrical components for the main characters. During the second session, the teams finished the puppets and developed props and backgrounds. During the last session, the

children rehearsed, performed and evaluated the overall experience.



Figure 4. Performance situation on location (Medellín workshop)

Children were receptive and active participants during all sessions of the workshop. Yet, again, the local differences are not the focus of this paper. Instead, the necessary changes in the workshop designs were traced as formative evolutionary steps.

Outlook and Dialogue

Workshops at both locations have shown that the overall framing and workshop design work across very different conditions. They also show emerging differences on every level of the core events. The created narratives, the materials, the puppet designs, and the final performances all differ. Exchanging these differences, realizing them in different cultural contexts, while operating within the given scaffolding of a puppet-building workshop establishes a transnational dialogue that includes material, practice, and social context. A key component of this dialogue is the shared use of online documentation. Both teams share videos, instructions, photo documentation, and related design materials online for ongoing discussions and further development.

A key component of the adjustments done in Colombia was the translation of the originally English instructions and the illustration of each step with clearer graphics. Their final documentation includes bilingual descriptors and is optimized for printing. This stands in clear contrast to the English workflow documentation from the Atlanta group, which used google documents and photo images. As the project stepped from a lab

environment into the application on site, the localization of the original documentation from a research-based design work to an accessible and appealing format is one example of transnational and transcultural adjustment.

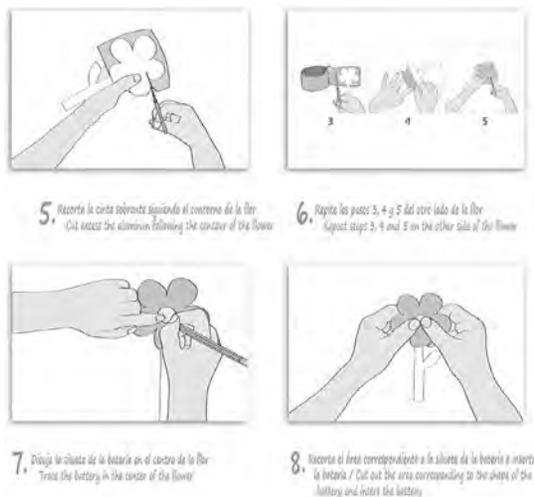


Figure 5. Sample page of documentation for the Medellín workshop

Likewise, the changes in material from copper tape to conductive adhesives and from craft paper to sturdier carton changed the puppet designs, opening up new directions. One such direction is the turn to props and stage design. The Atlanta workshops focused entirely on the design and making of puppets with little work on props or scenery, the Medellín participants included much more differentiated scene design and stage development. The use of different materials might have supported this step. As the Medellín realization of the workshops led to a bigger focus on the surrounding stage and scenery, they also adapted the circuit building components to this stage set up. The participants in Medellín clearly demanded more context for the puppet performance than those in the US, where some props but almost no back-drops were created. This has led to an additional design components for a puppetry stage. The performance staging enters the design development of the workshops and will be one of the design impacts from the Medellín workshop that feeds back to the Atlanta versions.

The emerging stage design from the Medellín workshop resembles that of a single-standing performance theater. Notably, this reflects historic

developments in puppet theater, which has seen such portable stages in many variations (Blumenthal, 2005). These designs have been documented and reflected in the workshop documentation to test them in return in local workshops in Atlanta, be altered in reply and sent back to Medellín.

The workshops and puppet design have proven to work locally, yet the most relevant findings are the differences that materialized between the workshops in Atlanta and those in Medellín. We are only beginning to explore these differences through the workshop scaffolding that we have developed but the original set up has proven to be flexible and distinct enough to allow participants to articulate their own expression with the means available to their specific situation. This, in turn, shapes the ongoing transformations of the workshop practice both on the craft and technological as well as the performative and artistic side. We argue that this dual engagement provides the necessary depth for a distributed transnational STEAM based dialogue.

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Authors' Biographies

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Isabel Restrepo holds a PhD from Universidad de Antioquia and a MFA in Art with emphasis in Multimedia from San Diego State University. In 2008, Restrepo founded the interdisciplinary group Hipertrópico to study relationships between art, technology and society. She directed key research within that group, including the project on Augmented Reality and Imaging and Artistic Education: A Pedagogical Model. In her exploration, Restrepo has utilized Open Source as a tool for production, experimentation and teaching digital media in art. Such work has led to the creation of the pedagogical multimedia Líneas Digitales, based on the use of GIMP. In addition, she has worked as curator and educator.

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Hackitectures.

Reordering Physical Spaces, Electronic Flows and Social Bodies. ISEA2017

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Abstract

The architectural gap between the real and the virtual from the point of view of inhabiting is a field of study within the branch of the Hackitecturas - driven by the need of the technological subject to be a participant in the transformation of the places that he inhabits. The current emerging society, the society of information and knowledge, begins to demand changes where spaces for social reality are appropriate to its needs. From here, architecture - the science that deals with the organization and production of the space we inhabit -, has to reach a transformation in the development of its concepts and goals in order to organize and produce new spatialities. In order to do that, architecture itself generates the need to begin to connect with other fields of knowledge, getting to know, imagine and create the new habitats.

Keywords

Hacker, Architecture, Hybrid Spaces, Electronic Flows, Social Bodies, Geolocalization, Free Software and Hardware.

Introduction

“Real time, open broadcast and participation from different geolocations and their staging are the keys to redefine the architecture and activate the new public space” (pablo de soto / hackitectura.net / 2003 / okupa futura _ corvera)

From a Hackitecturas approach, it is considered that the current situation of the network society can serve as a basis for identifying the necessary conditions in the incorporation of the Space of Places to the Information Society. Conditions that will change the concept of habitability, since it will no longer be that of having to be physically in a place but, through connectivity, it restructures and generates changes in temporal space relations between the local and the global, places and spaces.

“(…) the most intensely contemporary architecture is one the that poses as priority these issues; the wisdom,

the knowledge and the production of spaces of flows” (De Soto, 2003, parr.6)

Multiple emerging processes are participating in the current spatiality of flows and network organization technologies, generating the configuration of alternative spatial orders and habitats within the architectural space. In this context, all the dichotomies that make it unstable begin to redefine, its transformation being visible through the communication systems and nodes that work in favor of habitations suitable for new needs.

In this article we make an analysis, based on the conformation of all spaces, electronic flows and social bodies, in order to investigate their connections and their meaning in society and the contemporary territory.

The study of habits opens up an understanding of them towards the architectural as a deterritorialization (Deleuze and Guattari), as a social and at the same time material and mental production (Heidegger, Lefebvre). We work here from imaginaries, cartographies, narratives, trying to think architecture from the margins through social, cultural and technological transformations.

In light of this we can ask ourselves, how do we intervene the territory? And above all, how do we incorporate the electronic flows into the thought and forms of space production?

Text

The term Hackitectura encompasses the aforementioned thoughts, a word that comes from two activities and therefore diverse terms. On the one hand we have the word Hacker and on the other hand the word Architecture, which must be defined in order to position and contextualize this analysis.

The term Hacker in the hacker jargon dictionary - the “jargon file”, collectively compiled on the network -, defines hackers as: People enthusiastically engaged in programming, and who believe that putting information

into common spaces constitutes good, and that it is also an ethical duty for them to share their expertise by developing free software and facilitating access to information and computing resources whenever possible. (Himanen, 2002, p. 2)

Broadening the term, a hacker is a person who has stopped using his computer to survive and has moved to the next two stages. He uses the computer for his social ties: e-mail and the Internet are the ways to access and be in contact with the community. But for the hacker, a computer is also entertainment, the computer itself is entertainment; you get entertainment from the fact that you are doing something interesting and at the same time achieving a social impact.

Following with the analysis of the terms, Architecture is analyzed within its most contemporary understanding, that is, as an artistic, scientific and research activity, which deals with inhabiting and, therefore, with the ways in which we are in space, its transformations and the creation of new ways of habiting. This had been defined by Perez de Lama as "(...) a recombinant practice of physical spaces, electronic flows and social bodies that is carried out by groups of people whose specialties include diverse backgrounds: architects, programmers-technologists, and citizen-activists." (Pérez de Lama, 2007, p.55)

According to Eduardo Serrano the territory can be intervened, transforming the relations between the physical environment and the inhabitants, making electronic flows enter as a component able to modulate the relations between both, producing territory.

The transformation of places and spaces must begin to be designed taking into account the multiplicity, the invisible space of the immaterial and their connection flows. The need for an architecture of interfaces and nodes makes it essential to develop a rhizomatic structure in the search for systems that are not self-centered but in continuous expansion.

Society is at the present time within what is called the Network Society which, according to Castell, is characterized in the space sphere by the transition from the space of places (traditional architecture) to the space of flows (contemporary architecture).

Through these definitions it can be seen how in a territory connected as part of the space of flows, life there will also have other dimensions. This new way of inhabiting, creates new urbanisms generated by the application of these digital networks to the configuration

of the city. This city, typical of a hyperconnected society, aims towards the search of environments capable of feeling the human experience.

The space of the flows is giving rise to a rhizome, generating new geographies, emerging from variable and liquid geometries, and proposing machines of transformation of the world whose objective is the connected multitude. Free diffusion, shared information and knowledge are all in the hands of communication technologies and information as well as globalization.

It is possible to imagine other diagrams for the space of flows, other assemblages between globalization and non-formating; compositions that, from the point of view of urbanism, had been defined by Pérez de Lama (2006) as "geographies of the connected crowd" (p.19).

The hackitecturas use a methodology, both collectively and conceptually, of free software and hardware, in order to explore the theories previously analyzed. Through experiments, they recombine ideas of science fiction, technology and social movements for the generation of these territories.

The tools of free software and hardware come from a discourse of social cooperation and collective intelligence. They are used in order to generate the social construction of public spaces, open and participative, that favors the integration of the subjects in community. The ethical motivation behind the use of free software is inherited from the hacker culture, which argues that software is knowledge that must be able to spread freely, and that its concealment is not only an antisocial attitude but also that the possibility of modifying programs is a form of freedom of expression. In this aspect one can go deeper into essays by Richard Stallman or the analysis of Pekka Himanen in her book "The Hacker Ethic and the Spirit of the Information Age".

Free software is not limited to being free, it also has a fundamental social value, since the only restriction that it receives is that of being free, which means that it can be explored, verified, reproduced and extended in all its capacities for the benefit of all, in a manner very similar to the nature of science production. The use of this type of tools, as well as the projects generated related to hackitectura, are moved by social, participatory and collective changes, making use of shared knowledge.

In terms of projects proposed within these territories, at the national level there is a project of territorialization, the Information Society Project of Extremadura and Línex, for the construction of a public communications

network combined with the development of a free operating system for educational and administrative use (Línex: Linux + Extremadura).

Once the construction of the network was resolved, those in charge, bearing the political responsibility over it, considered the need to acquire equipment and software to make it work. It was then that the pioneering and futuristic possibility of installing free software, which at that time was becoming a viable alternative, came about. That is to say, instead of buying licenses of nearly monopolist suppliers of software - called proprietary -, Extremadura decides to mount all the management software of the network and of the operative systems and applications of all its computers with programs of open code, free software - which is free or available at low cost for its use and transformation, as it has been developed cooperatively by thousands of hackers, for what has also come to be called the collective intelligence of the Network.

With its own development of an adaptation of GNU / Linux, the standard of free software, the adaptation would eventually become GNU/LinEx <http://www.linex.org>. With the savings, important budgetary items are dedicated to the training of local programmers and technicians, and to educating the population about the new digital platform.

As it is often the case, great innovations are not easily recognized. And although the Extremadura + Línex Intranet project is well known especially in the field of information technology, it is not in the area of urban planning or land management. However, it is undeniable for any unprejudiced observer that the deterritorial/reterritorializing capacity of the information society project in Extremadura goes far beyond any traditional project that could be undertaken with the conventional tools of the architectural or urbanistic disciplines.

William Mitchell, former dean of the School of Architecture at MIT proposes another concept that is in connection with the above mentioned about the relationship of subjects and the use of active free technologies: With the new inhabitant for / with whom to think, Architecture must cease to be the isolated individual, center and measure of all things (that of humanism), to become as Mitchell called spatially extended cyborg.

We would do better if we took as a unit of subjectivity and survival, the biological individual plus its

extensions and interconnections (...) I am not the Vitruvian individual, enclosed in a single and perfect circle, mending the world from the perspective of my Personal coordinates, while determining the measure of all things (...) I build and I am built, in a recursive mutual process that continually implies my fluid and permeable limits and my networks indefinitely branched out. I'm a spatially extended cyborg (Mitchell, 2003, p.39).

Mitchell proposes to think of architecture and the urban space of the Twenty First century as a territory that is dynamically constructed through the reticular interaction of mobile bodies, electronic flows and physical spaces: we communicate at a distance through semi-ubiquitous networks -Invisible.

According to the theories of prosthetics and cyborg, which consist of tools as extensions of the body that allow us to interact with the medium, we can see - in the network age - how technological extensions interact at many levels with other subjects, getting to be confused with the territory.

Toyo Ito speaks about this type of cyborgs, proposing to call it the body of the modern electronic movement, being this a body that floats simultaneously between natural and electronic flows, finding us therefore in the search of a house that does not yet exist, a habitat that begins to be visualized without materializing. Here is his longing of no architecture: "A house that, having left its materiality behind, would become floating, the sphere of the living in the midst of the flows, the whirlpool in a river that flows uniformly, pure life" (Ito, 200, p.25-29).

There are many projects in the field of art-science-technology study emerging with new forms of hybrid spaces, through an ethereal architecture within the cybernetic labyrinth in which we currently move. These are projects that deal with the concept of architecture from energy flows and data related to information and communication technologies as well as physical space.

One of the lines of research developed by the Hackitectura.net team is the construction of situations using digital tools that allow the appropriation and re-signification of a space, generally urban; appropriation that is carried out by the inhabitants of the space on which they intervene and, during the action is transformed, becoming a node of the space of flows.

The events consist of connecting to the network the spaces in which it is intervened, with the widest possible band, to use these connections in order to, in real time, receive emissions from different geolocations,

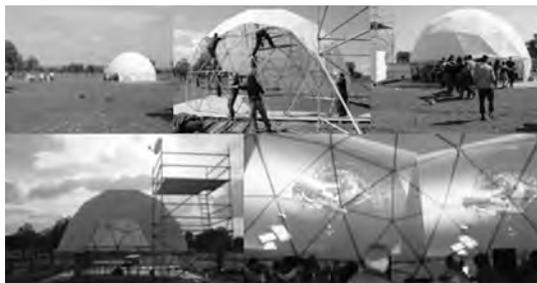


Figure 3. Hackitecturas, *Emerging Geographies*, 2007

The laboratory, which included artists, hackers, free software developers and inhabitants of the region, physically consisted of a geodesic dome equipped with a bidirectional Internet connection via satellite that hosted a series of workshops, round tables and performances. Among the participants: Clausthome (Riga, Latvia), Carl Biosmark (Karosta), Nicolas Henninger (Exyz), Brian Holmes, Meskalito Nagual, Straddle3, Joseanito Llorente, BeastBox (Lisbon).

Another project encompassed within the term Hackitectura is that of the artist Marco Peljham. Makrolab is an artistic project consisting of a nomadic and energetically autonomous capsule, connected to the Net, conceived as an observatory of migratory, meteorological and digital flows.

Makrolab is able to support the concentrated work of 4 people in isolation conditions for a period of up to 120 days. The initial idea was to get a mobile and autonomous unit that offers technical possibilities to realize scientific-artistic projects. It was presented in the ISEA, with an excellent reception of critics and public. The context added considerable value.

It was one of the star projects of Documenta in Kassel in 1997, possibly the most relevant artistic meeting of the last decade. Makrolab, in which the Slovenian space agency is involved, is an autonomous habitable device connected to the satellite network and local wireless systems, which is moving around the world. In each of its locations - so far Kassel, Australia, North Sea and Venice - the insect-ship has housed a group of scientists and tactical media artists who develop specific projects during their four-month stay in isolation.

The project has to do with three major issues: telecommunications, migrations - in a broad sense - and climatology - all of them related to the flows that travel the globe. Makrolab sees these fields as the territory

that it aims to identify, map, penetrate and investigate, in all ways and directions, during the 10 years of the planned life of the project, from its physical dimensions to its psychic, social, political and artistic dimensions. In 2007, Makrolab was permanently installed in Antarctica as a research station.



Figure 4. Marco Peljha, *Mackrolab*, 2010



Figure 5. Marco Peljha, *Mackrolab*, 2010.

Acoustic Space Lab, in the VIRAC radio-telescope in Latvia consisted of the agency of the radio telescope VIRAC with a group of media-artists from Latvia [2001-2003] and is another of the fetishes of urbanism.

The objective in that first acoustic space laboratory was to make accessible the great antennas of espionage and exploration of the cosmos to a group of international media-artists who would try to make a first valuation of alternative potential of the technologies of reception and satellite emissions.

For the most part, those invited were artists/technologists who experimented in the new fields of sound and digital imaging and in their manipulation in the space of flows. Advised by one of the antenna technicians, and among other activities, activists captured sounds from outer space, intercepted communications

in Europe and directed the antenna to the surrounding environment. All material was recorded for analysis and processing.

The telescope antenna has since become a fetish of the digital crowd, and has in some way served to inspire the development of numerous projects, from activism to research of new media.

In the resulting media / architecture meeting that took place it was discussed, among other issues, the possible applications of the social dynamics of open networks to the creation of new open and public (physical) spaces, the design of processed architectures, and the impact of wireless cartographies and networks on the notions of space/time and social organization. At the same time, experiences/demonstrations of site transformation were carried out through the organization of physical and virtual networks.



Figure 6 y 7. Acoustic Space Lab, 2003.



Figure 8. Acoustic Space Lab, 2003.

In these projects, the contemporary redefinition of the relationship between technology, creativity and society is central. Within them new localities and social groups are becoming new territories of social, cultural, scientific

and technological experience, away from the traditional centers of content production, and economic, social and cultural forms.

Conclusions

Social networks + telematic networks + spaces/territories are the materials with which it is proposed to produce architectures of flows that are war machines - in the Deleuzian-Guaratinian sense of the term.

Although the conventional architectures of modernity intend to be represented as autonomous objects, in reality, in a broad and critical perspective, it is also necessary to see them as complex arrangements of the current production process, that must be changed by this new thinking and collective work.

From this research, it is considered that one of the ways to investigate possible transformations of architecture is to question not only the architectural devices themselves, but also the whole set of subsystems and the relations that are established between them in the production and the Social consumption of architecture.

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Domains, Publics and Access.
A Wiki in Progress on Access Archaeology
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Abstract

Domains, Publics and Access is an ongoing collection online of projects related to current access forms such as: open government, open design, citizen science, collaborative economy, commons, co-ops, crowdfunding, DIY, free culture, community currencies, p2p, piracy, etc. The main goal is to preserve initiatives that appear and disappear in different countries because each project is the declaration of a possible future. That's why the project as the poetics of social forms is studied by an access archaeology that explores the hypothesis of the emergence of new bottom-up institutions. The hypothesis is latent in the work of several authors, but Geert Lovink and Ned Rossiter pose it explicitly around the online organized networks. They provide the theoretical framework for the qualitative textual analysis of the accountability, sustainability and scalability of different projects. The faceted classification adapted to a MediaWiki articulates the field work as a distributed analysis process, and shows how not only organized networks but also top-down networked organizations define the poetics of access forms. The result is an online common-pool resource that displays the historic and antagonistic limits of access and that can be used to develop new research questions –in and out of academia– through the integration of new facets and projects in a simple way.

Keywords

Archaeology of the Present, Media Archaeology, Bottom-up Institutions, Poetics of Social Forms.

Introduction to the wiki

Domains, publics and access (dpya.org) is an online collection focused on cataloguing, preserving and documenting projects that propose or explore general access to production, distribution and consumption of goods and services. By combining mass media with heterogeneous social practices, the projects query the vertical and centralized access management by public and private institutions historically associated with the domains of art, culture, science, economics, politics and technology; for instance, management of museums, galleries, libraries, archives, publishing houses,

laboratories, universities, press, enterprises, banks, hospitals, transport, governments, factories, etc.

The projects that assay more horizontal and decentralized forms of access can be found online linked to recent terms such as open access, open data, open content, open education, open government, open design, open spectrum, open science, cryptocurrency, citizen journalism, citizen science, collaborative economy, crowdfunding, crowd-sourcing, free software, free culture, p2p, tactical urbanism, etc. These terms can be found alongside older terms like commons, public domain, time banks, grassroots media, solidarity economy, community currency, cryptography, co-ops, tactical media, DIY or piracy. They all constitute the vocabulary of current access forms.

The collection gathers projects from different countries since the second half of the 20th century, highlighting those created in Mexico, as this country is the place where the research started. The only condition is that the projects must be related to the vocabulary of current access forms. Keeping in line with this criterion, the collection includes projects launched by public and private institutions, and diverse social actors; because the questioning to the vertical and centralized institutions historically associated to the different domains is happening in and out of them. This is how the collection responds to the current cohabitation and hybridization among new and old forms of access that have different degrees of centralization and decentralization, verticality and horizontality.

Unlike other online collections, such as the Collaborative Consumption directory (collaborativeconsumption.com) or the P2P Foundation database (wiki.p2pfoundation.net), the wiki *Domains, publics and access* does not prefer any form of access over any other. On the contrary, the collection comprises projects that mobilize the terms of current discussions about access without taking sides. It tries to offer an

overview as broad as possible about current forms of access to prevent the ideological orientation involved when the terms are isolated from one other.

Domains, publics and access tries, as well, to prevent some of the other risks implied in the online collections: their ephemeral nature. The main goal is to preserve the traces of appearing and disappearing projects daily in different countries, using tools available online. As these are recent initiatives, all of them have (or had) an online site stored in Wayback Machine (archive.org/web/), the free online service of Internet Archive to preserve web sites in WARC format. All the collected documents about the forms of access and the projects are also stored in Internet Archive.

This paper develops the research strategy that supports and nourishes the collection. Firstly, the projects become the object of study of an access archaeology. Secondly, it locates the object of study in the theoretical framework of organized networks and networked organizations, formulated by Ned Rossiter (2006) and Geert Lovink (Lovink & Rossiter, 2005; Lovink & Rossiter, 2010; Lovink & Rossiter, 2013; Lovink & Rossiter, 2015). Thirdly, it describes how the distributed cataloguing of the projects through a faceted classification system constitutes the research methodology (Herring, 2007). Finally, it shows the results obtained so far and the derived applications of the collection as a common-pool resource (Ostrom, 1990).

The Project as an Object of Study

Poetics involves a group of principles or rules that defines the products out of a literary or artistic genre, a school or an author. To Boris Groys (2010) poetics displaces aesthetics in contemporary art theory due to the multiplication of producers brought on the rise of mass media. Instead of being viewers, we become artists focused on the public production of the I in a constant self-poetic exercise that transforms subjectivity into an audiovisual project. But art is not the only thing that goes public. The transformations of art in the contemporary agora can be perceived too in domains that do not look for the individualization of the producer. For instance, the web projects of citizen science, collaborative economy, social money, open government or open design, transform the consumers into scientists, entrepreneurs, bankers, politicians, engineers or designers. These initiatives mobilize the viewers around a shared project where they participate actively. The poetics of these projects surpasses the art

domain and the self-production of the I to organize the production in contemporary societies.

Nevertheless, the projects related to the vocabulary of current access forms are emerging initiatives with an unclear role in the production organization of contemporary societies. Whether they are artistic, scientific, cultural, economic, political or technological, each project is, as Groys says “above all the declaration of another, new future that is supposed to come about once the project has been executed,” (Groys, 2010, p. 73) and the future is uncertain. Thus far, the only certainty is that many projects are flourishing inside the nation states and the transnational market.

As an object of study, the project follows Fredric Jameson’s (1991, 2002, 2005) analysis of the poetics of social forms. Rethinking the tradition of Marxist cultural theory, Jameson explores the relations between aesthetic form and social context through the formal analysis of cinema, literature, painting and architecture. Alexander Galloway (2004, 2006, 2012) continues with the exploration about the poetics of social forms by analyzing interfaces, computer protocols and videogames. In both cases, the formal analysis is oriented to cultural criticism. But unlike this research, the collection deals with cataloguing, preserving and documenting the poetics of access forms as a previous step towards a critical exercise in the near future.

The collection turns the process of cataloguing, preserving and documenting the poetics of access forms into the object of study for an access archaeology because countless initiatives launched everywhere are at risk of being forgotten. An access archaeology has as its main objective, to rescue the projects before this happens and to retrieve the traces of those projects already gone. To accomplish this, it combines the political horizon of the archaeologies of the present with the techniques of media archaeology. The archaeologies of the present locate, dig and preserve the remains of contemporary material culture (Harrison, 2011; Harrison, Graves-Brown & Piccini, 2013; Sastre & Lafuente, 2013; González Ruibal, 2012). Specifically, the archaeologies of the present value the margins of the material culture, from garbage (Rathje & Murphy, 2001) to mass graves (Salama, 1992). Projects linked to the vocabulary of current access forms are marginal in relation to the traditional public and private institutional frameworks. “These days, most bricks and mortar institutions can only subtract value from networks. They

are not merely unwilling but in fact incapable of giving anything back. Virtual networks are not yet represented in negotiations over budgets, grants, investments and job hiring” (Lovink & Rossiter, 2005). In this scenario, an access archaeology has to be used to regain and analyze those constantly appearing and disappearing projects in the contemporary agora. Media culture is part of our material culture. Its rescue and analysis, therefore, requires the resources that the media archaeology (Ernst, 2013; Parikka, 2012) can mobilize for the preservation of the poetics of access forms.

Organized Networks and Networked Organizations as Conceptual Framework

An access archaeology explores the hypothesis of the future emergence of new institutional forms inside the nation states and the transnational market. This hypothesis is latent in the work of several authors. Trevor Scholz (Scholz, 2016; Scholz & Schneider, 2016; Scholz & Lovink, 2007) coined the term “platform cooperativism” (platformcoop.net). The platform co-op ecosystem is comprised of online platforms that support production and sociality, digital labor brokerages, web-based marketplaces that are collectively owned and democratically governed, and all those initiatives that directly support this economic model. Rachel Botsman and Roo Rogers (2010) have popularized the consumption or collaborative economy category. Benjamin H. Bratton (2016) defines *the stack* as an accidental megastructure derived from the planetary scale computation that is both a computational apparatus and a new governing architecture. Tim O’Reilly (2010, 2013) upholds the benefits of the algorithmic regulation and the government as a platform. Michel Bauwens (Bauwens, 2006, 2007; Bauwens, Ramos & Vasilis, 2016) leads the activities of the Foundation for Peer to Peer Alternatives around the transition towards the so called “p2p society”. But Geert Lovink and Ned Rossiter (Lovink & Rossiter, 2005; Lovink & Rossiter, 2010; Lovink & Rossiter, 2013; Lovink & Rossiter, 2015; Rossiter, 2006) pose the hypothesis in an explicit manner, discerning organized networks from networked organizations

The networked organizations refer to the adaptation of the old public and private institutional frameworks of governments and companies to the Internet and the web. “(...) The techniques of governance within the networked organization, unlike the organized network,

do not place a primacy on the media of communication. Or rather, bricks and mortar prevail as the substrate within which communication and social-technical relations are managed” (Rossiter, 2006, p. 205). In contrast, organized networks emerge inside media in mailing lists, IRCS, news groups, wikis, etc. It is a concept that works like an analysis tool for the political demonstrations in the network societies (Castells, 2000) and as a political action proposal focused on the creation of new bottom-up institutions. “Organized networks emphasize horizontal, mobile, distributed and decentralized modes of relation. A culture of openness, sharing and project-based forms of activity are key characteristics of organized networks” (Lovink, 2010).

The organized networks are, by themselves, a futuristic response to the nation state crisis and the rise of the neoliberal market with bottom-up projects that set their own accountability, sustainability and scalability through online collaboration platforms. Against the temporal actions of the tactical media (Raley, 2009) or of the smart mobs (Rheingold, 2002), the organized networks offer long and mid-term collaboration strategies with the aim to create new autonomous institutions. The organized networks substitute for the notion of virtual communities (Rheingold, 1993) where the consensus prevails as a bases for the social relationships. They work based upon diversity and conflict, establishing nonrepresentative democratic mechanisms in the accountability and business models to guarantee the sustainability and scalability on the scope of their actions (Lovink & Rossiter, 2005). With this, “the socialtechnical antagonisms that underscore ‘the political’ of organized networks are instantiated in the conflicts network cultures have with vertical systems of control: intellectual property regimes, system administrators, alphamales, tendency toward nontransparency and a general lack of accountability” (Lovink & Rossiter, 2010).

An access archaeology explores the hypothesis of the future emergence of new institutional forms, not as a political action proposal but as field work. This implies to need to reconsider, in two complementary directions, the analysis tool for the political demonstrations in the network societies of Lovink & Rossiter (2010). Firstly, the field work forces the inclusion of all the projects linked with the vocabulary of the current access forms. As the collection shows, governments and companies also launch linked projects with that

vocabulary¹. Today, not only organized networks but also networked organizations define the poetics of access forms. In this respect, the hypothesis must consider the role of the networked organizations in the emerging process of new institutional forms. Secondly, the field work points out the need to expand the concept of organized networks considering the offline poetics of access forms, horizontal and decentralized, that have emerged over time. Organized networks are above all social networks, and therefore they do not constitute the social software result and are not immanent only to the network societies (Lomnitz, 1977). Not only are grassroots media organized networks that precede the Internet and the web but also current organized networks combine new media with old access forms to offer on the web goods and services. These old poetics of access forms have their own offline history which can be traced by archaeology. “Political intervention, in other words, must always be situated while traversing a range of scales: social-subjective, institutional, geocultural” (Lovink & Rossiter, 2010) and also (geo)historical (Braudel, 1992, 1982a, 1982b).

Through an archaeological perspective, the approach to the three required criteria for any social network to organize and become a producer is therefore modified. The responsibility, sustainability and scalability (Lovink & Rossiter, 2005) include poetics of access forms prior to virtual communities and network societies. The collection shows how some projects articulate direct government mechanisms around cooperatives² or common-pool resources³, which means that offline and old horizontal and decentralized access forms are also adapting to the Internet and the web. The projects’ sustainability depend on old business models; for instance, voluntary donations, sale of goods or barter. The business models acquire legal status under preexisting national jurisdictions where the project is launched either for profit⁴ or nonprofit⁵. Even organized networks can operate as companies. This all adds up to the fact that the scalability in time and space of the projects does not establish a priori limit. The ephemeral access forms such as tactical media, tactical urbanism or the occupy movement should be considered. In the

¹See categories “Public” and “Private”.

²See category “Co-ops”

³See category “Commons”.

⁴See subcategory “Profit”.

⁵See subcategory “Nonprofit”.

end, the three articulation criteria for current organized networks share more than a passing resemblance with the networked organizations. “In reality, all forms of techno-sociality combine both horizontal and vertical forms of organization. Our argument is not so much that a hard distinction separates these modes of organization as a degree in scale” (Lovink Rossiter, 2005).

In summary, the collection explores the hypothesis of the future rise of new institutional forms through cataloguing, preserving and documenting projects linked to the vocabulary of current access forms shared by the organized networks and networked organizations. To this effect, the collection includes, equally, projects launched by public and private institutions and diverse social actors, since the questioning of the vertical and centralized institutions historically related to different domains is happening inside and outside them. This implies that the organized networks and the networked organizations share the search for direct government mechanisms (accountability), business models (sustainability) and growth dynamics (scalability). An access archaeology responds to the current cohabitation and hybridization among old and new poetics of access forms that present different degrees of centralization and decentralization, verticality and horizontality.

The Distributed Cataloguing Process as Method

The project cataloguing process is performed through a faceted classification system adapted to the categories and subcategories of the MediaWiki software⁶ used by the collection. The faceted classification is used in library and information science for the storage and retrieval of information (Denton, 2003). A faceted classification is “a set of mutually exclusive and jointly exhaustive categories, each made by isolating one perspective on the items (a facet), that combine to completely describe all the objects in question, and which users can use, by searching and browsing” (Denton, 2009). Every facet or category comprises different terms or foci (subcategories) that describe it and both may be expanded as the indexed items come up with no limit or hierarchy established a priori. The advantages of the faceted classification are: it does not require a complete knowledge of the items or the relationships among them;

⁶MediaWiki is a free software open source wiki package written in PHP, originally for use on Wikipedia. It is now also used by several other projects of the non-profit Wikimedia Foundation and by many other wikis.

it can incorporate new items easily; it is flexible; it is expressive and it allows several perspectives and diverse approaches to the classified items (Kwasnick, 1999). All these characteristics allow the adaptation of facets and foci to the categories and subcategories of MediaWiki. In addition, MediaWiki incorporates in its design both ways in which the faceted classification is integrated to the web: keyword searching and facet-based navigation (Denton, 2009). It is important to note that so far the collection is not considering how the faceted classification can be incorporated into the semantic web features (Rodriguez-Castro, Glaser & Carr, 2010).

The *Domains, publics and access* faceted classification system complies with a double function: it is designed to store/recover projects and to respond to the research hypothesis. The first function is ensured by the MediaWiki features. The second one is performed by the use of the faceted classification system as a tool for content analysis. The content analysis is a social science methodology that permits the codification of explicit media content by making a difference between structural (e.g. the duration of a video or the extension of a text) and semantic themes (Bauer & Gaskell, 2000). As shown by Susan Herring (2008) a faceted classification system may be applied successfully to respond to research hypothesis. The collection resumes the Herring methodology to standardize the cataloguing process through a qualitative textual analysis of the projects launched by organized networks and networked organizations.

The sampling units that serve to identify the population and establish the basis for sampling (Domas White & Marsh, 2006) are the projects linked to the vocabulary of current access forms emerging in different countries since the second half of 20th century. The sample or population is not random and is not restricted to a previously defined number of projects. Any user can include the projects that he or she considers to deserve being preserved for future generations. Thus, the selection is performed under the distributed collaboration or crowdsourcing that MediaWiki enables. Every user turns into a potential curator of the collection by selecting the sampling units of his/her own “playlist”. Since all the projects have (or used to have) a web site, the wiki turns into a “social web crawl”. This is how the sampling is proven to be truly representative of the total population, not only because the selected projects are linked to the vocabulary of current access forms but

also because the selection is performed through a direct democratic mechanism where users can choose which projects represent their needs and values, including the projects where they actively participate. This “social web crawler” is a political extension of Wayback Machine, the Internet Archive web crawler. The sampling units are filed as a WARC format in Wayback Machine to ensure the preservation of the data collection units.

Every project is catalogued with the categories and subcategories, that the collection is organized under. The facets and foci are the units of analysis and constitute the basis for reporting analysis (Domas White & Marsh, 2006) in terms of structural features and semantic themes. The semantic themes are codified in the facets included in the sections Domains and Access. In Domains projects are indexed by their main affiliation to one or several predefined facets: Art, Science, Culture, Economy, Politics and Technology. Thus far, these facets lack foci and they are intended to offer a simple facet-based navigation, wide enough to incorporate a diversity of emerging access forms in all the social production areas. In Access, projects are classified following the vocabulary of the current access forms: Citizen, Collaborative, Commons, Co-ops, Crowd, Crypto, DIY, Free, Future, Grassroots, Indy, Occupy, Open, P2P, Pirate, Private, Public, Tactical. Every facet has different foci that expand as new projects are being catalogued. For example, the Open facet includes: MOOC (Massive Online Open Courses), Open access, Open content, Open data, Open design, Open education, Open government, Open science, Open source economy, Open source hardware, Open source software, Open spectrum. Only the Private and Public facets are part of the structural features. This way, a distinction among government initiatives and all the others can be made. The rest of the structural features are included in the Publics section. In Publics the projects are labeled by their linguistic, geographic and temporal universe. All the published Language(s) in the projects are collected, and the Start Country(ies), the Start Year and the Year of Completion are codified.

The necessary information for cataloguing is extracted from the project web site. Even the main source from which new projects are extracted and incorporated are the explicit links they establish with other initiatives. Only in exceptional cases, secondary sources are used to complete the cataloguing. The exceptional cases include disappeared projects with irretrievable web sites (not

archived in Way-back Machine), and offline projects already disappeared or current projects that do not have the necessary information on their own web sites. That's why the qualitative textual analysis is preferred in the faceted classification over other types of content analysis done taking into account particular media, such as blogs, wikis, chats or mailing lists. The text can travel through different media without losing its narrative quality. Although the media presence of the projects is preserved or recovered -when possible- the analysis does not depend on a particular media form.

The importance given to the qualitative textual analysis attempts to solve two problems bound together. On one hand, when the text is privileged over the media, the research hypothesis avoids the risks of internet-centrism described by Evgeny Morozov (2013). It is assumed that Internet and the web are here to stay but there is no guarantee of both surviving as they currently exist. This is the reason why it is so important to analyze texts and preserve the media's formal aesthetic at the same time. On the other hand, this method allows the analysis of poetics of access forms offline that persists nowadays, and the analysis of current projects that does not have a proper online presence. To incorporate the old and marginal access forms is the only way to include the ones disconnected from the network societies, excluded from the last technological innovations but historically involved in the invention of bottom-up organized networks (García Canclini, 2006). Otherwise the organized networks would be operating only within the boundaries of the so called first world.

The faceted classification as a qualitative textual analysis tool has been designed to code the forms of accountability, sustainability and scalability of organized networks and networked organizations over time and space. The political mechanisms described in the accountability are displayed in the categories and subcategories of the Domains and Access sections. The business models proposed to ensure the projects sustainability are analyzed through Public and Private facets of the Access section, disaggregated in different foci that appear as the projects are being catalogued; for instance, Profit, Nonprofit, State, Foundation, Public Benefit Corporation or Limited Liability Company. The scalability or growth dynamic is reflected in the Publics section where the languages, the geographic origin and the duration of the initiatives are reflected. The distributed cataloguing in MediaWiki allows the users

to incorporate new facets and foci during the research process, that are able to meet the future transformation of the poetics of access forms without eliminating the trace of previous initiatives.

In the wiki every project has its own page that works like the index card of the old catalogues in libraries. Each "index card" includes the following data extracted from the analysis:

- The units of analysis (faces and foci) are at the end of the page.
- At the beginning of the page is a selection of quotes extracted from the projects entitled "Self-portrait" where they describe themselves.
- A brief "Description" that synthesizes the analysis performed on the accountability, sustainability and scalability of the project.
- One or several images of the project home page (if available).
- The project URL (if present).
- The project URL registered in Wayback Machine (when the site allows).
- The link to the Wikipedia page of the project that may expand the information relative to the project (if present).

This way, the catalogue of the collection can be consulted like an old card filing system. The "index cards" can be downloaded in .pdf files and printed separately following specific research questions or consulting criteria.

The Collection as a Common-Pool Resource

The collection is offered to the general public as a common-pool resource (Ostrom, 1990) regulated by the Peer Production License. The Peer Production License created by John Magyar, B.A., J.D. and Dmytri Kleiner derives from the Attribution-NonCommercial-ShareAlike Creative Commons License. This license prevents the illegitimate commercial use by establishing restrictions that protect the collective work from exploitation with private ends:

- c. You may exercise the rights granted in Section 3 for commercial purposes only if:
 - i. You are a worker owned business or worker-owned collective; and
 - ii. all financial gain, surplus, profit and benefits produced by the business or collective are distributed among the worker-owners
- d. And use by a business that is privately owned and managed, and that seeks to generate profit from the

labor of employees paid by salary or other wages, is not permitted under this license. (Kleiner, 2010, p. 47)

The restriction turns the collection into a common-pool resource and protects it from the potential abuse of the public domain regime in the free market as Cori Hayden has demonstrated (2010, 2011).

The collection is a private-public collaboration between the Arts and Humanities Department of the Universidad Autónoma Metropolitana - Unidad Lerma and the Alumnos47 Foundation. Both institutions are engaged in maintaining the site that hosts the collection but they are not the collection's owners. The collection establishes its accountability and publishes the names and functions of all the people involved in the project development. The collection operates as a citizen science initiative (Lafuente, Alonso & Rodríguez, 2013), non-profit and with no legal entity. The financial sustainability relies on the support given by the Alumnos47 Foundation and the budget breakdown is publicly available at all times in the wiki. The collection started in 2015 in Mexico City and its scalability is bound to several factors. The MediaWiki structure enables an unlimited growth capability in terms of indexed items quantity and number of participants because it can be replicated and translated into 193 different languages.

The *Domains, publics and access* site is now being translated into English (dpya.org/en).

To this day, the collection has 130 catalogued and preserved projects, 188 projects on hold to be catalogued, available in 46 languages and from 43 different countries. The collection includes, as well, three sections dedicated to the documentation of the poetics of access forms. The Documentation section now has 28 interviews, more than 100 media manifestos and 208 specialized texts, in Spanish and English. Interviews follows a questionnaire published by the fanzine *Radical Software* in 1970. The questionnaire is applied to all the collaborators of the collected projects that are willing to participate by providing their personal experience. The interviews are intended for the future enrichment of the qualitative textual analysis incorporating the producers *emic* point of view (Harris, 1980) because, so far, the interviews performed are not sufficient as research material. Even though the questions were posed several decades before by video activists and artists, with the objective of getting to know each other better, they are still valid in the current context. The only modification made to the

questionnaire was the media in discussion. Television has been substituted by Internet as distribution channel and the World Wide Web hypertext is used as a replacement for video. The point is to give a voice and a face to the catalogued projects, although there is always the chance to give an anonymous testimony relating the interview only to the project where the interviewee is collaborating. Manifestos exposes all kinds of perspectives about access, reactionary and progressive, that show how each new media present is transformed throughout the history of this genre. Today enterprises, governments, artists, activists, scientists, journalists, hackers, etc. all seem to have something to declare about domains, publics and access. New manifestos appear and old manifestos are forgotten, so this incomplete collection by definition offers a selection that hopes to be enriched with new contributions. Respecting the long history of the genre, it is possible to include any manifesto dated before the second half of the 20th century where a position is expressed on the use and function of mass media and access forms in force at that time. Library groups books, articles, news, reports and any other text dedicated to the poetics of access forms indexed in the wiki that are available online for free consultation and downloading. Materials with licenses that penalize their free circulation and distribution are excluded. It is another collection, incomplete by definition, that does not aspire to be exhaustive but invites those who wish to contribute to add new documents. All the interviews, manifestos and documents are preserved in Internet Archive.

The wiki is an educational resource integrated into the Art and Digital Communication Degree curricula of the Universidad Autónoma Metropolitana - Unidad Lerma. The students will be able to study *Domains, publics and access* as an optional subject divided in three levels. During the course the students become researchers through a process that begins with the data collection units chosen by them, continues with the analysis and the visualization of the collected data and finishes in the last trimester with a scientific publication of their own that might be either a paper or a commented compilation of specialized texts in a particular access form.

In addition to the pedagogic application, the design of the collection enables the development of different methodologies such as the social network analysis (Gil & Schmidt, 2002) or the discourse analysis (Herring, Stein & Virtanen, 2013). Due to the faceted classification

in MediaWiki that allows the integration of new facets and foci in a simple way, investigators can generate new research questions. Thus, the current research is not looking for definite answers. It is an experiment about the construction of an open research space able to operate as meta-research, that is to say, as research focused on favoring and nourishing other research inside and outside of the academic environment.

The collection is intended to display the variety of access forms that cohabit nowadays, because the historic limits of access are established not only through consensus but also from antagonist positions that compete against each other to define their scope in a specific time and place (Mouffe, 2013). The wiki collects the terms that inform the current discussions around access without favoring any of them. When this vocabulary is shown, in its plurality and organized by country, a tool is offered through which all the stakeholders can participate in the discussion or have an overview of the available possibilities in their own context to judge by themselves the risks and opportunities of every initiative. However, if the largest possible number of stakeholders is meant to be reached, online presence is not enough. To meet the needs of the population with a lesser knowledge of the vocabulary of the current access forms, there is a series of public meetings in Mexico City, from October 2016 to October 2017, dedicated to dialogue with the producers of the Mexican projects catalogued in the wiki. All the recordings of the meetings are also published in the wiki and uploaded to Internet Archive.

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Augmentations Across Virtual and Physical Topologies: Mixed Reality Re-assembled

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Abstract

An analysis of the material-discursive practices surrounding Augmented Virtuality and Augmented Reality reveals the sometimes digressional, sometimes convergent positions taken by computer science and media art on the issue of embodiment. Mapping out some of those positions, this paper considers Mixed Reality as a topology that has an entangled and material relationship with the body, that goes beyond an analysis of Mixed Reality as a technology of augmentation: rather, a topological understanding of Mixed Reality explores the patterns of diffraction (Barad 2007, p. 29) that ripple and disrupt the material thresholds between physical and virtual, troubling the over simplified real/ virtual dichotomy that permeates much Human Computer Interaction (HCI) research. Tendering an argument for Mixed Reality as a continuous topology operating between physical and virtual spaces, I will address the contrived duality of embodiment/virtuality embedded in much of the literature surrounding Mixed Reality. Then, I will offer a contrasting view of Mixed Reality as a contiguous topology where virtual and physical are interwoven by contingent and conditional ‘meshworks’ (De Landa, 1998) of augmentation, involving technicity, devices, bodies, and objects.

Keywords

Augmented Virtuality, Augmented Reality, Software Assemblage, New Materialism.

The Bounded Virtual: Limits and Thresholds in Mixed Reality

Augmented Virtuality is any system that couples human actions to a virtual environment in real time across three spatial dimensions (Milgram and Kishino 1994, p.1324), while Augmented Reality is a physical, real world environment augmented by a computational system that is registered in three dimensions in real time (Azuma 1997, p 355). In HCI discourse, Mixed Reality is conventionally framed between the poles of reality and virtuality, conceived as a duality that contains both middle instances of Mixed Reality — Augmented Virtuality and Augmented Reality.

Building on Caudell and Mizell’s (1992) definition of Augmented Reality as a datafied window sitting on the physical world, computer scientists Paul Milgram and Fumio Kishino wrote the influential research paper “a Taxonomy of Mixed Reality Visual Displays” (1994) as a functional tool to assist in the accurate classification of Mixed Reality on screen displays. Mixed Reality is broadly understood in HCI as the combination (to varying degrees) of real and virtual worlds. Envisioned as a linear passage between two poles, their diagram of the Reality-Virtuality Continuum taxonomically indexed all the broad instances pertaining to current Mixed Reality displays, while the accompanying article discussed specific instances of network configurations and their display types. Taxonomy — as a branch of positivist science concerned with producing schemes for classification — is embedded with the notion of limitation, operating as a border within which to anchor categories and systems considered to be ontologically distinct from one another. Milgram and Kishino’s taxonomic approach shifted focus away from a nuanced assessment of the user or the affective possibilities of the network set-up, toward a manifestation of the capacities and configurations of the technical objects at hand, and their specific capacity to perform as display types. Milgram and Kishino’s intent behind the Reality-Virtuality Continuum was to remedy some of the difficulties encountered by HCI researchers by designing a clear, descriptive model to situate technical network set-ups that are materially neither pure virtuality or pure reality.

However, the dualistic arrangement posited by the Reality-Virtuality Continuum is problematic, since not only does it proscribe a delineation between Augmented Virtuality and Augmented Reality based primarily on technicity, rather than on the interactive experience of the user. However, as can be seen in many examples in the field of media art, practitioners are continually trying

to expand the perceptual and affective possibilities for the participant, using virtual phenomena to provoke nuanced sensory affects that encourage the participant to tune into to virtual events and meld their physiology with that of the digital.

A key problem with Milgram and Kishino's taxonomy is that it is primarily a classificatory list of display modes. Displays deliver the 'virtual' side, while 'reality' is subtended as the sole privilege of the human. Intermingling, should such occur, is segmented into datafied 'virtual' screen space and physical 'real' world: "Completely graphic but partially immersive environments (e.g. large screen displays) in which real physical objects in the user's environment play a role in (or interfere with) the computer generated scene, such as in reaching in and "grabbing" something with one's own hand" (1994, p.1323).

Mixed Reality is discursively bounded through technical objects (displays) and their ancillary content (generated by computer), where human intention (the grab) is the sole agential force. Such formations do not allow for the myriad of embodied and sensory happenings that emerge between the physical and the virtual for the participant. HCI research does not acknowledge that phenomena are coemerging 'in between' all the time, and instead HCI practice perpetuates a view of the digital as isolated to the screen, effectively pushed out of the physical world. Further, the position of 'user' in a networked configuration is itself a reduction, one that ignores the significant shifts that continually self-generate through embodiment.

From a new materialist perspective, the relational positions held by Reality, Augmented Reality, Augmented Virtuality, and Virtual Reality are actually all topologically contiguous with one another in a software assemblage. In order to further creative research in Mixed Reality in art, there is a need to address the mutually co-shaping and embodied phenomena that affectively facilitate to anomalies between bodies and data systems. In addition, human agency must, crucially, be unwound as a primary structuring force, to allow the spontaneous unfolding of unplanned transformations between all kinds of matter.

Mixed Reality in Experimental Media Art

In the pioneering artwork *An Interactive Plant Growing* (Sommerer and Mignonneau 1992), participants were invited to touch living plants in order to precipitate

participants are able to co-construct their experiences of virtuality in an expressive space (such as in notable Mobile AR(t) such as *Bio-mer Skelters* (2013-, various locations) by Tamiko Thiel and Will Pappenheimer, *Border Memorial* (2012-) by John Craig Freeman, and many other works by the Manifest AR collective), as well as in virtual reality artworks, such as Simon Penny's *Traces* (1998) or Petra Gemeinboeck's *Uzume* (2003).

Klemmer et. al. (2006) take a perspective on embodied interaction that follows a similar track, except with greater emphasis on the practice of designing for 'skilled' bodies, rather than a 'walk up and use' model favoured by Dourish. In the influential research paper "How bodies matter: five themes for interaction design" Klemmer et. al. selectively glean concepts from psychology, sociology and philosophy with the stated aim of producing 'richer interaction paradigms' in the field of Tangible User Interfaces (TUI). Their paper combines a taxonomic approach — where capacities and skills involving bodies are indexed next to causes and effects of the machine in order to divine common and divergent qualities — with quick references to phenomenology, philosophy and sociology. The aim is to activate the physical objects we already use in the world as TUI's, with the goal of welding these using the glue of 'embodied interaction' with the digital. focusing on items with which we already have a high degree of haptic familiarity, Klemmer et. al. advance that the most powerful model for embodied interaction design is the real world. Their focus is on leveraging skills that they consider most bodies possess, and that can be further honed through contact with various types of TUI, when appropriately paired to networked data systems as control points.

With reference to influential research papers in HCI, this paper argues that the segmentation of Augmented Reality and Augmented Virtuality as distinct categories has unduly limited the experimental potential of Mixed Reality, and that a pragmatic and relational reworking of Mixed Reality as an interlocking, dynamically arranged meshwork of assemblages is necessary. Further, this segmentation is grounded in the overarching taxonomy of mainstream HCI, where embodiment and virtuality are set against one another (Weiser 1991; Winograd and Flores; Dourish; Klemmer et. al.) Weiser's take on embodied virtuality — as well as the majority of the influential body of HCI research that follows that

affect-oriented process requiring a nuanced, contingent approach: “Embodied interaction is not a technology or a set of rules. It is a perspective on the relationship between people and systems. The questions of how it should be developed, explored and instantiated remain open research problems” (p.192). Dourish argues that embodied interaction has been neglected by older examples of HCI research which took a ‘procedural’ approach to interaction as a series of instructions, performed by the user in context, to achieve a specific computational out-come (Card et. al. 1983; Norman 1988). New approaches that incorporate embodied interaction come out of the research of Terry Winograd and Fernando Flores (1986), and Mark Weiser (1991), a tack Dourish extends. In such work, the turn toward embodied interaction, draws on the processes of everyday life, anchored by the concept that pragmatic actions occur as matters of immediacy, without cognitive rationalisation. Dourish advances a case for the enhanced leveraging of everyday behaviours to facilitate the development of computational interfaces in three main areas: tangible, embedded, and social computing. He notes: “The [HCI] trend I have emphasised here is the gradual incorporation of a wider range of human skills and abilities. This allows computation to be made ever more widely accessible to people without requiring extensive training, and to be more easily integrated into our everyday lives by reducing the complexity of those interactions” (p.14).

Leveraging everyday social behaviours to situate technology in the world, pervasively and ambiently, according to Dourish, is the most effective way to effect the design of tools for pervasive computing: many examples exist from the past two decades of the commercial application of this method, especially in the burgeoning field of mobile hard-ware such as smartphones, tablets, and their software. Embodiment becomes another tool that can be deployed to extend the reach of pervasive computing. For example, utilising human behaviours such as play is a technique shared by both industrial and artistic vectors of virtuality (mobile locate-) games such as *Ingress* (2011-) and *Pokemon Go!* (2016 - openly use the data generated by players develop and extend products such as Google’s *Maps* and *Earth*. There, play is directed at the structuring of the body in global flows that utilise virtuality as a tool to further corporate goals. Divergently, artistic examples tend toward an unstructured notion of play, where

the on screen growth of up to twenty-five species of virtual plants, all of which manifested adaptive coordinate behaviours such as size, colour and translation, but only if the participant found the right combination of micro-gestures. Participants need to use their particular haptic sensitivities to explore the relational space between their hand and the plant interface: modifying this spatial relation unlocks the adaptive growth and promotes either the virtual plants positive flourishing, or its negative descent into a weed or ‘killer’ plant.

Usefully, this artwork is not a discreet experience that occurs within the confines of a room in a gallery and is left there: rather, the artist’s see it as a perceptual and sensory happening that utilises acts of embodiment — the haptic touch of the participant on the plant interfaces, the visual and aural perception of the on-screen growth as intrinsically fused to the gestures of the participant, the intuitive tuning that processually allows the plants to emerge — as co-operative gestures with the real plant world. The artists note: “Since it takes some time for the viewer to discover the different levels for modulating and building the virtual plants, he will develop a higher sensitivity and awareness for real plants” (Sommerer and Mignonneau, Artist’s statement, 1992).

Here, the notion that some of the haptic intimacy with virtual plants moves out of the room with the participant, points toward the potential of the work to facilitate unique permutations of embodied experience. While such artworks can be analysed under the terms of the Reality-Virtuality Continuum, to do so is to diminish their open and experimental frameworks, and certainly also to occlude their affective power in favour of the rationalisation of affect in a system of classification where the technical set-up is a straightforward configuration into which the human enters, with the goal of finding the control points rather than tuning themselves to the emergent nuances of an adaptive data system.

HCI and Embodiment

Paul Dourish discussed the emergent field of embodied interaction in the influential text *Where the Action Is: The Foundations of Embodied Interaction* (2001). Breaking with ‘traditional’ Human Computer Interaction (HCI), where the design of computational systems emerged from what was possible in an engineering sense, Dourish incorporates insights from ethnography, phenomenology, sociology, and cognitive psychology, to re-figure interaction design as an intuitive and

path — does not so much break with the privileging of cognition instantiated by an earlier generation of HCI researchers (what Dourish calls traditional HCI), but rather supplants an approach centred on the mind with an approach privileging the body as a formed totality. Operably and structurally, the conversation is deeply embedded in the same mind/body duality, just perceived from the opposing end. Unfastening the simplified taxonomy that restricts Mixed Reality, affords consideration of the anomalies at the thresholds of Augmented Reality and Augmented Virtuality. A relational materialist approach to these problems of interaction is necessary, so questions of human computer interaction in experimental art become less about privileging *either* a technology focussed or a user centred approach, and instead show preference for the effects and affects of matter.

Embodiment, if approached as a co-emergent, mutually generating phenomena — rather than a fixed and discreet interaction as in HCI — can be productively engaged to reassemble the liminal zone between the virtual and the physical as neither the privilege of cognition or the body. Trajectories that favour the transdisciplinary approach taken by researchers from the post humanities and new materialisms are a major source of validation for approaches that operate against dualism, such as the software assemblage. As a provisional series of individuated technical-material-discursive formulations, software assemblages afford an approach to interfacing and augmentation as processual, material, and relational, a perspective that reaches across both physical and screen events, across modalities (of sight, sound and touch), and pulls out threads from various disciplines (art, computer science, entertainment, gaming).

In the examples from HCI research discussed above, embodiment is seen as the result of connecting the three main perceptual modalities (vision, hearing, touch) to some kind of computational or machinic network where the user is the agential force that shapes the data system. This approach is conceptually as well as materially restricting, since it foregrounds the artificial segmentation between the participant and the machine, and occludes the extent to which data systems shape the participant through embodiment. HCI research presupposes that the body is an already ‘formed body’, that comes to the interaction as a totalised entity: The ‘user’ or the ‘human’. Few questions are asked as to how bodies and machines might shape one another through forces that are at the

same time both procedural *and* spontaneous, cognitive *and* affective, virtual *and* embodied. N. Katherine Hayles (1999) systematically explored the discourse around an earlier generation of cybernetic researchers, in order to show the active and relational shaping of embodied experience by computational technologies and human computer interaction. Hayles contextualises Mark Weiser’s (1991) term ‘embodied virtuality’ as a shifting topological state where technology and media are active in producing the patterns that gave rise to the emergence of embodied virtuality, as a lived condition of social bodies. Hayles’ investigation into the material and discursive practices that lead to the formation of human practices and behaviours as they crystallise with technology, gives consideration to the environmental and contextual responses to technology as a materiality. In environments where embedded computers and the body coalesce, both emerge together as partially formed entities that transform one another through co-presence on all sides. The point is not to prefer ‘embodied virtuality’ over ‘Virtual Reality,’ as Weiser and others suggest, or vice versa, but to consider the ways that bodies and computational networks shape one another, in continuous and contingent social, technological, abstract, physical and perceptual vectors, that are, at their smallest portions, micro-texturally material.

The software assemblage is influenced by an understanding of embodiment in relation to digital technologies and interactions, where virtual space is not considered as disembodied from the physical world, but a site of co-presence where mutually reciprocal shaping occurs (Munster 2006; Murphie 2002; Massumi 2002). A materialist approach to interface suggests the need to explore the contingent relations between all elements (human and machine) as they unfold, reconfigure and assemble again, across the specific spatio-temporal phenomena that reveal the actual processes and relations of interfacing. Andrew Murphie’s extemporisation on the virtual from a Deleuzo-Guattarian perspective, questions the conventional (HCI) positioning of Virtual Reality (VR) as a zone for the enactment of mimesis and digital simulation (Murphie, 2002). He argues that, arriving with VR, is a shift from an interest in representation to an interest in operation. In less creative uses (Murphie cites Brenda Laurel’s narrativity) where a VR machine (whatever that might consist of as a current technical object) acts upon the user, the body is inserted into a technologically generated framework with limited options. However, if

Virtual Reality is taken as an opportunity to generate ‘co-extensive’ connections between the virtual and human perception (Murphie 2002, p.8-9), it has the capacity to present “humanity with the possibility of the modulations of the virtual, previously operating below the general threshold of perception, being seen to overtake and disrupt the more ‘solid’ notions of our social existence”.

To extend Murphie’s argument regarding a modulating virtual within Virtual Reality, my concerns in Mixed Reality, would be to also challenge the commonly held HCI design practice of placing the participant in a restricted role as a controller of screen space. Such a role will always fall short of an adequate address to the impact of the body as a non-discreet, contiguous forming that modulates between virtual and physical. It is the material flow between the virtual and the physical — the oscillations back, forth, sideways, across and within vectors — that constitute the self-organising human-art-machine that is the software assemblage. If computational abstractions that manifest from the body are seen as simply a set of point coordinates in a digital data set, mimetic rather than morphogenetic outcomes are privileged. Virtual spaces are not sites of mathematical abstraction, but are relational and expressive spaces where materials (data, bodies, or whatever) coalesce and transform each other, and themselves.

Augmentation as Embodiment in Experimental Art

In my ongoing software assemblage series, *Tactile Light* -Jan2017 version, I grew a two metre square of Wheatgrass, and used this as a living site for interactive real-time augmented projections.



Figure 1. Still from *Tactile Light* -Jan2017 version, live performance by the author

An interactive data system constructed in Unity was paired with a Leap Motion gestural interface and a webcam (to create feedback). Then, the data system was

projected onto the living screen [Fig. 1]. The data system consisted of representations of hands manipulated using the gestural interface and simultaneously distorted in near real-time by feedback with the webcam. While the co-emergent phenomena arising between the participant’s hand (as it activated the gestural interface), had ‘caused’ the on-screen emergences that were also hands, these virtual hands were so distorted as to defy a straightforward mimetic interpretation. To paraphrase Murphie’s argument, the virtual instills a crisis into the dichotomy between representation and the real (2002: 9). He identifies the processual crossing of thresholds, such as body/machine, representation/‘reality’, as an unfolding series of individuated events that sketch the computer-body network.²

As organic-techno-social entities that reassemble with every iteration, software assemblages as they occur in my practice-based research, are provisionally composed of a variety of conjoined elements: in *Tactile Light* [Fig. 2] there is a vertical wheatgrass sheet, vertical wheatgrass lattice, wire, a projector, speakers, gestural controller, a human, darkness, a computer, all drawn together by custom software; in *Tactile Sound* [Fig. 3] there is a horizontal wheatgrass sheet, Piezo discs, LCD monitor, gestural controller, a human, light, a computer, speakers, and again, drawn together by custom software.

My approach to the design of these software assemblages mobilised the shifting, contingent and contiguous relations between the body, devices, living plants, and computational systems in order to produce augmentations across both virtual and physical sites that mutually operates on and in, the physical world. Both software assemblages leverage operational setups comprising elements that are organic, technical and social, operating as a semi-unified system that fluctuates between more or less stable states. These software assemblages are ecological, living, enacted and realised through processes of emergence that are organic, as well as technical and social. Organic is taken here in its material sense of being subject to processes of decay as well as suggesting a compositional mode that is processually morphogenetic.

A broader research question emerges: how can viewing the spectrum between the virtual and physical as a contiguous topology assist in adding to considerations of embodiment in the field? In *Tactile Light* and *Tactile Sound*, I brought the software assemblage formulation into negotiation with Augmented Virtuality and

Augmented-Reality, as topological aspects that should



Figure 2 (above). Still from *Tactile Light*, performer-data system integration as ecological, or, a software assemblage.



Figure 3. Still from *Tactile Sound*, performative, real time co-emergence of augments. Live performance by the author.

never have been critically separated in the first place. Here, embodiment is diffracted through a series of performative real time experiments. Screen events were not isolated as simply data, instead the virtual ground of mediation was the conjunctive apparatus itself, which fused body, grass, and machine. Technical interfaces like the Leap Motion were treated as no more significant to the research than physiological interfaces such as the human hand. What emerged in the resultant phenomena was not only an experience that foregrounded an attentiveness to the micro-gestures of the hand, but also the hand as a processual and contingent formation that produces numerous instantiations of itself as textural 'on screen', as local and extensive with the data system and webcam, and also amorphous and fleeting in the virtual 'space' of projection that is the ambient topology of light as matter.

Experimental Media Art and the Making of Human-Art-Machines

In experimental media art since the 1990s, there is an influential lineage of embodied interaction that explores nuanced co-emergence of virtual bodies, as a theoretical discourse, an artistic practice and a force in culture. The augmentation of virtual worlds, where a participant's gestures and movements are translated into screen space through a conjunction with a data system, is a major area of research. Here, unstable mixtures of reality and the virtual are explored through sensor based networks that activate various hybrid occurrences whose challenges to the limits imposed between virtual and physical space, are palpable. Various projects by Christa Sommerer and Laurent Mignonneau (*TransPlant*, *A-Life*), David Rokeby (*Very Nervous System*), Camille Utterback (*Text Rain*), Scott Snibbe (*Motion Phone*, 1995-8), Golan Levin and Tmema (*Manual Input Sessions* 2004-6) These examples from the history of experimental media art that manifest performative conjunctions in Mixed Reality, can be re-considered as software assemblages, rather than the more conventional (Humanist) description as 'installations'. From a materialist perspective, all consider the diverse ways in which the visible relations between human and nonhuman elements enter into dynamic relational arrangements via software, code and algorithms.

From Taxonomy to Diffraction: Approaching Mixed Reality as a Software Assemblage

The potential to re-configure the Reality-Virtuality Continuum in a more appropriate formulation that has the capacity to take into account the relational aspects of the body, technical networks and devices. Drawing on Deleuze and Guattari, the software assemblage is a permutation of software as interface; a machinic assemblage (Deleuze and Guattari 1987, p.23) arranged through the agential relations of software, and shaped by relations with various co-emergent material forces, human and otherwise. This hybrid arrangement encompasses virtual, technical, physical and fleshy objects, in a contingent and conditional networked configuration that is critically embedded with the capacity to re-configure through self-organisation. In order to further explicate the software assemblage, it is necessary to unfold some of its more precise procedural operations. To facilitate this task, I bring Deleuze and Guattari into contact with Karen Barad, through their

mutual interest in the differential relations of Being, as procedurally fuelled by the self-organisation of matter. To be clear, the operable intimacy I am extracting from these highly influential materialist thinkers is not expressed in the texts of either: Barad especially is outwardly hostile to Deleuze, while obviously Deleuze and perhaps also Guattari would most likely be unaware of Barad's extremely significant, but far more recent contributions to philosophical thought. Though all have arrived at materialities of becoming through divergent processes, the capacity of their ideas to inform a productive new research axis on materiality in experimental art, is highly promising. The operable affinity I suggest is leveraged out of their mutual yet independent development of differential processes of becoming, and the potential of such processes to transform ethical, material and discursive stratifications. For all, matter has its own form of morphogenesis that occurs independently from human intervention, is perpetually generating and re-organising itself according to the relations it forms (contingently) with other materials: matter coalesces, concretizes, disperses, erodes, re-assembles.

Susanne Witzgall has commented on the associations between Barad and Deleuze, which she sees as connected by a shared interest in questions surrounding the nature of the processes that differentiate Being (and by implication, becoming): "Barad appears to assume a similar primary difference of Being and detects in the elementary particles of quantum field theory a similar virtual, manifold indeterminism of differential relations as utilized by Deleuze for his problem-Idea" (Witzgall 2016, p.146).

Karan Barad's agential realism provides an especially useful addition to the software assemblage since it fleshes out the actual movement of matter in the world (intra-actions), the objects matter creates (phenomena), and an understanding of bodies and matter in movement (diffraction). For Barad, phenomena are the concrete material results of the 'intra actions' of matter (Barad 2003, p. 811), at their smallest unit, quanta. In an agential realist account, in common with new materialist theory,³ humans are a particular configuration of matter and therefore are not privileged in relation to other material

³ Manuel De Landa (2012, p.43) has commented that a common thread linking all new materialist accounts is the premise that matter is vibrant and connected. He says: "... neo-materialism is based on the idea that matter has morphogenetic capacities of its own and does not need to be commanded into generating form." (Interview with Manuel DeLanda, in Dolphijn & van der Tuin).

configurations (2007, p.33). For Deleuze and Guattari, the conditional arrangement that facilitates this mattering is the abstract machine while the active formings that occurs after the cut are assemblages. For Barad, it is the intra-actions of matter and the phenomena created by the processual workings of the apparatus and the discursive-material practices behind the measurement of the phenomena in an experimental scientific set-up, matter is fundamentally an arrangement of quanta.

Using the software assemblage formulation as a theoretical apparatus to parse over Mixed Reality, brings a materialist conception of interfacing into contact with artworks that conjoin hybrid human and data systems to produce a performative space of negotiation. Augmented Virtuality in art cannot be analysed effectively under the impoverished terms given by the Reality-Virtuality Continuum, where segmentary parts are disconnected and discrete from one another, then placed back in an artificially contrived spectrum that is always already bounded by a structured and dualistic schema. Further, a taxonomy supports the commonly held definition from computer engineering pedagogy where virtual objects are primarily simulations of the physical world. Re-configuring Mixed Reality as a soft-ware assemblage rather than a series of separate technical categories is crucial, since it leads to a conception of the emergence of matter (such as the body) that does not hold digital verisimilitude as a goal. There is a need to unfold the complex and highly nuanced technical-material-discursive formulations that merge from customised networks conjoining human and nonhuman elements in processes of interfacing and augmentation, to afford an enhanced sensory experience of the virtual that traverses, or caresses, embodiment.

An experimental media artwork that conjoins the hand with a computational hardware and software system, is the *Augmented Hand* series (2014), by Golan Levin, Kyle McDonald and Chris Sugrue. Participants were asked to insert their hands into a machine that captured images. These images were then translated into virtual mutant versions of hands. Taking a photograph of the hand, the software performed some highly believable renderings of deftly manipulated hand 'forms', adding extra fingers, distorting the shape and size, and generally perceptually refiguring the familiar digits of each participant. As the custom software that powered *Augmented Hand* grabbed images of participant's actual hands, they were instantaneously translated into a distorted form. These

forms still resembled one's own hand, yet contained disconcerting, Frankenstein-like additions.

In this artwork, as digital matter (such as the software itself) moves processually through matter (the human hand), negotiating shifting meshworks, the movements and transitions of the bodymachine network (the co-shaping of mutant hands) actually materially influence a human experience of 'reality'. Moreover, material flows of people and software, transversally coming together in the environment of the artwork, can be approached as forces that reassemble not only *relations* with the body but also the *concrete matterings* of the body itself. The human body is just as much an interface as is a physical object: both are matter engaged in matterings, with emergent performative effects that are themselves transitional phenomena. As participant's hands became figures of the material reassembly of the human body, toward a mutant cyber body, those actual hands were transformed by the processual workings of the machine. This tracing of the virtual into reality via the physical hand, is not simply a perceptual trick, but an embodied experience that merges with the participant's 'reality' even after the experience is temporally over.

Summary

Earlier in this paper I discussed the core taxonomic practices in HCI that have led to the artificial compartmentalisation of Mixed Reality as a 'middle' instance on the Reality-Virtuality Continuum (Milgram and Kishino 1994), a contrived spectrum that is essentially a new dichotomy between 'real' and 'virtual' in the computer engineering sense of those terms. Re-situating Mixed Reality in a material network of practices that spans research, industrial computation, desktop computing and experimental art practice, my aim has been to accrue an extensive definition for Augmented Virtuality beyond its more common taxonomic use. Further, I suggested that notions of classification that manifest as limits operated not only to segment Reality from Virtuality, but also embodiment from Virtual Reality (Weiser 1991). Rather, I proposed the software assemblage as an experimental diagram that operably infects varying mixtures of physical and virtual worlds. Mixed Reality, when explicated as a topology, operates as a critical response to the restrictions imposed by the bounded virtuality espoused by HCI research.

Using examples from media art as well as my

own practice, this paper has explored the emergent dynamics of performative interfacing as an element in an experimental art assemblage rather than an industrial media assemblage. Co-emergent configurations that diffract material phenomena such as a human participant, a screen, as well as various objects virtual and physical, encourage an active co-emergence, where the digital materials of algorithms, code, and the fleshy matter of the body and other phenomena such as a grass screen, become entangled through, with, and by an intensive sensory process.

Acknowledgements

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Author Biography

Rewa Wright is fascinated by augmented emergences in organiccomputational-material systems, which she calls *software assem-blages*. She works across the territories of generative art, net-worked abstraction, experimental documentary, audio-visual performance, and mixed reality. She has presented her work at ISEA2013 (Sydney), the Post Screen Festival 2014 (Lisbon), and ISEA2015 (Vancouver), ISEA2016 (Hong Kong) and Vivid 2016 (Sydney). She is finishing her Ph.D in realtime, in the afterglow of a future not yet born.

Bio-creation & Data
Papers

TURBA Concert in 15 Movements for 64 Neural Xoscillators

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Abstract

TURBA is a hybrid environment of artistic speculation that combines an electromechanical robotic device and its sonification with the network structure of 64 neural oscillators and the social context of the collective behaviors. None of the actions generated by TURBA is previously arranged: no sound, no movement, no pattern is deliberately produced. Quite the opposite, these elements come alive because of its own processes in its own network structure.

Keywords

Robotics, Neural Network, Contagion, Data, Sound Generation, Collective Behavior, Installation, kinetics

Introduction

TURBA is part of a wider investigation made from an artistic approach that deals with the subject of the concept of the human being by means of bodies, perceptions and metaphors coming from computer programming, robotics, life simulation or artificial life.

This research is called *Codex Contaminari_Humana Coded* [1]. It consists of three intertwined parts: ‘Turba’ which generates and interprets emergent behavior patterns by a neural network; ‘Uncanny Bihotz’ concerned with the construction of the organic elements made up of synthetic units and ‘Ehime Daruma’ being a symbol of the thought transformation capacity onto the matter, this time, as a consequence of the virtual changing into the real.

Despite their digital nature, each of the three pieces also contain data from ‘another human condition’ brought by their own substantial contact, which is mainly conceived as the act of adding to the logic of the binary data variables of an irrational computing [2] or an alchemical logic. As a matter of fact, the three of them primarily aim at searching the poetical elements from the magnified data and once it is brought into an aesthetic experience, it undoubtedly enhances the perception of the hybrid beings technologically designed. In the case of

TURBA, a network structure of 64 neural oscillators has been ‘infected’ with the meaning of other self-organized procedural systems of social or cultural nature.

Social Background: Collective Behavior and Contagion Theory

The Royal Spanish Academy dictionary defines *turba* as a crowd of confused and disorderly people. According to the thought of the social sciences a *turba* belongs to the category of collective behavior, mainly in accordance with the contagion theories. These theories were first developed by Gustave Le Bon (1895) [3], and later continued by Robert Park (1967) [4], and Herbert Blumer (1951) [5]. They defined a collective behavior as one that spontaneously arises, is relatively little organized, quite unpredictable, that has no development plans, and is dependent on the mutual stimulation among its participants.

In such situations there is often a free play of emotions, a high degree of personal interaction, influence and competition, and the emergence of opinions and transient submissions. So, the crowds exert a hypnotic influence over its members, which, protected by anonymity, leave their personal responsibility and surrender to the contagious emotions of the group. In this way, the crowd takes own life, causing emotions and leading its members to irrational action.

Depending on the context, the behaviors that may be included in it are: disaster, crowds, mobs, gangs, panics, rumors, extravagant fashions, mass hysteria, passing hobbies, propaganda, public opinion, social movements and revolutions. None of them is completely controlled by cultural norms.

Contagion theories seek to explain networks as conduits for “infectious” attitudes and behavior. These infected networks serve as a mechanism that exposes people, groups, and organizations to information, attitudinal messages and the behaviors of others

(Contractor & Eisenberg, 1990) [6]. Due to this exposure it increases the likelihood that network members will develop beliefs, assumptions, and attitudes similar to those of their networks (Carley & Kaufer, 1993) [7].

A turba is a crowd engaged in an aggressive act.

Technical Background: Neural Oscillators

The mathematical equations for the neural oscillators used in TURBA are based on the work of Shun-Ichi Amari (Amari, 1977) [8] and are specifically explained on the website of the Laboratory for Experimental Computer Science at the Academy of Media Arts Cologne [9]. In TURBA, these equations have been rigorously adapted to the visual programming environment vvvv (Figure 1) in order to create neural oscillators.

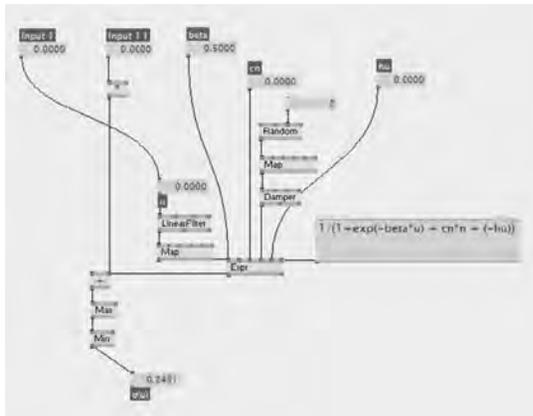


Figure 1. A neural oscillator core built in vvvv

A dynamical system describes the temporal evolution of a state variable in time. In case of the neural oscillators there are two state variables *u* and *v* that represent the neural activation level of the excitatory and of the inhibitory neuron. According to this explanation, neural oscillators allow creating rhythmic behavior. They can be realized with just two mathematical equations that describe the behavior of two mutually coupled systems in time. The first system is a self-excitatory neuron that has a positive feedback connection onto itself, so when it becomes active it activates itself even more.

A second system is an inhibitory neuron that is activated by a positive connection from the excitatory neuron and it sends back negative (inhibitory) feedback

to the self-excitatory neuron. When the excitatory system becomes active it activates the inhibitory neuron that in turn suppresses the activation of the excitatory neuron (Figure 2). Once the excitatory neuron is deactivated the inhibitory neuron loses the positive input and becomes inactive. Now without the inhibitory input the excitatory neuron becomes active and activates the inhibitory neuron again. Then, like a little heart, a new cycle begins, creating rhythmic behaviors

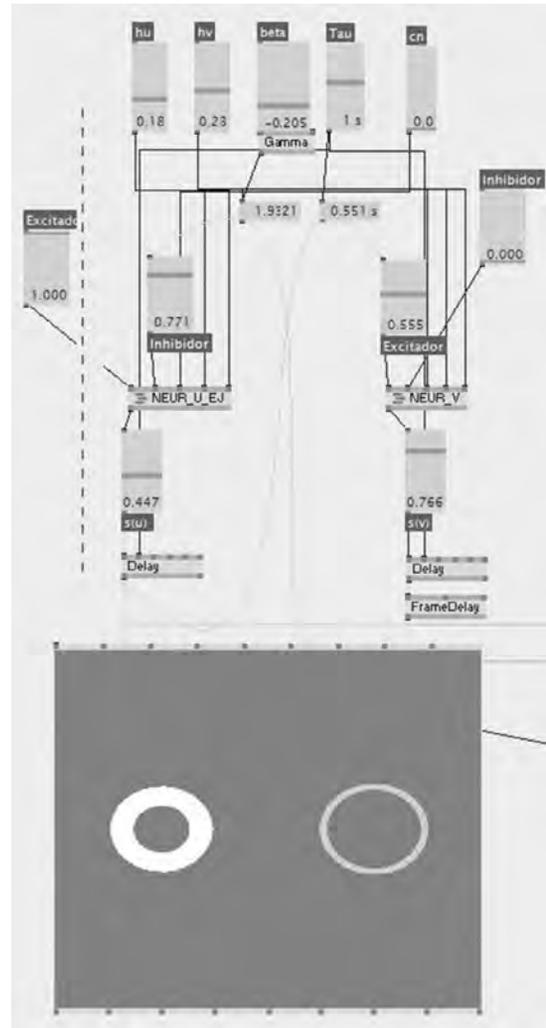


Figure 2. Two mutually coupled oscillator system

In TURBA a network of oscillators has been built through software (Figure 3). Each of the small boxes (nodes) of the following diagram is a couple of oscillators; from each of them, as synapsis in search of vital communication, three connections go out and other three connections come back. All of them have been randomly linked. To do this, we have followed a strictly random order process proposed by the program.

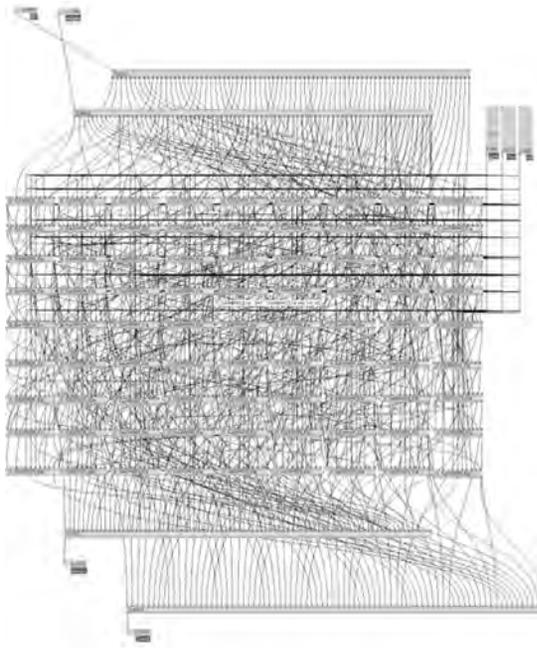


Figure 3. The oscillators' network

Up to here comes the explicit programming in oscillators' behavior: each excites and inhibits, and in turn, each is excited and inhibited by others. From here, all behavior arises from the structure itself. This means synchronization behavior is not explicitly programmed, but appears as a result of the network connectivity between the oscillators.

None of its components is the engine or timer for that behavior, but all act contagiously among them. We can say that the oscillators perform, but have no plans.

But if this system receives feedback from the synchronization that it generates, TURBA creates disturbingly similar rhythms to the movement of an organic body, carrying the work piece to emergent behaviors of asynchrony, chaos or collapses...

Hardware Background: The robotics

Physically, TURBA is a mechanical, electronic and sound installation. This structure consists of iron and aluminum, which supports 64 iron rods (Figure 4). Each of them contains a servo motor attached to grasses.

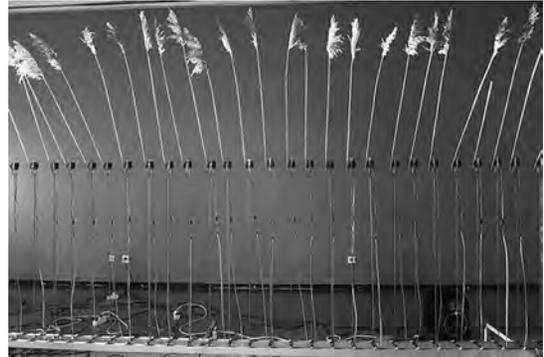


Figure 4. TURBA installation (view)

As a last resort, all this hardware structure has been built to understand, listen to and view the activity of the neural network of oscillators: what kind of patterns, classes and emergent behaviors arise from this peculiar nature. In this sense, the robotic structure of TURBA is strictly functional.

But since this hardware structure is also linked to an artistic and social meaning, part of its morphology is related to concepts of a symbolic staging. Herbs at the ends of the rods are grasses with a high power of contagion. Each time they move driven by the action of servo motors, they expand their seeds in the air, its active ingredients, their genes, their memes... (Figure 5)



Figure 5. Still of the motion generated by the servomotors

At the same time (Figure 6) the whole is illuminated by a light cross, creating a shadow that allows understand all individual slices as part of a group, where the personal characteristics have been removed, or to put it another way, where capabilities of own decision have been disappeared, devoured.

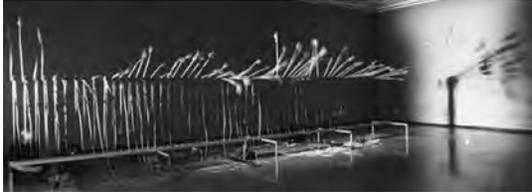


Figure 6. TURBA installation (view)

The Concert

TURBA has the subtitle of Concert in 15 movements for 64 neural oscillators. In the internal process of this structure, small changes in any of the parameters associated with the excitation and inhibition of the oscillators, will generate large changes in machine's performance. We have identified 15 moments (what later will be the movements of a piece of generative sound) in which this activity takes a special personality. Each of them has been named in Latin taking into account the metaphor that emerges from the generated movement:

- 1-Natus
- 2-Expergitus I
- 3-Expergitus II
- 4-Sinus I
- 5-Tesla I
- 6-Sinus II
- 7-Turba
- 8-Fedum
- 9-Spatha
- 10-Caro Data Vermibus
- 11- Exspectatio
- 12-Abyssalis
- 13-Collapsus
- 14-Addormiscere
- 15-Tesla II
- 16-Fine

In order to better understand each of these movements and the relationships among them, they have been carried to the sonification of a sound wavetable synthesis (Figure 7). From here, TURBA becomes an electroacoustic and acousmatic orchestra whose

performers are the oscillators and the score is written in

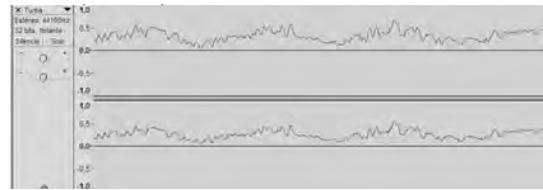


Figure 7. TURBA sound recording

Once the neural network has been built, it is permanently attached, or what is the same, oscillators always interpret the same score. But depending on the status of system startup, or processor speed of the computer itself, or the order of the transitions from one movement to another, each of these interpretations is slightly different from each other.

Conclusions

The work serves to contemplate and understand a biological function in a mechanical context from artistic premises. What we see or listen to in TURBA, it is the activity of software entities and data in movement. These data have been led to the construction of a physical piece in a carefully prepared context, for a better understanding of what is happening inside the computer, but, in the end, as a mirror, it's built for a better understanding of what is happening out there.



Figure 8. TURBA installation (view)

On the one hand, it provides data to the discussion of collective behavior based on neural networks, and, on the other hand, it projects a scientifically measurable dimension in an artistic work. In addition, we thought the data are not abstract structures without body, even as software entities or raw data; they need a context, and they need to be balanced in a global system where there is a wider ecology between logical explanations and poetic insights. A crowd is not a network of neural oscillators, but they can behave or work in a similar way. In TURBA there has been constructed a mixture of elements that work together to be interpreted also in a joint way.

Links: Video: <http://bit.ly/1M5YjZz>

Sound: <http://bit.ly/1WRksh7>

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Author Biography

Patxi Araujo (Spain, 1967). Artist and Professor at the Department of Art and Technology (Faculty of Arts) at the University of the Basque Country UPV/EHU. Artist experienced in the field of fine arts, applied his research in scenery, installations and events, and in immersive and interactive environments. He has made numerous individual and collective exhibitions, receiving awards and mentions in different competitions and international events.

Currently his research focuses on the generation of content and critical thinking through the relocation of the work, the viewer and the artistic reason itself in the territory of the new media.

Reimaging Coral Reefs: Remodelling Biological Data in the Design Process

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Abstract

Coral Reefs are filled with infinite and unique forms, variations of shape, and complex phenomena and processes. These forms and processes have inspired both scientists to document, archive and collate, and designers to reimagine these intricate ecosystems in their creative design work. In this paper, we explore how designers integrate scientific data from coral reefs, by examining two projects. Firstly, we discuss *Reefs on the Edge*, an interactive installation using scientific data from a marine biologist to visualize the effects of ocean warming on corals reef ecosystems. Secondly, we discuss *Coral Colonies*, an installation that adapts mathematical codes of coral geometries to create biomimetic coral prototypes. We conclude how design and science use visual data taken from biological processes to help raise awareness and promote biodiversity, sustainability and the survival of the Great Barrier Reef (GBR).

Keywords

Coral Reefs, Code, Interaction Design, Drones, Tangible User Interface Design, Interactive Installation, Climate Change, Marine Biology, Transdisciplinary Collaboration

Introduction

While scientists use data and biological processes to observe, measure, analyse and categorise, designers explore biological data to create, shape and design materials. Biology as a discipline of science seeks principles of order by researching phenomena of the natural world through, observation, measurement, analysis, and categorisation; this raw material may be deployed as an instruction manual in a design context (Reinhardt, 2015).

Generic systems as found in nature, universal biological methods and principles, biomimicry and biomimetics have increasingly become drivers and problem solvers in diverse fields - from science to design. In nature, unique variations develop through universal code according to specific affordances. The same principles can be found in the way structures and

organisations are formed, and information is processed.

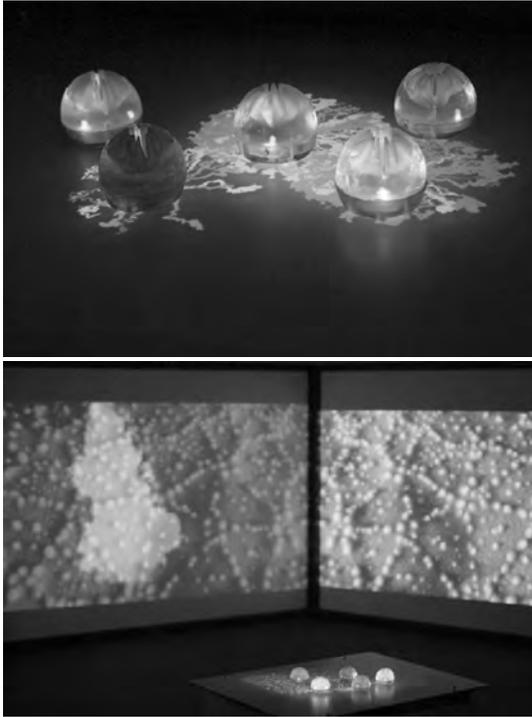
In this paper, we show how biological processes taken from coral reef ecosystems have become an inspirational site of exploration for designers to reimagine scientific data in interactive installations. We discuss how two research installations - *Reefs on the Edge* and *Coral Colony* - integrate biological data into the design process to reimagine, and potentially reconfigure, coral reefs.

Background

The Great Barrier Reef (GBR), the world's largest coral reef ecosystem, is situated in northern Australia and covers over 344,400 kms. It includes over 3000 coral reefs, 600 continental islands, and approximately 150 inshore mangrove islands (DSEWPC 2013). Twenty-five percent of biological organisms populate these beautiful complex forms. Yet despite being one of the most astonishing places on Earth, more than one quarter of coral reefs in the GBR have recently disappeared due to widespread coral bleaching (Hughes et al. 2002). The effects of climate change, such as ocean acidification, ocean warming, pollution, overfishing, and sea level rise, threaten coral reef ecosystems. Higher ocean temperatures have been shown to cause coral bleaching (Hughes, 2003; Hoegh-Guldberg et al. 2007; Pandolfi et al. 2011). Multiple and diverse data are currently being collated that document the condition of the reef.

In order to combat conditions caused by climate change in the GBR, urgent transdisciplinary collaboration in fields such as biology, design and architecture are necessary. These transdisciplinary collaborations can provide design solutions to regenerate coral reefs. In this paper, we explore how the creative interpretation of biological data through processing and scripting methods can be applied for interactive design installations; consecutively educate audiences about coral reef ecosystems; and foster desire to preserve these intricate ecosystems. These creative works act as

boundary objects between the different disciplines that range from marine science to biology to computational design, bridging between the different disciplinary criteria, concepts and frameworks (Star and Griesemer 1989).



1. (Top) Reefs on the Edge, Tangible User Interface Objects; simulating Coral Bleaching. (Bottom) Multiple Channel Video, and Tangible User Interface Table ©Caitilin de Bérigny

Reefs on the Edge

In this section, we discuss *Reefs on the Edge* (2011-2016), an interactive installation created using scientific data collected by marine biologist Dr Erika Woolsey. Woolsey's research investigated the survival of young corals in the Great Barrier Reef, and the effects of temperature on embryonic development (Woolsey, 2013). The impetus to create *Reefs on the Edge* was to visualize Woolsey's scientific data, and to educate audiences about climate change in the GBR.

Reefs on the Edge gives audiences an opportunity to learn about rising sea temperature, and the effects on coral reef ecosystems. The data is visualised by abstractly representing coral bleaching (figure 1 top),

and spawning (figure 2). Depending on how long the audience engages with the object, the simulation either 'spawns' or 'bleaches'.

Reefs on the Edge was designed by Caitilin de Bérigny and created by a team of researchers at Sydney University. Designers Phillip Gough and Adityo Pratomo built the TUI objects; Ge Wu edited the multiple -channel video installation; and Michael Bates created the soundscape.



Figure 2. Reefs on the Edge, Interactive Installation. Tangible User Interface Table ©Philip Gough

Data Visualization-Reefs on the Edge

Reefs on the Edge is comprised of a tangible user interface (TUI) table (figure 1 top and figure 2), and a three-channel video installation (figure 1 bottom). For the previous, the scientific data collected by Woolsey was integrated into a four-dimensional installation, by using Processing to create the data visualization which controlled a video-projection onto TUI tables:

“Processing has been used for a broad range of purposes—from artistic to analytical—to communicate data and is an ideal platform for interactive installations, such as *Reefs on the Edge*, to enhance the artistic and scientific display digitally and help users relate to information” (de Bérigny et al. 2014).

The data was communicated to and explored by an audience when they manipulated the TUI objects on the table. By moving the TUI objects, shifts in the processing sequence were inducted and data flows immediately simulated, so that the audience learnt about impacts of minute and gradual but irreversible changes on ecosystems such as raises in sea temperature on coral embryos.

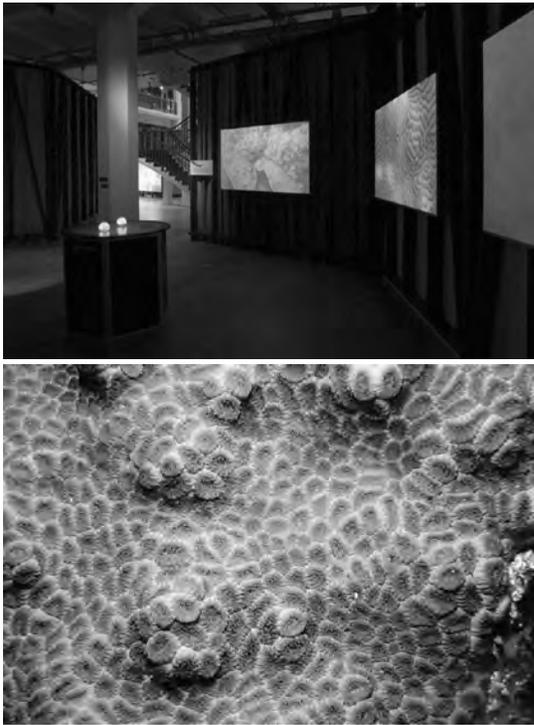


Figure 3. (Top) *Reefs on the Edge*. *Exo-Evolution*, GLOBAL, ZKM at the Center for Art and Media in Germany (2015 to 2016), ©ZKM. (Bottom) Image of Coral, taken by Charlie Veron, used in the film *Reefs on the Edge* (2002) ©Charlie Veron

Communicating Data: Video Installation

Surrounding the exhibition is a multiple three-channel video installation (see figure 3). Like the TUI table,

the communication of the scientific data was translated into the video component. The aspiration behind the video was to visually translate the effects of ocean acidification, raises in ocean temperature, and pollution in a non-didactic, visually engaging manner.

The installation employs current visual imagery, taken by de Bérigny on a field trip to One Tree Island Reef (see figure 4 bottom), comprises underwater photographs. The sound was recorded from an underwater microphone, designed and edited into a musical composition by Michael Bates. Significant visual data were further donated by former Chief Marine Scientist of the *Institute of Marine Science* (see figure 4).

Charlie Veron, known as the ‘Godfather of Coral’, discovered over 20% of all coral species globally. He collected photographic documentation of the major coral reef regions, participating in 66 expeditions, spending 7,000 hours scuba diving (Veron 2002; Veron & Stafford-Smith, 2000; Veron 1986).



Figure 4. Image of Coral, One Tree Island Reef (2014) © Caitilin de Bérigny

Veron’s scientific data (see figure 4) was further juxtaposed with artistic images of coloured dye. Dye is used here as a visual metaphor; representing acidification, pollution and changes in sea temperature (see figure 3). The dye sequences were layered on black and white images of coral; alluding to coral bleaching.

The interactive installation *Reefs on the Edge* developed through various design iterations, and was shown in numerous exhibitions: including the *Exo-Evolution* (figure 3) at ZKM The Center for Art and Media in Germany (2015- 2016), and in the *Meaning*

of Life: Celebrating 50 years of Biological Sciences at Macleay Museum (2013-2014). The work featured in an exhibition at Web Directions and was shown in an exhibition; Attract: Relate: Sustain, at the Verge Gallery in Australia.

Reefs on the Edge is a transdisciplinary collaboration in biology, design, art and acoustics, leading to an interactive installation that employed scientific data in the design process. Through the close-up and tangible display of slow but fatal effects on embryonic corals precipitated by ocean warming, the work communicated the effects of climate change on the reef, thus providing a space to learn about the GBR in an engaging, interactive environment through multi-modal interaction (sight, sound, touch).

Several aspects are key in the two installations that are discussed here; the visualisation, the embodied knowledge, and the human/non-human relations. We argue that biological processes, taken from coral reef ecosystems, can become an inspirational site of exploration for designers to reimagine scientific data in interactive installations. In this shift, observation, rationality, and economy take on different forms, beyond mere data management and analysis. By employing what Halpern coined 'communicative objectivity', attention and empathy of the audience is drawn to micro-conditions that have global impacts, and so, transformations in governmentality can be potentially initiated (Halpern 2015). In a similar manner, data is employed in *Coral | Colony*.



Figure 5. Coral |Colony, Future Nature exhibition, Australian Design Center, Sydney (2015) ©Dagmar Reinhardt

Data Visualisation- *Coral |Colony* (2015)

Coral | Colony collates research investigations into natural morphologies and systems, developed by Dagmar

Reinhardt (2010-15) and exhibited as part of "Future Nature" (Australian Design Museum, 2015). *Coral | Colony* comprises a range of media: marine specimens found in the inter-tidal zones of Australian Eastern beaches (New South Wales and Victoria); video clips of scientific documentations; animations of 3D-modelling processes, and segments of code. This archive uses different data sets; (found) natural specimen; and (man-made) boundary objects, to communicate nature in a tactile, and visually engaging manner (figure 5).

Coral | Colony explores multiple heterogeneous systems where an organism formed of singularities (the coral) contributes to form a larger ecosystem (the colony). The term "colony" describes the correlation and interchanges between numerous life forms. The colony's core and most predominant component - the *coral reef* - is a non-finite structure, with dynamic behavior and growth patterns. It is a multi-dimensional entity comprised of opposites; the animate and inanimate; the mobile and stationary; the temporal and generational systems that continuously evolve. The colony changes in a choreography with other entities (corals, fishes, plankton, etc.), and adapts by actuating an inscribed mathematical, and evolutionary code.

Data (Re)Design: Code to Fabrication

Corals are highly complex organisms that illustrate visible continuous changes, and unique variations. The biomimetic design approach for this work, applied mathematical logic in generative systems to create diverse forms and morphological variations.

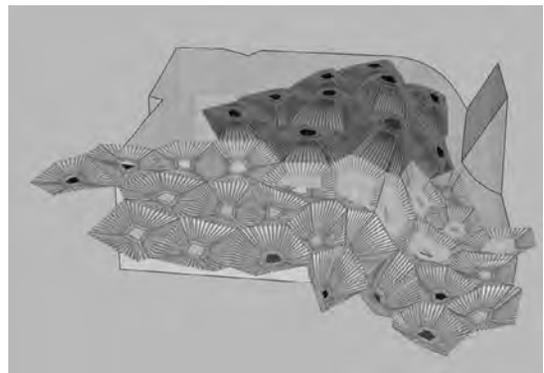


Figure 6. InteractiveCorals: Voronoi coral modules on reef segment (2015) ©Dagmar Reinhardt, EndOfLine

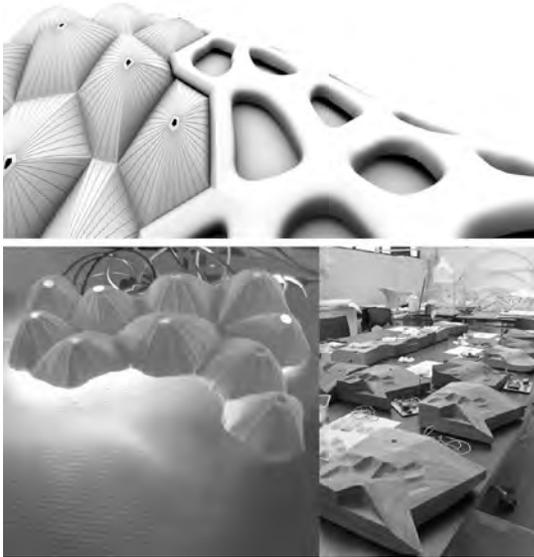


Figure 7. InteractiveCorals: Geometry Data Visualisation, Interactive LED, Modules (2015) ©Dagmar Reinhardt, EndOfLine

InteractiveCorals created a segment display of coral reef structure, with twelve modular components that contribute to the larger complex ecosystem. Modules consisted of multiple materials (mahogany, porcelain, LEDs). Audience members that engaged with the modules on a tactile level, experienced a pulsing of the corals light emission that mirrors their heartbeat frequency (figure 8). The *pulse of life coral sculptures* embodies these principles, in their formation and as a metaphor for relational structures and networks.

Several different steps of prototyping, material computation, coding and digital manufacturing translated the mathematical code for the coral pieces; from a) the organization of principle geometries in 3D modeling and scripting processes; to b) dataset transfer in digital and analogue manufacturing (CNC and Rapid Prototyping, slip-casting processes, and firing stages); and finally to the c) pathways of prototyping and finalizing live entities with pulse sensor and lighting patterns.

Examples of code found in deep sea corals used here included Voronoi geometries in cellular coral growth, turing patterns, or branching structures based on L-systems. These rules are mathematical instructions; code, or DNA sequences that are applicable in dynamic

systems. This code is a complex data set, developing through time.

In the first step, the geometry was modelled in parametric and scripting software (3D-modelling McNeel Rhino, plus Grasshopper plugin). In these isolated areas, two Voronoi pattern codes for a coral population are associated with individual base modules (figure 6). These two Voronoi populations of coral growth differ in geometry, are situated on the local topography, and inhabit density and expansion of each module's surface plane (figure 7). Singular cells of the Voronoi corals respond this surface as 'lost population'; they are engraved as negatives or 'ghosts' on the surface, thus echoing the 'live' and glowing corals (Figure 8).

The scripting sequence mimics the biological data through geometry. Both coral populations share similar appearances that organize relationships between individuals in the group (the Voronoi). The two species of corals exemplify different evolutionary lines, identified through 'profiling' of their structural skeleton and dimensions by touch.

In the second step, a transfer of dataset to digital manufacturing and fabrication was used to constitute the computational prototype. Two base sets were digitally fabricated for production in EPSF Styrofoam (for mould-making, and slip casting porcelain process), and a CNC routed mahogany base. 3D modelling files were reworked according to machine toolpath, and data send as fabrication command to rough and fine routing of module formwork, and for routing the engraved sequences of corals.

The fabrication then employed a slip casting process (Styrofoam to plaster to slip cast), where the original geometry was reproduced from the routed form, in a first plaster formwork; as singular cast; and the fired, cooled, glazed and refired, bridging between the universal coding, and the material constraints (figure 8).

Finally, and as a last transfer of data and code, the human pulse is conceptualized as giving life to the coral entities. A pulse sensor is embedded in the wooden base. A soft glow is emitted by LEDs underneath the coral structures. When a pulse is detected, the lone red LED blinks and a lighting pattern plays on the blue LEDs, before reverting back to the soft steady glow.



Figure 8. InteractiveCorals: (Left) prototypes for Voronoi coral modules. (2015) ©Dagmar Reinhardt, (Right) Brain Coral Study (2015) © Dagmar Reinhardt, EndOfLine

In *InteractiveCorals* biological data was used as a biomimicry approach in shape appearance, and the responsive behavior of the coral. The mathematical logic is here used as a multi-level tool; from generative and manufacturing to interaction and experience processes.

Future Trends in Data Collection

Developments in new technologies continue to create new methods to collate, document and visualize biological data. Drone technology provides high quality aerial footage, visualizing changes in coral reef ecosystems. Sydney University video artist Nathaniel Fay, in collaboration with a marine scientist, architect, and designer, currently explores processes for aerial drone data from the GBR, for a slow/change, large/scale research project (2017-2019). This drone footage research will provide new interdisciplinary methods to retrieve and consecutively interpret biological data. Projected outcomes will include systems of data visualisations and new media art installations that engage designers, scientists and audience.

Furthermore, there are currently a number of global initiatives forming transdisciplinary collaborations in design, architecture and biology to develop artificial reefs. One such example, is the *Reef Design Lab*, a multidisciplinary team in biology, engineering and design. In the *Reef Design Lab*, designer Alex Goad created a Modular Artificial Reef System (MARS) (see figure 9). The artificial reef MARS, is comprised of

modules; designed to provide diverse benefits to species specific habitat. The dimples on this MARS were designed to facilitate attachment of live coral; which grows to the structure, reshaping it into a living reef.



Figure 9. (Top) Modular Artificial Reef System (MARS), designed by Alex Goad. (Bottom) Alex Goad installing MARS underwater. ©Alex Goad

Like the *Reef Design Lab*, in the Maldives, *Reefscapers* developed a coral regeneration project. The project was developed after a massive coral bleaching event in 1998, wiped out over 90% of corals. *Reefscapers* developed by an environmental agency Seamarc, has submerged over 4,000 artificial reefs (Reefscapers 2016). For the project, the team welded dome frames, with a rust proof coating, and attached live coral to the structure. When submerged underwater, corals grow to the structure. Due to widespread global coral bleaching events, the creation of artificial reefs is significant to regenerate coral reefs. This project is an innovative illustration of how design can play an important role in marine conservation.

Conclusion

We explored how designers reconfigure biological data to create, and develop materials in their design process. We examined two interactive installations; *Reefs on the Edge* and *Coral Colony*. Both installations experimentally and creatively integrated biological and scientific data from coral reefs in the design process; through direct implementation of visual imagery, through secondary imagery and metaphorical gestures, through boundary objects and tangible user interfaces, and by using mathematical data to reproduce coral-like objects and tangibles. At the core, these interactive installations explored biological data by creating visualisations through biomimetic design approach in advanced computational code, processing and scripting environments code. Such design-led investigations raise interest in and awareness of the fragility of the Great Barrier Reef; by promoting environmental action to large public audiences in museums and galleries.

The described exhibitions and works are linked with what art-science theory describes as ‘the logic of ontology’ (Barry 2008), that is, an orientation apparent in diverse interdisciplinary practices towards effecting ontological transformation in and through objects, and as relations between different research disciplines. This is particularly significant with global phenomena which posit challenges such as climate change, which no single discipline can solve.

And while this paper has addressed novel methods for integrating biological data into a design process, much more work and research needs to be undertaken, given the short time frame and urgency of the reef’s present condition. Both data collection (such as retrieval via drone’s) and advanced fabrication to support coral growth have become more accessible. Most importantly, interdisciplinary collaboration will be the key. Processes such as the ones discussed here can help provide solutions for environmental sustainability for one of the most magnificent ecosystems on Earth; the Great Barrier Reef. In order to sustain biodiversity, and preserve coral reefs, transdisciplinary collaborations in design, biology and architecture are crucial for coral reef regeneration and recovery.

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Dagmar Reinhardt is the BArchEnvsProgram Director at the Faculty of Architecture, the University of Sydney, and the Master of Digital Architecture Studio Leader. Her Mathematical Code to Relational Networks 363 research is concerned with an interdisciplinary nexus between computational design, structural engineering, acoustics, biology, and architectural design. She has published on design models for latent material

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Nathaniel Fay is a Master of Philosophy research student in Design at the University of Sydney’s Design Lab. His research examines new mapping technologies to collect marine data using drone technology in the Great Barrier Reef. He is the Managing Director of One Ski Digital and works as a videographer and Lecturer in the Design Lab at the University of Sydney. His video work has been published widely and can be found at www.oneskidigital.com.

Data won't change your behavior: A critical design exploration of Quantified Self technologies

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Abstract

Data is becoming a ubiquitous phenomenon in our culture. Technologies that collect data about us on our behalf, such as lifelogging and quantified self devices, have been presented as able to help people change behaviors. This paper presents a study exploring the meaningfulness of these devices and their use. To investigate this topic, we designed our own QS device, using a critical design approach, called Feeler. We also conducted an experiment in which five participants used the device. Feeler guides users to meditate, study, and play. When the user is engaged in these activities with the device, it collects biological data (EEG) from the user and further asks users to share their own impressions about their attention and relaxation levels. From the experiment we collected about 7.5 hours of audio data, including think-aloud and semi-structured interviews. The audio was processed by marking interesting sections for further analysis and contextualization. Our results indicate that people are trustful of QS technologies and the ability of such technologies to help them initiate behavioral changes. We also found out that the use of these technologies is targeted towards productivity and self-improvement, such as avoiding procrastination, improving focus, and avoiding social media.

Keywords

Lifelogging, Quantified self, Critical design, Automated data collection, Technology design.

Introduction

We are living in the midst of a data revolution. Automated collection, storage, and analysis of data and media originating from various sources are changing our perception and experience of the world, the society we live in, our social relations, and ourselves. In general, these new forms of data are having a growing impact on our culture. Today data is currency. With it, we pay for the use of social media services. Sometimes data provide us hints of challenges and opportunities for action connected to our goals. Data also supposedly help us to make better decisions and solve problems.

Personal informatics, personal analytics, and

quantified self (QS) are areas of research and practices in which individuals collect data about themselves (Rooksby, Rost, Morrison & Chalmers, 2014; Swan, 2013; Wolfram, 2012). Such practices, including the collecting of *biomarkers*—or indicators of the user's biological state or condition—and *lifelogging*—or wearing computers to capture in various ways the user's entire life—are said to help people reflect on their life (Gurrin, Smeaton & Doherty 2014). The expectation is that the new and deeper understanding will lead to behavior change and thus better living.

Ubiquitous computing has enabled people to collect data at any time and everywhere in a non-invasive, almost invisible way. Wearable devices based on self-tracking have become affordable and people have started to self-track a myriad of things, including physical activity, location, sleep, emotions, and mental states, to name a few.

The motivations for self-tracking are diverse, although a common theme is the augmentation of human capabilities. For instance, in lifelogging the ultimate reason for engaging in such a data collection endeavor is to surpass the limitations of human memory (Bell & Gemmell, 2009; Mann, 2004). Inspired by Vannevar Bush's (1945) utopia of a Memex—a machine that could contain all the books in the world, as well as personal records of action and communications—lifeloggers pursue the dream of complete recall of everything they have ever done in their life. Although the question of how to retrieve the data or how to transform the massive amount of data into usable information and knowledge remains open, the vision is clear: by recording everything, we can know more and therefore be wiser, better, and more productive human beings.

“Self-understanding through numbers” is the slogan of the QS movement. Similar to lifelogging, QS involves the attempt to record important data about yourself to drive change and access means for personal

improvement (for example, wearable sport, wellbeing, and health devices) (Rapp & Cena, 2014). The emphasis is on continuous development. Therefore, many QS systems have some sort of automatic data analysis, coaching services, or gamification in order to motivate users to achieve their goals. The underlying idea is the classical business adage “If you can’t measure it, you can’t manage it.”

Most of the criticism of lifelogging and the QS movement has revolved around concerns about privacy and ownership of data. Often, users of these services are fully aware that the service provider will also have access to the data and will use it for commercial purposes. Although some critical voices have suggested different models wherein users have a right to manage data gathered about themselves, there is very little critical analysis of the practice itself and its more general implications for our culture (see, e.g., O’Hara, Tuffield & Shadbolt, 2008).

Personal data is also seen to provide power. Knowledge is power, but can lifelogging and QS provide us with knowledge that will truly help us in our lives? If so, in which aspects of life can they be useful? An interesting question is whether lifelogging and QS is driving us deeper into a competitive culture, in which the primary goal is to beat others and where the winner takes it all.

In this paper we present a study exploring the above questions by experimenting with a new practice and a device designed to collect biological data while the participant is studying. We describe the Feeler prototype—a speculative design artifact—which was developed to further understand how people relate to data collected about themselves and how the data may or may not have an impact on their behavior. We conducted an experiment with five participants (students) using the Feeler in 15 sessions of approximately 30 minutes each. In the following sections, we present the Feeler prototype itself, the research conducted, and the main results.

Feeler

Feeler is a set of computer devices with a tangible user interface (Figure 1) combined with an electroencephalography (EEG, also called “brainwaves”) data monitoring device. The Feeler system includes software running on a desktop app. The software collects the data and visualizes them after a study session. Feeler software gathers data about the users’ attention and

relaxation levels from the EEG device (a Mindwave helmet that uses Neurosky sensors) and communicates with the Feeler boxes via a Bluetooth connection. Feeler smart boxes consist of Arduino microcontroller boards connected to sensors, vibrators, infrared lights, and LED lights.



Figure 1. Feeler smart boxes

When using Feeler, participants follow a specific script that divides a study session into three different stages: meditation, study, and play. Each stage is associated with one of the smart boxes, which leads the student’s actions through visual and haptic feedback. The boxes give guidance and monitor the time spent on each activity, indicating the end of each task through a gentle vibration. After each stage, an icon illuminates and asks the user to connect the box to the next one in order to proceed to the next stage. Below we describe the functionalities of the Feeler smart boxes and the stages facilitated by the boxes:

1 Meditation: Before beginning to study, people are invited to perform a five-minute meditation exercise through deep breathing. In the meditation box, a pulsating LED light helps the user to maintain a calming breathing rhythm.

2 Study: The study portion is scheduled to take 20 minutes at a time. The study task consists of searching relevant content online and by reading, watching, and listening to the content found. A screenshot of the activities is taken every time a user’s attention and relaxation levels surpass certain thresholds based on measurements taken by the EEG device. In the Study box, a grid of LED lights gradually illuminates as time passes. The lights provide visual information to users about the time spent studying and the time remaining.

3 Play: The Play-box is a device with a memory game. Similar to the 1980s Simon Says game, the user

must repeat a light and sound sequence by tapping round touch sensors on the box. The game gets more difficult by adding a step to the sequence every time the user correctly completes a level. The game ends when the player makes a mistake. There is no time limit for this box, so the user can play as long as he or she wants.

While using the Feeler boxes, the user's EEG activity is monitored. After completing the Play-stage, the software running on a laptop asks the user to assess how she felt while meditating, studying, and playing. Users are also asked to estimate, based on a percentage scale (from 0 to 100), their level of attention and relaxation during the different activities. After recording this information, the Feeler software shows (Figure 2) a visualization of the EEG data compared to the user's own impression.

When looking at the EEG data visualization and her own estimation of her attention and relaxation levels, the user may reflect on her feelings and performance during the different stages. She may also go back and check from the screenshots what she was viewing when her attention or relaxation levels changed dramatically. This is expected to help users reflect on their study habits.



Figure 2. Visualization of EEG data and the user's personal experience from a session in the Feeler software

Research

To explore participants' thoughts about self-monitoring of biological data, we conducted a study with the Feeler. Our main interest was to determine the key issues and the implications of the integration of self-monitoring technologies into study situations. We did not aim to analyze the EEG data; rather, we wanted to explore how people make sense of the tracked data and how they feel about it. The key questions that guided the research were as follows: How do people react to automatically collected biological data in light of their

personal impressions? What happens when the data does not match their personal experiences? Do people modify their thinking or behavior based on the feedback provided by the QS device?

In order to further investigate these issues, we designed Feeler utilizing a critical design approach. In critical design, the aim is not to solve a problem or to find answers but rather to make us think and ask questions. Therefore, it resembles art forms that are critical, provocative, and challenging. One of the main questions asked with critical design is about what we really need (Dunne & Raby, 2013).

Speculative design is a critical design practice that focuses on the production of ideas by presenting possible future scenarios of use in which science and technology play a central role. It provokes questions about the impact of science and technology on people's lives by creating opportunities for interventions with possible products that are brought into an everyday context. As opposed to commercial product development and design carried out in product development units, critical design and speculative design bring possible products under public criticism (Dunne & Raby, 2013; Malpass, 2013).

A key aspect of Feeler is the juxtaposition of two data sources: (1) the EEG measurement, which in our time and culture is broadly considered to be objective and scientific, and (2) the participants' own impressions provided after using the Feeler boxes. By presenting different types of data, users are expected to reflect on the possible differences between the different data sources and to identify existing assumptions regarding attention and relaxation.

As part of our research we designed an experiment in which five graduate students would use the Feeler. Students taking part in the experiments were between 25 and 33 years old, originally from Finland, India, Colombia, and Poland. All were fluent in English and the sessions were held in English. The experiment consisted of a session lasting approximately 30 minutes using Feeler (Figure 3), followed by a think-aloud protocol and a semi-structured interview. Students committed to use Feeler once per week over the course of three consecutive weeks. In total, 15 sessions of 30 minutes each were conducted. The study work that participants agreed to perform during the sessions consisted of searching for online information related to their independent study projects. Before the participating in the sessions, participants answered an

online questionnaire that collected information about their backgrounds and study habits.



Figure 3. Typical Feeler experiment session

Students' main motivation for taking part in the study was personal curiosity. It is important to mention that none of them considered themselves to have extensive difficulties with their study work. In addition, most of the students were familiar with the concept of QS and with self-tracking practices. Specifically, 66% of them had, in the past, collected data about some aspect of their life, such as sleep, exercise, or nutrition habits.

We followed a qualitative approach for analyzing the audio recorded from the Feeler experiment. By listening to the recordings of the sessions ($N = 7.5$ hours), we identified a set of themes connected to our research questions and, from those, expanded our interpretation to wider contextual questions related to the use of biological data in human activities.

Results

From the recording of the think-aloud and semi-structured interviews, we recognized and marked interesting insights presented by the participants. The marked sections were then analyzed and contextualized to the wider research context presented earlier in this article.

Initially, we tried to extract from the participants' interviews how they reacted to the automatically collected brainwave activity data. Four out of five expressed strong trust in the data captured through the EEG device.

"It's interesting that I thought I was attentive, but I was actually not attentive" (participant 1).

It seemed that, somewhat surprisingly, participants assumed that the data collected by the EEG device and computer were more accurate than their own impressions. In one case, this belief reached the point of

changing the participants' perception of self.

"I'm actually surprised with the relaxation thing. I perceived myself as being too tense when I was researching but I realized that I was not that tense. I think it was actually positive to see it happening or see it being measured" (participant 3).

Second, we examined the participants' verbalized thoughts about mismatches between the results from the two different data sources. We discovered that the mismatch between the EEG data and the personal impressions from the first time participants used Feeler affected their assessments in the following sessions. Since participants were aware that their impressions would be juxtaposed with the data captured by the EEG device, they tried to match their impressions to the results they thought the Feeler system would return.

"I learned from previous data, from the EEG data. I kind of felt that (...) however much I think that I paid attention, I'm not actually paying that much attention" (participant 1).

Third, we analyzed whether people modified their thinking or their behavior based on the feedback provided by the QS device. According to the experimental design, Feeler was used three times during three consecutive weeks. This allowed us to observe whether participants modified their thinking or behavior after using Feeler.

Although behavior change is a long process that involves many factors, we can report that, to a certain extent, Feeler contributed to a change in participants' perceptions about their study habits. In a few cases, participants tried to develop new habits (it is impossible to assess via this study whether this experience led to lasting, long-term behavior change). Interestingly, what seemed to motivate students' changes (in their ways of thinking or their habits) was more connected to their personal experiences using Feeler than to the collected data. The observation and analysis of the EEG data played a role, but it only led to a change when participants connected this data to their experiences.

For instance, one participant was motivated to try meditation on her own in order to gain focus when studying. In this case, as well as in others in which participants mentioned their interest in meditation, the collection of data was considered less relevant than how they actually felt after meditating.

"I tested the meditation [aside from the experiment sessions] and I feel that it helps when writing my thesis or when I'm studying for an exam" (participant 5).

Another way students made sense of the data, was to use the collection and visualization of data to confirm their existing ideas. One of the participants explained that, before the experiment, he had been considering trying to focus on the same task over a continuous period of time. Because he was hesitant about the benefits of adopting this new habit, he never made the effort. However, once he realized the effects of task switching on attention, he became convinced about the need to modify his behavior.

“It’s [decrease of attention when switching tasks] raising interesting thoughts for me, about, for example, doing some continuous work for a long time (...). It’s strange because I felt I had felt this first, or like I was addressing this consciously sometime during the last year or two, that it is good for me, for example, to read a book in a continuous manner for a few hours but (...) I do something so rarely continuously for few hours that I think it’s crazy (...), being like this. So I think that brings that up more strongly. And now I feel like scientific data is backing it up” (user 4).

In other cases, rather than thinking about how to change their behavior, the participants were more interested in getting more automated data analyses that incorporate suggestions for behavior changes. Participants found it difficult to make sense of the EEG data and wanted some help from the system to develop new insights and modify their behaviors.

“If I get something like this [referring to Feeler], then okay, I have taken one step to do something about my lack of concentration (...). And then, this should help me through that process” (participant 2).

In the last session of the experiment, two participants reported having tried new practices when studying on their own as a result of the Feeler sessions. The fact that all participants recognized having learned something during the sessions using Feeler allows us to infer that, to a certain extent, the tool did modify their thinking.

Through this research—by developing a speculative design artifact and running an experiment with it—we also aimed to explore whether the method of recording life with lifelogging and QS-type devices can truly help us in our lives. The answer to this question depends on what we want to achieve through these technologies.

According to the participants, technologies based on automated data collection are connected to productivity and self-improvement. Participants took for granted that increasing productivity was the end-goal of using

Feeler. In consequence, they expected to see higher levels of attention and relaxation after using Feeler for a period of time.

“I would give it a couple of weeks to see if helps me improve at what I do, because I do all of these things, you know? I use these different techniques... there are productivity blogs and things like that, I do read them and I try to exercise what I read and things like that, so if it helps it’s great” (participant 2).

“If you use it on a daily basis, it will definitely make you more relaxed” (participant 1).

The emphasis on individual improvement brought us to conclude that at some level, lifelogging and QS, as cultural phenomena, are part of a competitive culture. Participants seem to have internalized a certain standard of what is considered “desirable,” even if the definition of what is desirable or not has not been discussed before. It is interesting to note that in certain cases, it is not clear who the participants are competing against.

“Yes, it was a surprise... I don’t know what I could do to have more attention, to be honest, because 40%, which it is what I had, I think it is low” (participant 3).

By design, Feeler does not include comparisons between users’ activity nor give indications about what would be the expected attention and relaxation levels. We interpret that this design decision disturbed participants since at some point all of them asked if it would be possible to see other people’s data or if it would be possible to know if their levels were similar to the average.

“I don’t know, does the attention usually go like this? Do some people have it really like this?” (participant 5).

Going back to the question of whether *lifelogging and QS provide us knowledge that will truly help us in our lives*, Feeler research has helped us identify some of the embedded values of lifelogging and QS technologies, such as productivity, self-improvement, and competition. With regard to whether these technologies are truly helpful for life, we can state that they are perceived as tools for achieving individual goals and higher levels of efficiency in a competitive environment.

In light of the results obtained during the analysis of the Feeler participant interviews, we might ask in what aspects of life can lifelogging and QS technologies be useful?

For some participants, avoiding procrastination and maintaining their focus was an important need. For instance, some participants felt that social media is causing a lot of distraction and that they would like to get rid of it.

“A lot, it [access to social media] really troubles me that I do! But that’s why I have that application that I’m showing you, right? So, normally, if this was part of my system I would sync these two in a way that when I connect this I would also press this. And what this does is that it locks it, so when I’m using *Clear Focus*, like today I will be doing that a lot, I keep my 4G off, so when I put the *Clear Focus* on, I’m not online, and then if I try to open Facebook it should not work” (participant 2).

Do we need to solve problems created by technology with more technology? Although there seems to be an app for any imaginable problem, sometimes the solutions provided by these tools tend to create more problems while encouraging technology dependency.

Even though the design of Feeler can be regarded as similar to other lifelogging and QS technologies, its main goal is to support reflection rather than behavior change. The three sessions scheduled as part of the experiment were not enough to detect or track any significant changes in the ability of participants to be attentive or relaxed. All participants expressed satisfaction with the work conducted during the sessions and most of them were willing to use Feeler in the future. Only one of them showed interest in having access to the data from the sessions. In the end, perhaps it was not that relevant to collect data.

Discussion

Lifelogging and QS technologies act as mirrors that people use for building the “self” and to guide future actions. The values embedded in these technologies connect to wider discourses or metaphors that people live by, as Lakoff and Johnson (2008) described. One of most powerful metaphors presented by the authors consists of considering “the mind as a resource.” A good example of this view can be found in the opening words of Gordon and Gemmell’s book *Total Recall: How the E-Memory Revolution Will Change Everything*. The book starts with the words “I’m losing my mind” followed by the authors claiming that forgetting means that we lose something (Gordon & Gemmell, 2009, p.3). *Total Recall* is the authors’ reflections of the MyLifeBits project, in which the aim was to have lifetime digital store of everything: video of every moment of life, emails, letters, memos, photos, pictures, phone calls, television, and radio programs watched and books read. In the book, Gordon and Gemmell highlight the potential benefits that such e-memory systems could

have in different areas, ranging from health to work, learning, and even afterlife.

Gordon and Gemmell adopt a technological utopian view in which increasing the productivity and efficiency of the mind through technology is a desirable future. The data captured by these technologies are trusted and regarded as a neutral and objective truth. However, no matter how much we trust the collected data, one important question to ask at this point is whether it is desirable that technology mediates such intimate experiences as our memories and mental states. Who are the real beneficiaries of such a level of technological dependency?

According to Nye, “The penetration of technology into all aspects of being means that “our new character is grounded in human technology symbiosis,” and that “prior to reflection, technology transforms character”(2007, p.199–200).

The analysis of the interviews conducted during Feeler research highlights the connections between lifelogging and QS technologies and well-accepted values in neoliberal economic systems such as productivity, self-improvement, and competition.

As Winne does in his article “Do artifacts have politics?” (1980), we must question the politics of lifelogging and QS technologies. Feeler speculative design is not able to answer this question, but the research has created the conditions for people to think and talk about the effects of self-monitoring and the value that the collected data might have in people’s lives. Over the course of these sessions, the initial excitement of some of the participants for life-logging and QS turned into a more critical and hesitant attitude towards the potential benefits of these technologies.

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Mechanisms of Listening and Spatial Mental Imagery

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Abstract

Listening requires attention, engagement toward an environment, and relies on subjectivity and (self) consciousness. The paper explores mechanisms of listening in the sonic arts through an ongoing research based on art process informed by cognitive science. The project focuses in particular on the American composer Pauline Oliveros' concept of *deep listening* (Oliveros 2005). She proposes an expansion to all what is humanly possible to listen to. It leads to the phenomenal world that lies inside the auditory cortex about one's personal space perception. To engage toward an environment as a sonic architecture and as a perceived atmosphere, necessarily involves the body. Sound and space are linked to vibration, and resonating energy within the body may result in mental imagery of space. The vibrational aspect of sound through experience provides new ways for spatial perception, as well as new paths in novel philosophy of sound and auditory perception. That is, the paper investigates fields of possibility of sonic meaning and experience in mind in relation to the world. Collaboration with cognitive science includes the investigation of body perception in relation to a spatial ecology.

Keywords

Listening, Perception, Space, Sound, Art, Science, Mental Imagery.

Introduction

Another dream: in the inside which is the outside, a window and myself. Through this window I want to pass to the outside which is the inside for me. When I wake up, the window of my room is the one from my dream; the inside I was looking for is the space outside. – Lygia Clark

The mechanisms & neurophysiology of *hearing* are well defined (Bregman 1990). However, the subjectivity of *listening* is less understood. Hearing is a physiological phenomenon, whereas listening is a psychological act according to Barthes (Barthes 1985: 245-260). The aim of the research presented in this paper is to better understand and possibly shade light on the subjectivity of listening.

First, space is defined in relation to (perceived) atmosphere and body. Then the paper moves toward *heightened* modes of listening. The following section proposes the idea of touch, as sonic vibration, as an important component for the perception of sound and space toward the body. The approaches are then introduced in the next section as a combination of practice-led and phenomenological investigation. The paper continues then with the results from a study conducted by the author and named Intention/ Perception (In/Pe): Five electroacoustic pieces were presented to an audience for a dedicated listening, and with the idea to stimulate the experience of a spatial representations in mental imagery. Then, as an outcome of the research, the piece *Bodyscape* is introduced. The last section resumes the process of development lying between artistic process, (cognitive) science research, and possible directions in art and science collaboration in electroacoustic contexts.

Space, (Perceived) Atmosphere and Body

The term *space* derives from the French *espace* and Latin *spatium*. The later, from the point of view of this project, refers to the Greek *chôra* as being the *distance* between objects, sites, places and, as proposed by Casey:

'*Chôra*' is 'room' that is filled, not vacant space (*kenon*)(Casey 1998: 353)

Moreover the idea of *chôra* as a receptacle, not a void, in mental imagery, is viewed by Rickert as 'a locatory matrix for things [...] Chôra includes emotions, sensations, and other marks and traces of psychical and material experience' (Rickert 2007: 259, 260, 261). *Chôra* in the current paper relates to the idea of space filled with sound and how it leads to a) a definition of space by (moving) sound and b) a merger defined by the relation of sound and space. Therefore, the space is not a vacant space, but it exists because sound defines the space and *vice versa*. Moreover, the project investigates

the space occupied by sound and the kind of imprint that is left in the mind of the listener, as the merger of the sound and space relationship.

Extensive philosophical questions defining the space and how it is perceived are proposed in *The Poetics Of Space* by Gaston Bachelard (Bachelard 1992). The development of Bachelard is based on the poetic representation of space as internally produced by the imagination. Bachelard interprets metaphorically intimate spaces by proposing the house as a symbolic view of the body. Therefore, the study of space within the humanistic perspective is the study of ideas and spatial feelings linked to sensation, perception and conception (Sanguin 1981: 568).

The sum of the relationships of sound and space is *felt* and *is* actually the atmosphere that consequently *affects* and leads to perception *within* the body of the auditor. Böhme proposes that ‘the primary “object” of perception is atmospheres’ (Böhme 1993: 125). Therefore, in the context of atmospheric architectures it is the *felt* architecture that *affect* the body of the viewer/auditor. As claimed by Massumi, it relies ‘on the irreducibly bodily and autonomic nature of affect’ (Massumi 2002: 28). In the current research, *affect* includes the body as mental image.

The relationships between sound, space, body, perception, and issues about interiority and exteriority are of particular interest and refer to the *Glass House* of the architect Mies van der Rohe, with the idea of interpenetration of external and internal space as the work implies a connection among sound, space and architecture as a metaphor of internal vs. outer spaces of the body. Mies van der Rohe’s *Glass House* includes Duchamp’s ideas found in *The Large Glass*, as proposed by Lebel:

The design of the *Glass* thus can never be seen *by itself*, apart from its surroundings, but it is inscribed, as it were, like the other image of a double exposure, ceaselessly transformed by a background of reflections in which that of the spectator himself is included. (Lebel 1959: 68)

The ideas of silence, and the interpenetration of the interior, exterior, and the reflections of the surroundings metaphorically refers to the spatial mental imagery perceived by the listener.

Deep and Heightened Listening

The sound object is linked to *reduced listening* as a sound removed from its original context through recording

practice. Pierre Schaeffer first coined the term with the information theorist Abraham Moles between 1948 and 1952 (Schaeffer 1952) while conducting research into *musique concrète*. It was further elaborated in his book *Traité des Objets Musicaux* (Schaeffer 1966). It implies an abstraction of the context of origin and a focus on the sound object, which becomes a self-referential entity. The opposite of *reduced listening* is *heightened listening*, and a major influence in the current study refers to larger sections of sound as soundscapes, which include the context. The composer Barry Truax mentions that ‘perhaps the biggest obstacle that environmental sound erects to its musical usage is the fact that its meaning is inescapably contextual’ (Truax 1996: 52). However, the focus here is on the late American composer Pauline Oliveros and her concept of *deep listening* (Oliveros 2005). Thus, *reduced listening* removes the context of the recording and focuses on the *sound object*, whereas *heightened listening* observes each detail of the sound, as proposed by Oliveros:

With heightened listening ability one can detect the slightest differences in sounds. This enables acute voice recognition, echo detection, spatial location, etc. Such heightened listening substitutes auralization for visualization (or seeing) by creating sonic pictures (Oliveros 2010: 79).

She developed ‘a practice that is intended to *heighten* and expand consciousness of sound in as many dimensions of awareness and attentional dynamics as humanly possible’ (Oliveros 2005: xxiii). Oliveros specifically proposed sound imagining in her sonic meditations (Oliveros 1974). Such ideas (sonic pictures and sound imagining) contribute towards the development of a new dimension in listening, composing, and perceiving sound. The heightened and deep listening modes are paramount in the exploration of the relation of sound and space, and for the study of the visual imagery induced by sound, it may relate to architectural and environmental space visualisation where the body of the observer/listener is certainly present. If the listener experiences the space and environment in his mental imagery while listening, then I expect that he shall perceive as well his body as part of the environment that can be acted upon (sense of agency). By claiming that the first person experience is an environment, it necessarily involves the observer/listener, and as such it might appear in the mental image.

Sonic Vibration and Proprioception

Sound is a vibration that may be touched, and the idea opens new opportunities for the perception of the dynamic relations of sound and space as multimodal perceptions. Primarily, the experience *is* the artwork. Movement generates proprioception for the measurement of the geometry of the external space. When sound is included in this equation, it triggers visual mental imagery within the listening experiences. Considering proprioception opens fields of possibilities for the composition of works in electroacoustic contexts. The audience is sensually involved by sound, as the vibrational wave of sound touches the whole body, and generates an internalised experience. The body thus becomes the theatre where the piece appears. The geometry of the external space is measured by a sonic proprioception, allowing new insights for psychoacoustic and (deeper) listening experiences. More fully explored in dance, proprioception is a sense that could enhance perception of sonic arts beyond spatialisation and may even have the potential to redefine spatialisation. The term proprioception suggests a perception of the world through our 'secret sixth sense' as proposed by Metacek and Mechsner, which define the term as follow:

In 1906 Charles Sherrington coined the term proprioception (perception of one owns) for the sensory modality based on these receptors and called it our 'secret sixth sense' [...] Proprioceptors precisely measure physical properties, such as muscle length, tendon tension, joint angle or deep pressure. Signals from this sensory orchestra are sent by afferent nerves through the spinal cord to the somatosensory, motor and parietal cortices of the brain, where they continuously feed and update dynamic sensory-motor maps of the body [...] So proprioception provides information on the physics of the body, the momentary distribution and dynamics of masses, forces acting on the limbs and their highly nonlinear interactions. The maps derived from these complex calculations not only guide body movement, they also (together with touch) sense the size and shape of objects and measure the geometry of external space. (Smetacek and Mechsner 2004: 21)

Proprioception provides information to the body on the geometry of the external space and invigorates the idea of a possible novel form of listening inducing spatial visual imagery. In particular, it highlights the idea of

experience of the work of art as a physical perception, which triggers the phenomenal world of sensation. The French philosopher Jean-Luc Nancy underlines about listening, touch and sensation that:

To listen, as well as to look or to contemplate, is to touch the work in each part—or else to be touched by it, which comes to the same thing [...] An intimate and delicate marriage between sensation (or feeling, it's all the same) and the composition of the sensory. (Nancy 2007: 80)

The secret sense revealed by proprioception in the mechanisms of perception and the similarities between sound and touch in perceiving sonic vibrations open the door to the idea of art and electroacoustic music being an experience for dynamic perceptive behaviours. It includes as well the opportunity to augment listening toward dynamic multimodal experiences. In electroacoustic contexts it leads to spatial representations in visual mental imagery.

Approaches

The initial ideas of the current study emerged in 2009 during a residency with the Swiss Artists in Lab project at the Brain Mind Institute in Switzerland (Forcucci in Scott 2010: 150) and were further developed until today (Forcucci 2015; Forcucci 2016). The project relies on a combination of practice-led research, which blend with ideas inspired from cognitive science, physiological data acquisition and first person experience as an open process of investigation. The visual mental imagery is observed within the audiences' experience of sonic works, by linking the artist's intention and audiences' perceptions (Blanke, Forcucci and Dieguez 2009). That is, the analysis of the perception of an artwork should include in addition to the viewer and/or listener, the author perspective. For this reason, the combination of (cognitive) science and (sonic) art may bring new questions on both side, not by vulgarising one by the other, but by ways of unifying the development process and inspiring each other.

The creation of sonic environments as practice-led research, heightened and deep listening, structured interviews of audience to explore subjective issues through comparison of patterns, and physiological data acquisition (EEG, EMG, ECG) for artistic developments set the base for the research presented in this paper. Two ways collaboration with cognitive scientists is sought to validate precisely the embodiment of space through

the vestibular system and proprioception. Accordingly, Benson proposes that:

The non-visual systems that contribute to the perception of orientation and movement of the body embrace the vestibular, somatosensory, proprioceptive and auditory systems. (Benson in Warren and Vertheim 2014: 145)

Varela claims that one of the objectives of experimental neurophenomenology is to bridge first-person experience and neurophysiological data (Varela in Bockelman et al. 2013aa) and thus extending Edmund Husserl's idea of 'naturalizing phenomenology'. The project proposed here aims at naturalizing phenomenology by focusing on 'an *explanatory gap* between the objectivity of cognitive sciences and the subjectivity of experience' (De Preester 2002: 641). Subjectivity *per se* is directly linked to listening and vice versa.

In/Pe Project

The Intention/Perception (In/Pe) project is the name of the research developed by the author, *via* an empirical survey informed by phenomenology. The result of a practice-led methodology leads to a portfolio and the audience perception of it. The analysis, through a questionnaire, informs the Intention/Perception link emerging from the *audience's empathy with space perception*. The idea is to explore whether and how the audience develops empathy toward the experience of the space explored by the composer. The qualitative phenomenological methodology relies on a questionnaire investigating the respective spatial visual mental imagery of the participants exposed to the portfolio. The link with the portfolio is paramount, since the inquiry relies on the process of the development of the artworks (however not presented here): the practice-led methodology is approached not as a sole project, but in relation to the audience perception – by including perception of oneself within the visual mental imagery. In other words, the intention is not to develop the artworks according to the answers given, but to observe whether common spatial patterns emerges from the perceptions of the audience.

A majority of the participants in the survey were chosen mainly among students in music, sound studies, media art, and art, as well as established artists, musicians, composers, and curators; only a small fraction were not professionally involved in the arts. The reason for choosing them lay in their inclination and their specific

training in spatial representation. These categories have better mental representation of space, because their practice requires constant and intense visualisation into mental imagery (e.g. imagining playing a particular section of a piece or imagining a person or an object to draw or sculpt). Thus, the choice relies primarily on their potential respective abilities 'as artists to represent objects in space, and for musicians, because they perform well in visuo-spatial tasks' (Brochard *et al.* 2004: 103, 104, 106, 107, 108). Moreover, as proposed by MacIntyre, Moran, Collet and Guillot 'a strength-based approach may be valuable in illuminating both fundamental and applied questions' (MacIntyre, Moran, Collet and Guillot 2013:1). However, the relation between their professional backgrounds as regards their perception is not analysed, yet it provides information about their familiarity with experimental forms of art, music and spatial perception.

The investigation was conducted without a control group, because it was analysed through individual experiences with structured interviews. In addition, most of the interviews were made during fieldwork, where organising any contributory features of control groups is problematic. This is a pilot study, and control groups will be included in future research.

The above-mentioned proposals relate to the observation of the experience of the participants as the main scope, and as explored in the twentieth century by philosophers such as Husserl and Merleau-Ponty (Husserl 1931; Merleau-Ponty 1963). Hence, in Husserlian phenomenology it is claimed that:

Our experience is directed toward — represents or 'intends' — things only through particular concepts, thoughts, ideas, images, etc. These make up the meaning or content of a given experience, and are distinct from the things they present or mean. (Phenomenology 2013: 2)

In relation to the In/Pe project, the investigated experience of the audience relies on the 'ideas, images' (as perceptions) of architectural and environmental spaces, which make up the meaning, and it is thus distinct from the composition *per se* (things they present or mean). As proposed by Merleau-Ponty, who:

focused on the 'body image', our experience of our own body and its significance in our activities [...] In short, consciousness is embodied (in the world), and equally body is infused with consciousness (with cognition of the world). (*Ibid*: 11)

The current project aims to observe how the audience perceives their body in the architectural and environmental space through the listening experience. Husserl and Merleau-Ponty 'spoke of pure description of lived experience' (*Ibid*: 4), which relates here to the lived experience, through listening, of the spaces investigated by the research. Heidegger in Ratcliffe also 'stresses that the body, although neglected by his previous works, is important and needs to be discussed by the phenomenologist' (Ratcliffe in Gallagher and Schmicking 2010: 133). The body, in the present research, is included in the exploration and creation of space, by a) the movement of the composer while field recording and b) by the audience when listening and perceiving the architectural and environmental space within the visual mental imagery. Thus, the body is present in the mind of the audience by exploring what the composer has recorded and composed.

Thirty candidates were invited to listen in darkened spaces to each of the five pieces of the portfolio. They were recruited while in art residency in China and at universities in the UK, Germany, and Brazil. The participants were introduced to the aims of the research before the listening sessions. No information about the pieces was provided; this was omitted deliberately in order to avoid influencing their answers. All participants gave written consent for the study according to the protocols of the human research ethics policy of De Montfort University, Leicester, UK. These were approved by DMU's relevant committee. None of the participants was remunerated.

Data Synthesis

The synthesis of the data collected from the In/Pe project relies on a questionnaire, which focuses on the observation of common spatial patterns emerging from the listening process of the portfolio. The portfolio includes three fixed-medium pieces (*The Fall*, *De Rerum Natura*, *My Extra Personal Space*), one sound installation (*Kinetism*), and one performance (*Music for Brainwaves*). The questionnaire investigates visualisation of architectural spaces as well as natural environments in mental imagery by asking the following questions:

- a) Which architectural spaces or urban environments, moving vehicle or moving persons and natural elements were perceived through visualised mental images?
- b) In which locations, architectural spaces or natural

environments the participants envisioned themselves while listening?

c) Which types of sound made the participants think of a particular location, space or environment?

And if yes, which one?

Then the answers for each question are grouped inside clusters:

Question a)

-Architectural / Urban Environments;

-Moving Vehicles / Moving Persons;

-Natural Elements;

Answers not retained.

Question b)

-Locations / Architectural Spaces;

-Natural Environments;

-Answers not retained.

Question c)

-Sounds;

-Related Locations / Spaces to the sounds;

-Answers not retained.

The questions are linked, meaning that patterns of perception of architectural spaces, locations, and environments may be observed through the three questions and thus verified through repetitions of patterns inside the clusters. The participants were requested to explore the spaces they perceived during the listening experience. The participants' answers are analysed in order to find common patterns of space. The answers are then grouped by patterns of analogue answers. *Table 1* provides a synthesis of the answers. The same participant may answer with more than one pattern to the same question. Poor data / Answers not retained are considered as those not answering the question or being incoherent (e.g. 'There was no reference for me to begin', 'lots', 'many', 'random thoughts', 'Not too far, but far away enough to not be touched by the noise'); for Question c), giving information about the sound although not the related locations/spaces or *vice versa*, such data are not retained. The analysis of the data provided a positive answer to the question of the research, which asked whether participants have a common perception of architectural spaces as visual mental imagery while listening to the portfolio of electroacoustic works. The spaces appeared as follows:

Name of the piece	Visualised Architectural Spaces
<i>The Fall</i>	Large spaces: Hall, warehouse, industrial building; Small spaces: Cave, tunnel, pipe.
<i>De Rerum Natura</i>	A black, confined space (such as a cave, and underground).
<i>My Extra Personal Space</i>	An internal space (building, atelier, beach house or shelter); An industrial space (a factory, harbour, industrial plant or port city); A church or cathedral.
<i>Kinetism</i>	An enclosed space (inside human body, box or room).
<i>Music for brain waves</i>	A room (apartment, closed room).

TABLE 1

The questionnaire submitted to the participants initially included questions on the quality of the pieces (relaxing /stressful, pleasant/unpleasant, happy/sad, musical/not musical). The participants were asked to answer by value on a *Visual Analogue Scale* (VAS) going from -3 to +3, and then to describe the reason. However, the results were not convincing in terms of homogeneity. That is, they were spread along the visual scale from one extreme to the other with no significant patterns. The questionnaire also included questions which asked a) if the participants had the impression of being in contact with their bodies; b) if they saw any part of their bodies moving; c) if they were in a static or moving position in their mental imageries; d) from where they did imagine themselves looking towards the perceived images; e) if they saw many locations, spaces or environments, and if so, whether they perceived them simultaneously or sequentially. Instead I decided to concentrate the analysis on the research question of the current study, concerning the quality and typology of the perceived architectural and environmental space.

Discussion

When cross-analysing the answers of the participants among the different pieces, the common pattern of architectural space appears as a small confined dark space such as a cave or an underground space. The interpretation of such a pattern is the possibility that visualising any space compares it to the internal space of the body. Such affirmation is for now, only a hypothesis and shall be further investigated. The questionnaire and the In/Pe project in general were effective because they

observed architectural mental imagery as spatial visual mental imagery. Firstly, because studies into mental imagery triggered by sound tend to relate to auditory mental imagery – even in the absence of sound, as claimed by Zatorre and Halpem:

[...] neural activity in auditory cortex can occur in the absence of sound and that this activity likely mediates the phenomenological experience of imagining music (Zatorre and Halpem 2005: 9).

In contrast, in the present study, the focus lay on the spatial mental imagery triggered by sound works. Sound and space are in this circumstance therefore closely related, since such spatial mental imagery might not occur without the sound.

The originality of the In/Pe project focuses on mental imagery induced by sound, combined with a methodology that is based on qualitative and phenomenological concerns in the representation of architectural and spatial visual perceptions. In other words, the approach of cognitive aspects and neural mechanisms of visual mental imagery must be approached by the experts and tools of neuroscience. However, the quality of the phenomena and possibly their interpretation could be emphasised by the current methodology, which investigates the typology of the perceived spaces.

The In/Pe project shed light on such issues according to the discoveries provided by the results as a map of space perception (*Table 1*). Similarly, Damasio proposes the idea of mapping as the main methodology of our minds to inform the brain, in order to develop and manipulate mental imagery:

The distinctive feature of brains such as the one we own is their uncanny ability to create maps [...] When the brain makes a map, it *informs* itself [...] When brains make maps, they are also creating images, the main currency of our minds. Ultimately, consciousness allows us to experience maps as images, to manipulate those images, and to apply reasoning to them. (Damasio 2010: 63)

Secondly, the findings proposed by the In/Pe project include the perception of the body of the auditor in the spaces and inside the mental imagery, especially in Question b) of the questionnaire (e.g. *In which locations, spaces or environments did you see yourself while listening?*) or through the sound of the body (breathing and heartbeat) in *Kinetism*, according to the patterns of the answers. The portfolio provides contexts where the bodily sounds includes motions (e.g. sounds of

footsteps in *My Extra Personal Space*, or a stroll in the sound installation in *Kinetism*), and thus it may provide room for self identification within mental imagery. Again, cognitive science has important tools in this area towards understanding motor imagery, according to Zatorre and Helpem:

Motor imagery is the imagination of the kinesthetics involved in actual movement and has been examined for both simple tapping and complex musical routines [...] In many musical situations, sound is associated with movement [...] Given the behavioural and neural evidence for people being able to imagine musical movements, is there evidence that auditory and motor imagery may be integrated in the brain? (Zatorre and Halpem 2005: 10)

However, the In/Pe project investigates spatial perception and the movement of the body into architectural spaces within mental imagery. This happens in electroacoustic contexts with loudspeakers, not as movement related to a musical instrument. Thirdly, in asking the participants to listen to the pieces and to visualise architectural mental imagery, it promoted a deeper listening, a way to focus on the composition, to analyse it, and to concentrate on their own (live) *experiences* during the listening process. Thus, it possibly creates a link between the composer (intention) and audience (perception), not only through a matter of sound, but by pushing it further as an experience, as proposed by Prinz:

Conscious experience is not restricted to what is in my head but includes the environment around me, then the richness of experience is not an illusion [...] The idea that the world is literally a component of conscious experience may sound bizarre, but it has been proposed as a serious possibility. (Prinz in Robbins and Aydede 2009: 423)

The environments in which the sounds were collected were explored while deep listening, allowing a deeper *experience* of the locations through sound. Later, the audience was invited to deep listen to the works, and to visualise in their own mental imagery the architectural spaces, allowing an even deeper experience of the works. The intention of the composer and the perception of the audience are thus linked through deep listening.

Bodyscape

The transdisciplinary collaboration presented in the previous sections has been developed through long term

exchange with cognitive science. Moreover, the piece *Bodyscape* (Figures 1, 2, 3, 4) integrates conceptually political and social situations.

As a performance, the project is a site-specific electroacoustic composition with live electronics and sensors. The performance space and its architectural resonating and spatial characteristics are included. The main idea focuses on the body of a dancer as the main sonic source. Two performances were presented a) at the Lab in San Francisco, USA in August 2015 and b) at Centre Friedrich Dürrenmatt in Neuchâtel, Switzerland in January 2016. *Bodyscape* includes as well fifteen days field recordings at the border of Botswana, Limpopo Region, South Africa with the biologist and composer Francisco Lopez in November 2015. Then, the research was conducted further in other regions of South Africa and on the base of a text from the Swiss writer Friedrich Dürrenmatt (*L'épidémie virale en Afrique du sud*) from December 2015 to January 2016. The novel was published originally in the column of a Swiss newspaper and describes a virus transforming the body of white persons into black ones. A text about privileges and how those are kept in a specific context. I explored the country with the text in mind and observed the social division within the population a decade after the end of the Apartheid.

The live performance in Switzerland includes layers of cut-up text, pictures, video and sound composed into an electroacoustic piece, like a road movie. The fixed media composition includes the live recordings of San Francisco (involving the instruments built by Cheryl Leonard, which are made of sand, wood, bones, stones, and the sound of the dancing body of Crystal Sepúlveda) and Neuchâtel (with the sound of the dancing body of Crystal Sepúlveda and the cellist Ulrike Brand). The recordings were then *composed* at NOTAM in Oslo Norway in April 2016, by layering and reworking them. These manipulations lead to a piece intended to be played in the dark and thus by possibly generating visual mental imagery to the audience, and in relation to the intention of the composer as proposed by the study contextualised in the In/Pe project. The composition invokes embodiment of another person. First, by recording the movements and sound of the body of a dancer in two different architectural spaces (The Lab Gallery San Francisco, and the Friedrich Dürrenmatt museum in Neuchâtel). Second, my exploration of the South African territory with Friedrich Dürrenmatt's novel,

which is an embodiment and appropriation of his text.

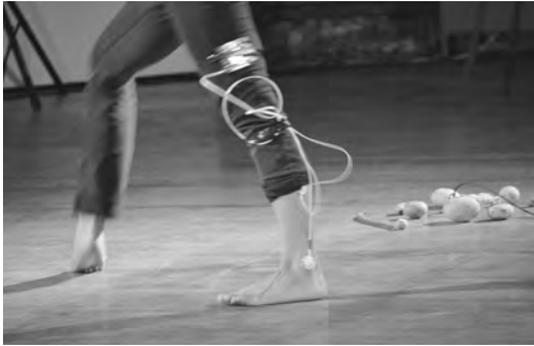


Figure 1. Luca Forcucci, Bodyscape at The Lab, San Francisco (with Crystal Sepúlveda and Cheryl Leonard 2015) ©Luca Forcucci. Photo: Swissnex SF



Figure 2. Luca Forcucci, Bodyscape at The Lab, San Francisco (with Crystal Sepúlveda and Cheryl Leonard 2015) ©Luca Forcucci. Photo: Mystic Media



Figure 3. Luca Forcucci, Bodyscape at Centre Dürrenmatt Neuchâtel, Switzerland (with Crystal Sepúlveda and Ulrike Brand 2016) ©Luca Forcucci, photo: Olivier Chételat



Figure 4. Luca Forcucci, Bodyscape at Centre Dürrenmatt Neuchâtel, Switzerland (with Crystal Sepúlveda and Ulrike Brand 2016) © Luca Forcucci, photo: Olivier Chételat.

Third, within a multitrack DAW, I layered the recordings of the spaces and environments during the compositional process at NOTAM studio Oslo in Norway. The fixed media piece relates to the *intention* of the composer encapsulating a spatial sonic identity, and a resonance of the spaces. This hopefully lead to visual mental imagery perceived by the audience of the movements of the bodies insides those spaces. This may be the *experience* during the diffusion of the piece in the dark, when the instrument builder, the dancer and the cellist are not anymore present physically.

Summary and Future Research

The current questionnaire from the In/Pe project offers a solid base for the inquiry since the results provide

positive answers not only to the research question about architectural space perception in mental imagery, but also about body perception in relation to motions provided by the sounds. Bodily feelings have been explored through bodily sounds, and how they relate to the perception of the self in mental imagery. On that basis, future research will observe how a multimodal environment may trigger emotions and emotional feelings, and how those can be investigated.

In the future, the research will consider collaboration with cognitive neuroscience in order to investigate issues of body perception, how the body is perceived in mental imagery and if it includes a sense of agency as ‘the experience that I am the one who is causing or generating the action’ (Gallagher 2012:18). It might be useful to merge both disciplines because the breadth of area of the undertaking requires additional knowledge from specialists; it may shed light on listening mechanisms in relation to mental imagery of perceptions of body, out-of-body experience, and space in electroacoustic contexts.

Art and science collaboration will be pushed further for the development of the research, since the actual main limitation of the study has been further investigation of the perception of the auditors’ respective bodies in the perceived spaces and environments in order to validate more precisely the embodiment of space through the vestibular system and proprioception; this will in turn lead to opportunities for the development of perceptions of space through sound and multimodal environments, including dynamic movements and dynamic situations.

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Author Biography

Luca Forcucci's research observes the perceptive properties of sound, space and memory. The field of possibilities of the experience is explored as the artwork. In this context, he is interested in perception, subjectivity and consciousness. A great influence is the late

American avant-garde composer and musician Pauline Oliveros and her concept of deep listening expanded to all what is humanly possible to listen to. Luca achieved a PhD in Sonic Arts from De Montfort University and a MA in Sonic Arts from Queens University of Belfast. The research was further conducted at University of the Arts of Berlin, INA/GRM Paris (Institut National d'Audiovisuel/Groupe de Recherches Musicales) while investigating at Bibliothèque Nationale de France François Mitterrand, and at the Brain Mind Institute in Switzerland to explore cognitive neuroscience of out-of-body experiences. www.lucalyptus.com

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Prolegomena for a Transdisciplinary Investigation into the Materialities of Soft Systems

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Abstract

This paper presents exploratory research on the materiality, aesthetics and ecological potential of soft robots. Within the still emergent paradigm of soft robotics research, bio-inspiration is often hailed as being of central importance. The paper argues that soft robotics should equally be seen as giving prominence to materiality and the enactive and processual potential of soft matter. The paper excavates different notions of materiality within media art that uses soft robots and in technical soft robotics research practices and discourses. Against this background, the author's own practice-based experiments with soft robots are presented.

Keywords

Soft Robotics, Soft Robots, Robotic Art, Bio-Inspiration, Materiality, Ecology.

Introduction

The field of soft robotics has in the past ten years become established as an emerging subfield of technical robotics research. A number of different definitions of soft robots exist but in general “soft” is taken to refer to the body of the robot as being constructed of a soft material. “Softness” is most often correlated with a mechanical property known as Young's modulus, defined as the relation between stress and strain for a linear elastic material. Soft roboticists Daniela Rus and Michael Tolley thus define soft robots as “systems that are capable of autonomous behaviour, and that are primarily composed of materials with [Young] moduli in the range of that of soft biological materials” (Rus & Tolley, 2015: 467).

In relation to robotics research in general, the field of soft robotics distinguishes itself by utilizing bio-inspired design strategies (often coupled within an interest in *morphological computation*) as well as an interdisciplinary outlook that seeks to combine research from engineering, computer science, biology and material science (Trimmer et al, 2015). Within

soft robotics bio-inspiration has mainly come from soft bodied animals or parts of animals that are soft, e.g. larvae, cephalopods and the elephant's trunk.



Figure 1. Caterpillar-inspired soft robot by Huai-Ti Lin, Gary G. Leisk and Barry Trimmer. ©Huai-Ti Lin, Gary G. Leisk and Barry Trimmer

Soft robots offer different conditions of possibility for interactions with humans than their more common rigid counterparts. From a naïve realist point of view it seems intuitively clear that this fact hinges upon inherent qualities of the materials from which they are constructed. Within technical and natural sciences research, these can easily be described with reference to the physical properties of e.g. silicone rubbers, which can be reproducibly measured and calculated. Physical descriptions, however, obviously miss the potential of soft robotics as an aesthetic, cultural and ecological phenomenon and elides the sensuous knowledge, cultural imaginaries and fascination the technology is able to conjure up. Approaching soft robots from the point of view of materiality, a first question thus becomes how to think in a way that allows one to escape the trap of a purely physicalist conception of matter (see Stoljar, 2016). And how one avoids its reductionism and violence towards knowledge, percepts and affects hailing from sensory perception or thinking constituted in practices and relations that lie beyond the grasp of positivist science.

Materiality

Within the social sciences and humanities a shift of interest towards materiality and matter has been evident for some time now. It is often described as a

swing back from or reaction against the linguistic turn and its emphasis on semiotics and signification. Some of its most obvious manifestations are taken to be the emergence of *object-oriented ontology*, *speculative realism* and a number of so-called new materialisms (Atkins, 2016). The term “materiality” is, however, used in very divergent ways in the various contexts, fields and sub disciplines where it has made its presence felt. The theoretical movements just mentioned, for instance, are mainly interested in materiality from ontological and metaphysical perspectives. N. Katherine Hayles has written extensively about matter and materiality and distinguishes between physicality and materiality. Physicality, according to Hayles, is “similar to an object’s essence; potentially infinite” and “unknowable in its totality” (Hayles, 2014: 172). Materiality on the other hand, is what we can know – “the physical qualities that present themselves to us” (ibid.). As Hayles notes, what qualities that “present themselves” obviously depends on how we attend to the object or material in question (ibid.) i.e. our choice of epistemology.

Drawing on this minimal definition of materiality, I will in the following two sections explore how the materiality of soft robots is constituted within two different contexts: the reception situation of contemporary media art and the fabrication and design processes within technical research practices. I review *how conditions are set up that enables the physical qualities of soft robots to be actualized (i.e. to manifest themselves and be recognized)*. I also consider *the processes through which this occurs and what material characteristics that emerge from them*.

Soft Robots in Contemporary Media Art

A small number of artworks currently exist that make use of technological means that can be considered variations of soft robotic technology. Jonathan Pêpe’s

¹ I only review projects here that were produced explicitly in an art or artistic research context. Moreover, I only include work that makes use of microcontrollers or other means of computational technology in combination with a pliable or deformable soft morphology. There is currently also a burgeoning interest within architecture in utilizing soft robotic technologies. Michael Wihart’s *Pneumorphs*, Bijing Zhang and Francois Mangion’s *Furl* (2014), the *Sarotis Project* (2016) and Dino Rossi’s work are examples of this. Many artworks of course also exist with more traditional uses of pneumatics – spanning the period from ancient China and Greek antiquity until today. Within contemporary art and media art pressurized air has also frequently been used to

installation *Exo-biote* (2015) is a notable example. It was produced in collaboration with soft robotics researchers at Université de Lille. The work consists of a transparent display case that contains several small white rubber parts in geometric and organic shapes, all kept in a very clean and designed commodity aesthetic.

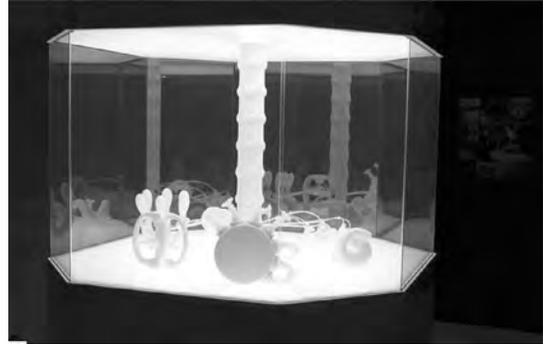


Figure 2. Jonathan Pêpe, *Exo-biote* (2015), Le Fresnoy, National Studio of Contemporary Arts; Neuflyze OBC; INRIA, the DEFROST team. ©Jonathan Pêpe

Some of the parts are able to pop up and whirl around or expand to provide movement. The piece has been described by the artist as a scenario that presents the viewer with a kind of artificial externalized prosthetic organs that come together as a pneumatic organism. In his view, it suggests a possibility for transhuman enhancement as a new mode of capitalist consumption (Pêpe, 2015).

Another example that is also the result of interdisciplinary collaboration between soft roboticists and an artist is *THE BREATHING WALL (BRALL)* (2015).

power piston actuators or McKibben artificial muscles or together with inflatables made of thin plastic. Soft robotic artworks also bear formal similarities to the tradition of *soft sculpture*, from the 1960s where a number of artists started using materials such as synthetic foams, rubber, soft plastic, paper, fabric and different kinds of fibres in their work.



Figure 3. Ece Polen Budak and Ozge Akbulut, *BRALL* (2015) (detail), silicone on polycarbonate panel, 145 × 145cm. ©Ece Polen Budak and Ozge Akbulut

This installation by Ece Polen Budak and Ozge Akbulut, was constructed in collaboration with Onur Zirhli and soft roboticist Adam A. Stokes from the University of Edinburgh. In the work panels of a silicone foam wall structure perform a kind of breathing swelling motion. This movement is further augmented with audio recordings of human breathing sounds played through a set of loudspeakers. The audience can physically touch the structure and interact with the system as the large air pockets are inflated in accordance with input from capacitive sensing conductive plates installed behind the panels (Budak et al, 2016).

Paula Gaetano Adi's biomorphic half-spherical autonomous robotic agent *Alexitima* (2006-2007) is another early example of a soft robotic artwork. Interestingly it was produced before soft robotics had become a prolific research field and it was designed and constructed by the artist herself. Like *BRALL* it interacts with audience members through touch. Here, however, yet another sensorial register is added: The tactile experience of soft latex rubber bending upon impact is accompanied by sensations of wetness as the sculpture responds to haptic stimulation with the secretion of a sweat-like fluid. Gaetano Adi posits the work as an exploration of "artificial corporeality" (as a supplement or alternative to artificial intelligence) and robotic body language (Gaetano Adi, 2007)



Figure 4. Paula Gaetano Adi, *Alexitima* (2006/2007), Autonomous Robotic Agent. ©Paula Gaetano Adi

Looking at the artworks I have cursorily presented in this section, it is possible to discern some central aesthetic interests and tropes that seem to cling to soft robotics when constituted as an artistic medium. For one, in the reception situation of soft robotic art we are primarily dealing with a materiality that is accessible through bodily and corporeal engagement. In Budak and Akbulut's work as well as in Gaetano Adi's the viewer is physically implicated with the robotic system via a haptic aesthetics – in order to experience the work we must touch it. *Pêpe's* installation similarly alludes to touching but via *negativa* – the pristine white soft rubber parts are warded off from the viewer by transparent glass plates and thus a gratification of the desire to touch it is withheld. The act of touching a soft robot is, arguably, an experience that carries with it, if not uncanniness, then at least an amount of cognitive dissonance: We are all familiar with pliable soft surfaces that respond to our touch, but from living bodies not artificial entities. In this sense, there exists a cognitive contiguity between soft materiality and animatedness. This contiguity is also evoked in the breathing expansion motion that is used in *BRALL* but also in a number of other soft robotic artworks including Paula Gaetano Adi's *Anima* (2009) and Ingrid Bachmann's series *Pelt (Bestiary)* (2012). The swelling motion of a soft structure here serves as not just a signifier of liveness, but a simulation of its basic unit – the breath, in what amounts to a kind of primordial production of presence.

Through their use of touch and/or rhythmic expansive movement the reviewed works manage to stage and present select physical qualities of soft matter in expressive ways that conjure up their centrality in organic life processes in general. This is done through

modes of presentation that rely on a direct interlinking with the human sensorium. Being that this occurs in the institutionalized art space the soft materiality of the works also inevitably expands to encompass cultural connotations of softness: Vulnerability (a quality also explicitly mentioned by Gaetano Adi when speaking of her work), weakness, the feminine (cf. the likeness between Gaetano Adi's robotic agent and a pregnant belly).

In the following section I will look at how the materiality of soft robots is constituted within technical research practices and discourses. As will become clear, technical soft robotics research brings questions of material transformation to the fore as both a resource and a matter of concern for robotics research.

Technical Soft Robotics Research

In technical research on soft robots the issue of materiality figures prominently as a key question has been which materials to use and how to most efficiently design and construct soft morphologies (Marchese et al, 2015; Rus & Tolley, 2015). The aim of developing new materials and reliable fabrication procedures has in fact served as a crux for an import of knowledge to the field from material science and also for its further development of existing rapid prototyping technologies.

Unlike traditional robots, soft robots are generally fabricated as continuous morphologies, rather than as assemblages of discrete components. This opens up the possibility for a different design and fabrication approach than when confined to assembling rigid mechanical parts as is usually the case for roboticists. A soft morphology is most often cast in a mold from a soft material such as silicone rubber. It might be tempting to see this procedure as being a version of the *hylomorphic scheme* as described by Gilbert Simondon. That is: As a fabrication procedure that is conceived as mind actively imposing a form on a "raw" matter that is inert and passive (Simondon, 2005). This is, however, misleading, I posit, as the two central points of Simondon's critique of hylomorphism are actually inherent to current soft robotic design and fabrication practices, namely that: 1. matter is not passive (but rather capable of contributing to the generation of its own form), 2. matter (in fabrication) is not raw but always prepared and produced.

Process and Material Transformation as a Part of the Fabrication and Functionality of Soft Robots

Some of the early pioneering soft robotics research came out of chemistry research in microfluidics, most prominently from the Whitesides Research Group at Harvard. In a number of soft robotics projects the capacity of matter to react with other kinds of matter and to transform given the right conditions is therefore an essential aspect. This is the case for what was promoted as the first fully autonomous soft robot and published in the prestigious *Nature* journal in 2016. It was fabricated by depositing various materials using a modified 3D printing platform equipped with syringes. Some of these materials would gradually evaporate to yield microfluidic air channels used for pneumatic actuation of the finalized morphology (Wehner et al, 2016). The design and fabrication scheme thus relied on transformational properties of matter, e.g. the capacity of fugitive inks to auto-evacuate. But what is more, the cyclical movement pattern enacted in the finalized robot was also accomplished by a pneumatic logic circuit driven solely by chemical reactions and no electronics. The robot's operation was rooted in making two fluids react to create a gas and a resulting pressure differential between the inside and the outside of the morphology's surface.

The research that is being done by the Soft Robotics Group at the Bristol Robotics Laboratory is another example of how the transformational properties of matter are being leveraged as not just a part of the fabrication process but for the actual functioning of soft robots. Here experiments are being conducted with biological means of generating electricity to drive soft robots by relying on microbial fuel cells and organic matter that is abundant in local ecologies. Moreover, rather than using silicone, which is manufactured through an energy demanding and elaborate process from sand and hydrocarbons and is very durable, the researchers are experimenting with using biodegradable materials such as latex rubber and gelatine. This is done to yield autonomous soft robots that may assimilate to and eventually perish in natural environments without causing damage to them. This visionary approach to soft robots highlights the fact that actual robots do not exist in an ahistorical vacuum of time, but have a life span and an entwinement with larger flows of matter that needs considering.

The Mangle of Practice

From the examples of technical soft robotics research I have surveyed in the previous paragraph it becomes clear that the enactment of a processual and dynamic chemico-biological materiality is central to the fabrication and functioning of certain state-of-the-art soft robots. If we look at descriptions of the creative process of designing soft robots, materiality also plays a vital and dynamic role here.

In a seminal article on soft robots from 2011 that introduced the *PneuNets* (*Pneumatic Networks*) actuation technology, which has since been widely used in soft robotics (and patented by the authors to be commercially exploited by their company), for instance, the authors write:

“We used a series of parallel [air] chambers embedded in elastomers as repeating components. Using intuition and empirical experimentation, we stacked^[31] or connected these repetitive components to design and test prototypical structures that provide complex motion.” (Ilievski, 2011: 1891)

For the authors, who were all working in the Whitesides chemistry research lab, an embodied and situated knowledge combined with active material experimentation formed the substrate from which their invention sprung. The final design of the robot, it seems, was negotiated between human and non-human material agencies – both natural and historically contingent ones.

In a similar manner, a lot of soft roboticists look to nature as a source of inspiration. But soft robots are more often bio-inspired than biomimetic. That is, rather than being copies or technical remediations of biological mechanisms aimed at exact replication they extrapolate these, following their virtual lines of flight. The bio-inspired mechanics are then iteratively prototyped, using rapid prototyping tools, to arrive at a desired level of functionality in the final design (see e.g. Kovač, 2013). The translation of a mechanical principle observed in nature into technology is thus evidently negotiated through a series of entwinements between contemporary social needs and desires, technology and matter. This dialectic between *resistance* (obstacles on the path to a goal) and *accommodation* (the revision of conceptual models) is what Andrew Pickering has described as *the mangle of practice*. According to Pickering, it is the emergent process that gives structure to scientific research through an interplay of material, conceptual and social practices (Pickering, 1994: 262-3.

Experiments Toward Soft Robotic Ecologies

My own approach to soft robotics is characterized by an interest in the aesthetics of interaction between soft robots and humans also characteristic of the soft robotic artworks I have reviewed in this paper. This includes how softness affords a specific expressivity, how soft robots are perceived differently than rigid ones and how the cultural, symbolic and meaning making potentials of soft materials play into this. My focus is, however, not solely on human-robot interaction or the structure of the experiences it may give rise to. Soft robots are part of and shaped by a multi-scalar material ecology that is physical as well as social and cultural. I aim to explore how acknowledging this fact may contribute to envisioning robots anew. Adopting an ecological framework, the task becomes to determine what the wider assemblages are that soft robotics couple with or make possible and how their materiality conditions or gains traction on experience, social forms, knowledge and politics and rearticulates them at different scales. I have been exploring this in a number of prototypes, some of which I will briefly present.

Entropy

Entropy is an early prototype constructed from silicone, silicone glue, wax and various found waste materials. It was constructed in a mold made of soil as a counteroffer to the sleek mass-produced commodity aesthetics characteristic of technical soft robots and as an insistence on a grounded non-idealizing aesthetic. The morphology performs a breathing motion at irregular intervals.



Figure 5. *Entropy* (2016). Video: <https://www.youtube.com/watch?v=y3MTcC0x5-g>. ©Jonas Jørgensen

The prototype was one in a series of material experiments in combining highly elastic silicone with other materials.

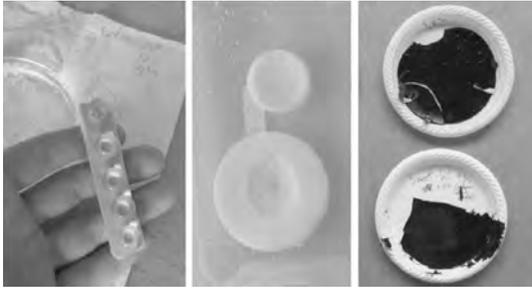


Figure 6. Examples of material experiments. Left: Coloured EcoFlex silicone and beads of hydrogel were submerged in water. The beads become transparent, swell and expand the silicone. Middle: Silicone embedded with kitchen salt then cured in an oven and placed in water overnight to dissolve the salt. The resulting structures were easily compressible and sponge-like with perforated holes all the way through which allows air to pass from one side to the other. Right: Cured sheets of silicone doped with carbon black to yield electrical conductivity (the attempt was unsuccessful). ©Jonas Jørgensen

The Fluid Medium

A number of more recent prototypes have been relocated from atmospheric air to an aquatic milieu – a future other organisms might face as the planet deteriorates further. These prototypes carry a technical interest in *morphological computation* (how soft materials can obviate the need for extensive computation in the control loop of a robot) over into aesthetic concerns: viscosity is explored as an *affordance* (Gibson, 1986) for silicone that enables bio-morphic life-like movement. They also speculate on how a productive interplay between a specific milieu and a soft body can occur and how softness exists as an intermediate state between liquid and solid.



Figure 7. Physical coupling between a silicone appendix (cast onto a servo motor) and its containing medium (water). The arm produces fluid motion with gradual biomorphic bending when submerged in water but flaps clumsily around when in the air. Video: <https://youtu.be/ifLChDLxdjE>. ©Jonas Jørgensen

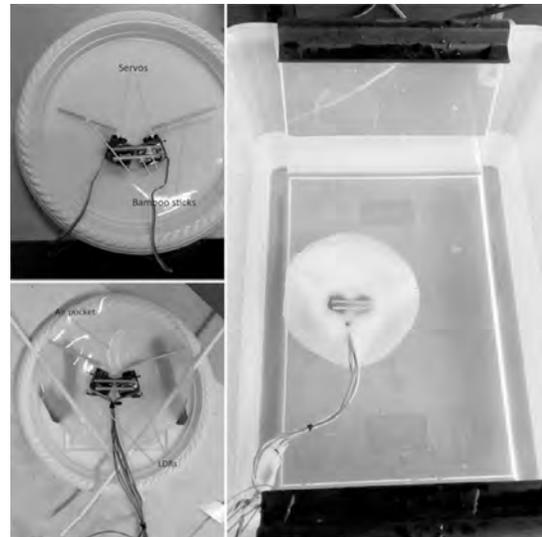


Figure 8. An improvised fishlike soft prototype was fabricated from silicone, bamboo sticks, epoxy, two servo motors and two light-dependent resistors. I plan to experiment with using evolutionary algorithms to evolve its swimming behavior. Video: <https://www.youtube.com/watch?v=U7c0oTtsseU>. ©Jonas Jørgensen

Soft Robot-Plant Ecologies and Biohybrids

Phytomatonics is a series of prototypes that explore how soft silicone might afford an artificial agent other relations with biotic elements in an environment than rigid materials. The series also relates to questions on

how we can speak and think about biological organisms and robots coming together in ways that go beyond instrumentality and anthropocentrism.

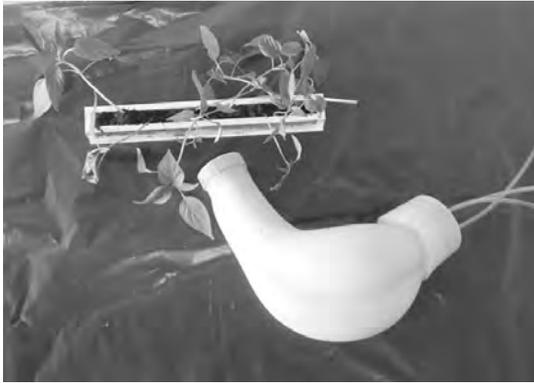


Figure 9. Soft robot-plant interaction. Video of the robot: https://www.youtube.com/watch?v=BO9zXX_XHr4 ©Jonas Jørgensen

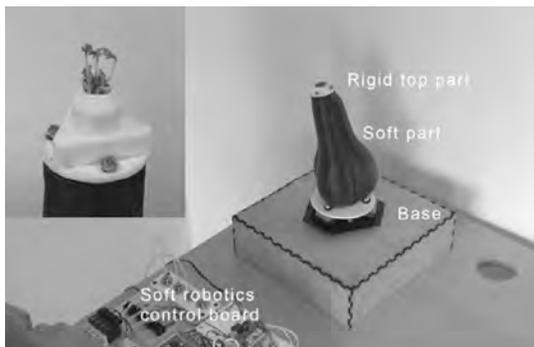


Figure 10. *Phytomatic 01* (2016). The robotic part of the system and the rigid tip of the robot with the three LDRs and cress plants. ©Jonas Jørgensen

The central element in the prototype *Phytomatic 01* is a black soft robotic tentacle. This soft body is equipped with three light-dependent resistors (LDRs) at its tip that allow the robot to detect incoming light. Directly below each LDR are three separate air chambers that can be inflated with an electrical pump to actuate the robot and make it move. At the tip of the robot, ordinary cress plants are placed. The robotic part of *Phytomatic 01* replicates characteristic aspects of a growing plant by means of soft robotics technology. More specifically: its phototropic behavior and the mechanism by which

directional change is accomplished through cell elongation on the shady side of the stem (triggered by an accumulation of the plant hormone Auxin). The robotic part's mode of functioning thus echoes the working of the plants at its tip and the robot's light-seeking behavior evokes notions of a common desire for light shared by both the biological and technical part of the system. The technological part of the system succeeds in replicating a biological mechanism through the use of soft robotics technology but for a goal that from a practical viewpoint may seem entirely redundant: The robot is programmed to position the plants in the direction of the incoming light – something that the plants are perfectly able to accomplish on their own.

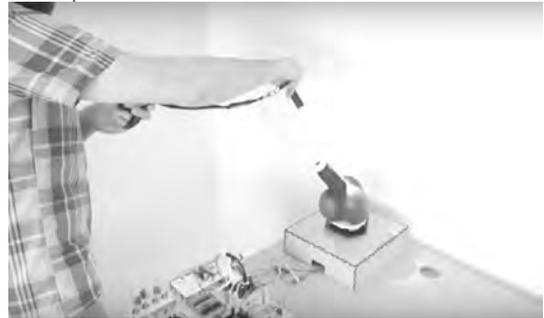


Figure 11. An overview of the prototype *Phytomatic 01*. Video: <https://www.youtube.com/watch?v=-awxAXI035E> ©Jonas Jørgensen

Conclusion

The embrace of soft materials by roboticists has the potential to radically change not only the appearance of their creations but also how they are able to relate to and interlink with their environments and other agents. This will obviously have consequences when the robots are brought out of research labs into “the wild”. How will cultural narratives and imaginaries of softness, robots and artificial life conjoin in the encounter with a pliable robot? What meanings and modes of relating will emerge from soft materiality combined with artificial intelligence? Through the line of arguing and the examples presented in this paper, I hope it has become clear, that both artistic practices and technical research are important vehicles to address questions like these.

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- art and aesthetics. Jonas is also a practicing media artist. In 2016 his collaborative artistic work was exhibited in Denmark, Norway and Finland under the *Hybrid Matters* project (<http://hybridmatters.net/>)

Author Biography

Jonas Jørgensen is trained as a physicist (BSc) and an art historian (BA, MA). He is currently a PhD fellow at the IT University of Copenhagen with a project that focuses on the intersection of robotic technology with

The Sound of Decentralization – Sonifying Computational Intelligence in Sharing Economies

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Abstract

Pervasive technologies in socio-technical domains such as smart cities and smart grids question the values required for designing sustainable and participatory digital societies. Privacy-preservation, scalability, fairness, autonomy, and social-welfare are vital for democratic sharing economies and usually require computing systems designed to operate in a decentralized fashion. This paper examines sonification as the means for the general public to conceive decentralized systems that are too complex or non-intuitive for the mainstream thinking and general perception in society. We sonify two complex datasets that are generated by a prototyped decentralized system of computational intelligence operating with real-world data. The applied sonification methodologies are largely ad-hoc and address a series of concerns that are of both artistic and scientific merit. We create informative, effective and aesthetically meaningful soundworks as the means to probe and speculate complex, even unknown or unidentified, content. In this particular case, the sonification represents the constitutional narrative of two complex application scenarios of decentralized systems towards their equilibria.

Keywords

Data, Data Aesthetics, Sonification, Decentralization, Optimization, Smart Grid, Smart City, Sharing Economy.

Introduction

Following the ‘datological turn’ of the last few decades (Kitchin, 2014; Chandler, 2015; Clough, Gregory, Haber & Scannell, 2015) several types of data aesthetics have been well laid out, including ‘diagram aesthetics’ (Heinrich, 2016), visualization/materialization practices (Bjørnsten, 2016), paradigmatic approaches to music composition (Koutsomichalis, 2016a) and database aesthetics in general (Vesna, 2007). Far from being a shift specific to visual culture, the above turn has dramatically affected music listening practices (Koutsomichalis, 2016b). Sonification and audification have been well standardized in both artistic and techno-scientific

milieux as plausible ways to aestheticize data (Dombois & Eckel, 2011; Walker & Nees, 2011). Approaches of a purely technical/scientific scope have been accounted for in the proceedings of the various International Conferences for Auditory Display¹ that occur annually, with a few exceptions, since 1994. There are numerous diverse, even disparate, trends to sonification and while there are numerous examples of a purely scientific or artistic merit, real life practice often transcends classification and it is not rare at all that scientific and artistic mileux are simultaneously relevant to a project (Prudence, 2014; Arsenault, 2002; Wilson, 2002). *Desoundralization* is a characteristic example of such a case, since our original intention is to both compose ‘intriguing’, in purely subjective terms, sound-art, as well as to experiment with new means/tactics that help us better scrutinize, perceive, understand and eventually present to an audience large-scale decentralized systems applied in contemporary social-technical ecosystems of power systems and urban environments.

Desoundralization concerns the sonification of rather complex data that exhibit decentralized computational intelligence, i.e. localized data that are an actual result of collective decision-making and peer-to-peer interactions between autonomous agents. In this context, and at least as far as our particular approach is concerned, sonifying such systems proves to be a largely ad-hoc process that brings forth a series of questions that are simultaneously of artistic and scientific merit: how can we sonify systems of decentralized computational intelligence that are too complex or non-intuitive to be approached with mainstream thinking and ordinary logic, so that they become ‘meaningful’ for both specialists and the general public? what structural qualities of the system under scrutiny may be revealed in this way? how can

¹. Available at <https://smartechnology.gatech.edu/handle/1853/49750> (last accessed: November 2016)

we probe data-sets and their embedded infrastructure when the latter is largely unknown or too complex/large to be known? Is it possible to demonstrate alternative decentralized design patterns for computational intelligence in data-intensive systems by means of sonification? How can we aestheticize or foreground those attributes that are relevant to intelligent decentralized systems, e.g. robustness, scalability, privacy-by-design, fault tolerance, fairness and social welfare?

Desoundralization is an ongoing, collaborative and highly-interdisciplinary endeavor to address the above questions. Our approach is pragmatic and largely empirical. We zero in on how we can embody the above questions as well as our particular responses into the actual sonic outcomes so that they are experienced in a phenomenological fashion. In this paper we account for the first outcomes of the project, namely for the first two studies in *decentralized computational intelligence*, and we elaborate on our methodological traits. In particular, we discuss the ways in which we sonify two distinct datasets produced by I-EPOS, a fully decentralized combinatorial optimization system (Pilgerstorfer & Pournaras, 2017). I-EPOS is applied in two domains of participatory sharing economies: (i) *energy management* for a more sustainable energy usage in a smart grid and (ii) *bicycle sharing* for load-balancing the bicycle stations of a smart city. The sonification process uses as input the two distinguished datasets produced by the same algorithm for each of the two application domains.

Decentralized Computational Intelligence

Several data-intensive techno-socio-economic systems are challenged by collective decision-making outcomes of the actors they consist of. For example, energy consumers choose the level of energy consumption and the moments when they consume energy from the power grid. Their collective choices may result in power peaks that can cause catastrophic blackouts or high overall energy prices (Pournaras, Vasirani, Kooij & Aberer, 2014a). Similarly, sharing economies emerging in the context of smart cities such as bicycle or other vehicle sharing (Midgley, 2011), require coordinated decision-making so that the availability of bicycles in stations meets a varied demand. In this way, utility companies and operators do not need to perform expensive manual relocation of bicycles among the stations. In such large-scale, distributed in nature, decision-making problems the aggregate result of local autonomous choices result

in system-wide out-comes that influence the overall reliability and sustainability of the environment in which citizens reside and act. Given that citizens' choices are made among different feasible options, or options with a varied cost for each citizen, the computational problem is combinatorial: the number of possible global outcomes is exponential as k^n , where k is the number of options of each citizen and n is the number of citizens participating. This computational complexity can even challenge Big Data infrastructures running MapReduce computational models (Lin, Yang & Hsueh, 2016).

Combinatorial optimization in techno-socio-economic domains such as the aforementioned one is challenging and not straightforward to apply. Such domains entail complications that go beyond technical ones. Big data infrastructures often require the collection of massive personal data for parallel processing in large, energy-intensive, and expensive data centers. This approach raises several issues of trust, privacy-intrusion, surveillance, discriminatory actions and undermining of autonomy (Hajian, Domingo-Ferrer, Monreale, Pedreschi & Giannotti, 2015; Helbing & Pournaras, 2015). An alternative approach is to perform a fully decentralized combinatorial optimization using collective intelligence deployed over crowdsourced Internet of Things devices ran by citizens. I-EPOS, the *Iterative Economic Planning and Optimized Selections* (Pilgerstorfer & Pournaras, 2017) is an example of such an alternative decentralized system. I-EPOS builds upon the earlier EPOS optimization mechanism (Pournaras et al., 2014a, 2014b) and adds on a fully decentralized back propagation learning capability. Software agents of I-EPOS run in citizens' devices structured in selforganized (Pournaras, Warnier & Brazier, 2014) tree topologies over which they perform a bottom-up and top-down net-worked exchange of information to locally perform an informed choice for a resource allocation plan to execute. This optimum plan may represent the schedule of energy consumption of a household appliance that minimizes power peaks or maximizes the stations with available bicycles to pick up. Selection is made using a fitness function that receives as input the plans of the agents and the aggregate agent selections made in the bottom part of the tree topology. Figure 1 visualizes the tree topology and the plan selections made at the first iteration of an I-EPOS execution.

For *Desoundralization* we zeroed in on the following local and global output data of I-EPOS:

Selected plans-local The globally optimum plans locally selected by the I-EPOS agents at every iteration.

Standard deviation-global This is the global evaluation criterion at every iteration and it is used as a local minimization criterion in the fitness functions of the agents as well.

Aggregate plans-global The aggregate, computed by summation, of all selected plans at each iteration.

Incentive signal-global The computed cost signal at every iteration used in the fitness function of the optimization process.

Output data are generated using real-world data from the

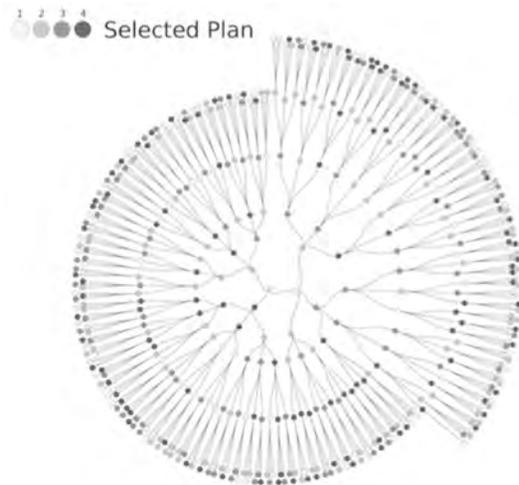


Figure 1. EPOS agents performing collective decision making over a self-organized tree topology for the optimization of the aggregate energy demand. Agent locally generate four energy demand plans and cooperatively make a selection

PNW Smart Grid Demonstration Project²—concerning the energy consumption for the period 23.07.2014, 01:00-12:00, from 493 households with 4 generated³ plans per agent to choose from—as well as from the

². Available upon request at <http://www.pnwsmartgrid.org/participants.asp> (last accessed: November 2015)

³. Plans are generated by shuffling temporal values of the original energy consumption. Such permutation may represent a change in a user activity, for instance, exchanging the time of taking a shower with the time of cooking.

Hubway Data Visualization Challenge⁴—concerning trips from 1000 extracted unique users recorded for the Hubway bicycle sharing system in Paris and showing the available bicycle stations at a two-hour morning time slot (08:00-10:00).

The fitness function of the agents is expressed by a gradient descent that minimizes the standard deviation of the plans collectively chosen over the tree topology using I-EPOS. In the smart grid domain, a minimum standard deviation represents a stable energy demand with minimal changes in the power supply. This decreases generation costs and increases system reliability (Pournaras, 2013). In bicycle sharing, a minimum standard deviation of incoming/outgoing bicycles among the stations keeps the utilization of all stations balanced and minimizes the operational costs of technical staff moving bicycles between stations.

Agents are self-organized (Pournaras, Warnier & Brazier, 2014) in a binary tree topology and can be sorted using several criteria, for instance, how many number of plans they have, or mathematical properties of the plans such as their standard deviation. For the purpose of this work, the following three agent strategies are evaluated:

STRATEGY A Agents with a high total number of plans and high standard deviation in the plans are placed on top. Agents use all their plans throughout the learning process and perform decision-making with a fitness function expressed with standard gradient descent (Borges et al., 2005).

STRATEGY B Agents with a lower number of plans and higher standard deviation are placed on top. Their fitness function is expressed in standard gradient descent (Borges et al., 2005) by considering two plans and adding one more every 10 iterations.

STRATEGY C Agents are randomly placed in the tree topology. They learn with their fitness function expressed in the adam gradiend descent (Kingma & Ba, 2014).

Figure 2 illustrates the learning curves of the three strategies in smart grids and bicycle sharing. The strategies may have comparable performance, nevertheless they traverse different optimization

⁴. Available at <http://hubwaydatachallenge.org> (last accessed: November 2016)

trajectories and their learning curves diverse. Accordingly, the three different strategies become an important empirical means to evaluate the fitness of the sonification and, up to a certain extent, to quantify the complex inter-relationships between abstract aesthetic qualia and measurable statistical information.

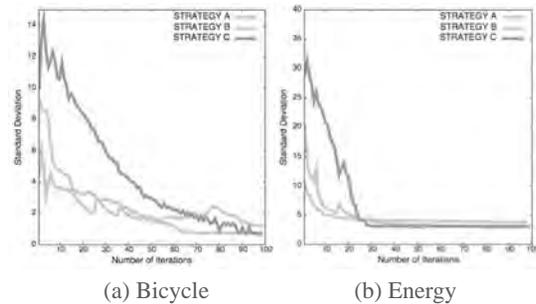


Figure 2. Learning curves of three agent strategies represented by the decrease in standard deviation over 100 algorithm iterations. These curves are a core part of the sonification that turns their measurable difference into an auditable result, an aesthetic perceptual experience of decentralization

Sonification as Material Speculation

Sonification systems are typically stratified and comprise a series of submodules that retrieve, clean, filter, process and parse data (Walker & Nees, 2011; Koutsomichalis, 2013). Coupling the output of such processes to sound synthesis algorithms is, then, addressed by mapping schemas. We have implemented the sound synthesis algorithm as well as the necessary mapping and scaling schemata using SuperCollider⁵, a state-of-the-art programming language capable of both real and non-real time sound synthesis. Sonification systems implemented in SuperCollider have had some relevance to our research (Koutsomichalis, 2013; Hermann, Bovermann, Riedenklau & Ritter, 2007; Grosshauser & Hermann, 2009; de Campo, Rohrhuber, Bovermann & Frauenberger, 2011). They, nevertheless, do not reflect on the decentralization process, i.e. the actual data locality and peer-to-peer interactions, and therefore, they mostly concern cases where the sonification process ends up being a manifestation of a central meta-authority with full information: a creative sound composition process that does not need to draw

parallels or convey concepts of network protocols designed for a decentralized data management. On the other hand, there is an abundance of resources regarding the sonification of decentralized systems, in particular evolutionary systems and flocking simulations (Huepe, Colasso & Cádiz, 2014; Miranda, 2004; Bisig, Neukom & Flury, 2007; Blackwell & Young, 2004). Most of this work, however, concerns simulation models and synthetic data, in contrast to *Desoundralization* that exclusively deals with real-world socio-technical data and the actual prototyped implementation of a decentralized system for computational intelligence applied to sharing economies.

Accordingly, our approach has been largely driven by pragmatic and ad-hoc experimentation. Pragmatic, in that we try out different tactics and then empirically assess the results against their potential aesthetic and scientific merits. Ad-hoc, in that we do not rely on any specific stratagem nor do we necessarily intend to extrapolate generic algorithms to be applied elsewhere. In this sense, and up to a certain extent, there is an analogy between our approach and well-standardized improvised composition practices—these typically concern unique and situated pieces of music meant to be performed in some particular context (space, time, performers, etc). *Desoundralization* also suggest a similar contextual and material specificity that is relevant to particular decentralized systems and the data they generate. We do not suggest that such an approach is unique or particularly innovative. We, nevertheless, emphasize that since we attempt to compose sonifications that are informative, aesthetically intriguing and effective as means to probe complex, maybe even unknown or unidentified content, this element of material specificity becomes of paramount importance—to the extent that our overall practice could be thought of as a way to speculate about the data under scrutiny. Thinking about decentralized data in material terms entails immensely complex interrelationships between agent-dependent/locally-produced information and the system-wide outcomes of agents' coordinated actions. As far as the two datasets under scrutiny herein are concerned, consider the sheer complexity of the optimum plans locally selected by the agents at every iteration (selected plans-local) as well as the ways in which they might relate with one another and with the various globally quantified measures in the scope of each different optimization strategy. We argue that our sonifications do

5. Available at <https://supercollider.github.io/> (last accessed: November 2016).

succeed in articulating this sheer complexity, at least up to a certain extent.

In that vein, our approach comprises testing and evaluating different mapping schemata and audio synthesis strategies. In the course of our experimentation with different sonification methods and mappings, complex aspects of the decentralized design and emergent intra/inter-dependencies between localized data become eventually apparent, yet in a haphazard fashion. Still, once some particular aspect or feature that we understand as exemplificatory of some function within the system becomes implicit, it is possible to further ameliorate and fine-tune the sonification so that the former becomes explicit and even foregrounded. It is undoubtedly questionable to what extent we create ourselves those features that we are supposed to probe, but such an uncertainty is integral to the scientific method in many contexts and has been one of the main arguments of those criticizing it (Feyerabend, 1993; Latour & Woolgar, 2013). In the context of *Desoundralization*, emergent uncertainties of this kind are rather desirable since they allow alternative insights to the systems under scrutiny and, more importantly, since they may also bear aesthetic merit.

Under these premises we discuss a few of our discarded sonification attempts and explain how they pave the way to the ones we finally adopt, so that the pragmatic, ad-hoc and largely speculative nature of our approach is accounted for.

For the bicycle-sharing data, we initially experiment with a few disparate and complex audio generators producing sustained noisy textures in parallel and then we use data to control the various synthesis parameters. However, the resulting audio offers little, if any, insight to the dataset: the transition from one iteration to the other is unnoticed and no particular change occurs as the data progress to the eventual convergence and, in general, nothing in what we would listen delineates the complex inter-dependencies enacted the coordinated action of hundreds of localized agents. Given the particular nature of the locally produced data—i.e. mostly zeros with the occasional appearance of 1 or 2—it immediately becomes evident that in order to represent peer-to-peer relationships between the various autonomous agents and to potentially reveal properties still unknown to us, we should focus on aestheticizing the intrinsic ‘rhythmicity’ of those numbers scattered across the 1000 nodes. Accordingly, we follow a completely

different approach, this time revolving around percussive sounds arranged in complex configurations of varying density with respect to the localized data. These series of experiments make explicit, albeit fail to properly account for, a series of simultaneous inter-dependent evolving ‘rhythms’ between the localized data and their system-wide quantified effects as the entire system approaches convergence. This observation has been eye-opening in how we should proceed further. Following, we scan the data in parallel from iteration to iteration, experimenting with different granular synthesis generators and trying to figure out which synthesis parameters have to be controlled by what kind of data so that the both the microscopic intra-dependencies of the localized data and their coordinated system-wide effects are properly delineated. In this vein, we experiment with different generators (based on both pure oscillators and the appropriation of real-world recordings), with more sophisticated audio-spatialization and more sophisticated metamappings employing formulated ratios and basic statistical analysis on the raw input data.

To begin our orientating within the energy-management dataset, we simply use the localized data (floating point numbers) to control the frequency of simultaneously sounding oscillators—one per agent. The result is rather discouraging: semi-periodic oscillations between the very same timbres—a strong indication that the variance and volatility of the localized data is rather limited. We then seek ways to both emphasize this rhythm and to better probe the subtle modulations that sustain it. The fact that the two datasets have more or less the same structural qualities (hundreds of local agents, hundreds of iterations, eventual convergence of some sort, etc.) is a strong indication that the same mapping strategy employed in the case of the bicycle-sharing dataset is applicable herein, too. However, the energy-management case calls for a completely different approach as far as audio synthesis is concerned: simple, percussive sounds can describe neither how points in a floating-number continuum relate with one another, nor how they are distributed across the hundreds of autonomous nodes that constitute this system. By experimenting with various other kinds of audio generators a peculiarity of the localized data becomes apparent: despite occupying a practically continuous domain and despite being arbitrarily volatile, most of the time they oscillate across fixed attractors. To arrive at sonifications that would be both exemplificatory of

this behavior and compositionally intriguing we have to come up with more complex and nonlinear generators that would accentuate subtle changes and occasionally behave in an unpredictable fashion. In this way we could manage to represent all stable, bi-stable and divergent states of the system with more interesting sonic textures.

We draw upon the experience of all our experiments and discarded strategies in order to first identify what exactly we aim at exploring in the data under scrutiny and, then, to properly account for it. Our approach has been largely iterative and empirically-driven and in this sense, it shares some grounds with design science paradigmatic methodology, where the goal is to create a satisfactory artifact via an iterative process (Baskerville, Kaul, Pries-Heje, Storey & Kristiansen, 2016; Martens, McKinnon-Bassett & Cabrera, 2012). The sonification algorithm in its final form embodies the insights gained from previous attempts. It also embodies our own subjective decisions on what emergent features should be foregrounded and in what ways, so that the sonification eventually becomes sound-art worth listening to for its own sake and, more importantly, a process of speculation about the system under scrutiny. While speculation of that kind might be unacceptable in other scientific milieux, it can become an invaluable tool in establishing new means for the general public to conceive complex decentralized systems that are too complex and non-intuitive for the mainstream thinking and general perception in society.

Sound Synthesis and Mapping

Herein, we illustrate the sonification process of the two output data of I-EPOS on energy demand and bicycle sharing. The sonification process does not require input about the tree topology and uses entirely the local and aggregated data of the agents. For each dataset, the approaches are complementary in spirit. For the bicycle sharing data we are inspired by glisson synthesis techniques (Roads, 2004, pp. 121-5). The sonification of energy management comprises a series of rather sophisticated generators that are active throughout the entire duration of the piece. In both cases the idea is to simultaneously represent the current state of all agents as they ‘perform’ the various algorithmic iterations, occasionally using complex mappings that also involve system-wide statistical measures, so that the emergent complexity of the original data manifests in sonic terms. In this way, as the sonification advances, one may listen

to how the overall performance of the system changes at each iteration to arrive at a certain performance outcome—a certain ‘telos’ suggesting the eventual convergence.

Algorithm 1 demonstrates the minimal glisson generator used for the sonification of the bicycle sharing data. The recording of a bicycle bell is used as a source sound to convey the application domain. The generator varies the rate by which a fragment of a pre-recorded sound sample is reproduced so that a glisson is generated. The algorithm scans the data and spawns thousands of glissons with their initial and final playback rate, the duration of their glissando, their amplitude and their positioning in the stereo field parameterized accordingly. Each glisson is also fed through a single-channel parametric equalizer and a low-pass filter, so that their spectral characteristics are also forged algorithmically. 1000 glisson synthesis processes—one for each agent in the original dataset—are initiated simultaneously. The arguments for each glisson are then calculated as follows:

Initial playback speed: Calculated by the factor of the selected plans divided by the factor of the aggregate plans divided by the maximum of all aggregate plans.

Final playback speed: Calculated by the initial playback speed and the difference of the topical standard deviation minus the standard deviation at the final iteration.

Frequency of the equalizer: Calculated by the ratio of the incentive signal and the maximum incentive signal.

Gain or attenuation factor for the equalizer: Calculated as the initial playback speed.

Glisson duration: Calculated with respect to the ratio of the aggregate plans and the incentive signal.

Amplitude: It is a random value.

Algorithm 1 Glisson generator

```
SynthDef(igen, { arg rate_start = 1, rate_end = 1, pan =
0, dur=0.5, amp = 0.1, freq = 440, db=0, buf=0;
var signal = Mix.new(PlayBuf.ar(2, buf, Line.kr(
BufRateScale.kr(buf)*rate_start, BufRateScale.kr(
buf)*rate_end, dur), loop:1);
signal = MidEQ.ar(signal, freq:0.4, db);
signal = LPF.ar(HPF.ar(signal, 40), 10000);
signal = signal * EnvGen.kr(Env([0, 1, 1, 0], [dur/4, dur/2,
dur/4], [-3, 0, 3]), doneAction:2);
Out.ar(0, Pan2.ar(signal, pan) * amp);
```

Note that in both sonifications the sonic image gradually progresses from monophony to a wide sonic image (stereo or multichannel). The overall speed is calculated as a fraction of the difference between the standard deviation of the last iteration and that of the current, so that the whole system becomes progressively slower (or faster, if desired).

Algorithm 2 demonstrates the audio generator used in the case of energy management. This generator is arguably more complex and comprises the esoteric Astrocade generator⁶, a reverb unit, a chaotic noise generator (Crackle), a single channel parametric equalizer and sophisticated multimappings hard-coded into the body of the synthesizer. Note that *reg1*, *reg4*, *reg5*, *reg7* are higher order inputs, which are mapped into several audio synthesis parameters the state of which often depends on more than one of the former ones. Note also that the parameters of the Astrocade are meant to emulate 8-bit programming registers, different bits of which often control different parameters, so that the generator cannot be controlled in a linear fashion. Chaotic noise, nonlinear ranges in conjunction with higher-order inputs and multi-mappings built-in the synthesis engine account for generators that would dramatically ‘magnify’ subtle changes in the input data and that would occasionally destabilize and behave in a chaotic fashion. As discussed in the previous section, such a behavior is desired. The logic of the rest of the algorithm is very similar to that of the bicycle-sharing data: a generator is instantiated for each of the 493 agents at play and subsequently controlled by the input data. The parameters are set with respect to the following schema:

reg1: Calculated by the ratio of the selected plans over the aggregate plans over the maximum of the latter.

reg4: Controlled by the selected plans.

freq: Calculated by the ratio of the incentive signal and the aggregate plans.

reg5: Calculated with respect to the selected plans multiplied with the frequency, as defined above.

reg7: Calculated by the ratio of the aggregate plans and the incentive signal.

Gain or attenuation factor for the equalizer:
Calculated as *reg1*.

Amplitude: Calculated by the value of selected plans.

⁶ According to the help file of SuperCollider, “a custom ‘IO’ sound chip driver by Aaron Giles and Frank Palazzolo”, which may not be “working as it should, but it’s still somewhat fun sounding”

Algorithm 2 Generator used in the sonification of the household energy consumption data.

```
SynthDef(gen, { arg reg1=0, reg4=0, reg5=0, reg7=0, pan
  = 0, amp = 0.1, freq = 500, db = 0;
  var signal = Astrocade.ar(0, reg1, 0, 0, reg4, reg5,
    15, reg7);
  signal = Select.ar( ((reg4+reg7+reg5) / 385).ceil, |
    signal, FreeVerb.ar(signal * Crackle.ar(0.9 + ((
      reg1 + reg4) / 400)), mul: (reg1 + reg7)/500); ((
      reg7 + reg5) / 500), 0.5, 0.7));
  signal = signal * LFNoise2.ar(freq / (reg1 + 5));
  signal = MidEQ.ar(signal, freq, 0.2, db);
  Out.ar(0, Pan2.ar(signal, Lag.kr(pan.lagTime)) * amp *
    0.2);
})
```

Modulating the various ranges, changing the denominators in the ratios, accelerating or decelerating tempi or the magnitude of the various changes (e.g. by multiplying with a progressively larger/smaller factor) all result⁷ in accentuating and foregrounding different system properties. Improvisation can be the means to further probe decentralized data.

Discussion and Conclusion

The outcome of this work has been 6 audio pieces⁸ with duration of about 20 minutes each. These represent the sonification of the three different strategies per dataset. The different strategies sound as different narratives leading to more or less the same ‘telos’—i.e. the state of convergence for each system. In both cases, the range and the characteristics of change to various globally relevant parameters, such as panning or speed, are fine tuned so that the ‘telos’ does not come too fast or too sudden and so that the most important micromodulations at play are accentuated throughout the entire sonification. Several sonic parameters are controlled by means of ratios or other mathematical formulations involving both local and global data as well as various statistical maxima/minima. In this way we can pinpoint those particular abstract properties that are identified as the most important or explicatory during the experimentation stage that has preceded. We can sustain the complex

⁷ The illustration of the sound synthesis eschews everything relevant to scaling and interpolation schemata for reasons of simplicity. The latter are, nonetheless, rather significant in defining how the outcome eventually sounds and are often defined by exponential distribution curves and even in a reverse order, so that higher input values correspond to lower output ones. Again, employing different interpolation/scaling schemata allow us to pinpoint different properties of the systems under scrutiny.

⁸ The audio pieces are available at <http://evangelospourmaras.com/shared/Desoundralization-mp3s.zip> (last access: February 2017).

nexi of micromodulations that seem to support and accentuate the aforementioned narrative so that we also arrive at aesthetically interesting compositions for sound-art enthusiasts.

Comparing the different strategies with one another is revealing. In the case of the bicycle sharing data, strategy a and in particular strategy c are more evocative of the sound origin, that is a bicycle bell: towards the end of the sonification the various abstract glissandi gradually transform to definite bell sounds. strategy b, which is the preferred one in terms of aesthetics, is abstract throughout and is rather characterized by minimal subtle change; the listener does not encounter the dramatic glissandi present in the other two strategies as the placement of the agents in the tree by the self-organization process result in plan selections with a more moderate acoustic impact. The case of the energy management data is very different, both because of the nature of the data and the synthesis generator in use. A more involved and non-linearly controlled sound generator is used as the basis of the entire sonification to account for the unstable, unpredictable and often haphazard nature of electricity. This generator occasionally ‘crackles’ or ‘explodes’ and often results in noisy textures while also sounding in the correct pitches. All strategies here seem to eventually self-modulate, repeating more or less the same sonic states over and over. All in all, the different strategies sound (dramatically) different, in this way exemplifying the different processes that are in play, their effects on the scattered autonomous agents, and our compositional decisions regarding which kinds timbres/textures should be associated with each system.

Desoundralization zeroes in on the output of I-EPOS and intends to probe the complex locally generated data as well as the way they inter-depend with system-wide properties and macroscopic statistic measures. The proposed sonifications allow us to gain invaluable insight in the internals of I-EPOS. Traditional visualizations such as the ones depicted in Figure 2 are helpful in delineating the behavior of the aggregate results and in quantifying statistical measures and overall system performance. Yet, it would be immensely difficult, if at all possible, to aestheticize complex qualities with traditional visualizations such as the inter-dependencies forged between the locally generated data as the iterations progress or the relationship between the latter and overall macroscopic qualities of the system. Our proposed sonifications do enable us to delineate

the complexities of decentralized systems as manifested both microscopically and macroscopically, to speculate on particular aspects of them and to present our findings in a straightforward phenomenological fashion that may also hold artistic merit. In our approach we take into account all localized agents and the data they generate in a bottom-up fashion, in this way exposing the granularity of the system, while at the same time we keep comparing them with system-wide quantified data directly encoding the results in sound. While it may be impossible for non-specialists to fully understand the deeper implications of such systems, it is still straightforward for the general public to appreciate the various processes at play in their proper granularity and, more importantly, to immediately perceive how overall convergence of the system translates to microscopic modulations in the locally-generated data and vice-versa.

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Visualising the Meditating Mind: The Aesthetics of Brainwave Data

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Abstract

Meditation is an ancient Eastern practice, which is receiving renewed popularity as a secular approach to health and well-being. Recent advances in commercial EEG sensor technology provide opportunities for visualising biological brainwave data by artists and designers, outside the fields of neuroscience and psychiatry. We chart the creative development of an aesthetic visualisation, *Narcissus Brainwave* that aims to provide insight into the shifting states of mind during the practice of meditation, informed by a series of user studies with meditators and non-meditators. Interestingly, assumptions we made from the interpretation of brainwave sensor data about when a meditative state was achieved did not always resonate with how meditators understood the quality of their inner meditation experience. This may be due in part to the limitations of a single electrode EEG device. Issues also arose related to personal preferences and cultural conventions for interpreting the meaning of the Buddhist-inspired visual symbols representing our model of meditation. Our study has revealed some of the challenges of visualising the meditating mind and creating meaningful aesthetic visualisations with commercial devices.

Keywords

Biological Data, Brainwaves, EEG, Meditation, Mindfulness, Visualisation

Introduction

Meditation is an ancient Eastern practice, now recognised as leading to benefits in health and wellbeing (Kabat-Zinn 1998, Keng 2011, Greenberg 2012). Despite the rising popularity of secular meditation in the West, novice and experienced meditators can struggle to maintain a regular practice. One of the issues facing meditators is that they may not know whether they have successfully entered into a state of meditation during their practice. In order to address this difficulty, this research aims to provide tools to visualise the participants' biological brainwave data during meditation to help them practice. It is based on

the assumption that when the mind enters a meditative state it has specific patterns of brainwave data that can be visualised as unique patterns. Scientific studies of the brainwave activity of experienced meditators suggest that this is the case (e.g., Fell et al., 2010).

This project aspires to go beyond traditional graphical presentations of biological brainwave data common in the sciences to the application of aesthetic approaches to data visualisation. Artists and designers are beginning to create visual works depicting the activity of the brain, with new opportunities arising from the recent introduction of commercial electroencephalogram (EEG) devices. We created a custom-built software program, entitled *Narcissus Brainwave* that uses symbols from Buddhist mandalas to visualise different brainwave states in meditation, and brainwave data from the Neurosky Mindwave device.

The focus of this paper is not on the technical development of *Narcissus Brainwave*; instead we explore the challenges in designing aesthetic visualisations using biological data captured from commercial brainwave sensors. Our objectives were to reflect the qualities of the inner experience of meditation, and to evoke similar qualities in the viewer. Towards that end, we developed dynamically changing visual designs that aimed to depict the meditating mind and to resonate with meditators' interpretations of their inner meditation experience. However, as we will see in this paper, this is not as straightforward as it seems.

In this paper, we first briefly describe the historical background of meditation and mindfulness. Then the use of EEGs for visualising brainwave activity to capture data is discussed through reference to key scientific and artistic studies. We illustrate and explain the visual design and interactive behavior of the aesthetic visualisation tool, *Narcissus Brainwave*, followed by a description of the underlying model of meditation. The

development of the software program that generates the visualisation is described in terms of the series of user studies conducted to understand the nature of visualising biological brainwave data in meditation and how the data from the studies informed design choices for the tool. Finally, our paper concludes with a discussion of the key challenges we encountered in aesthetic visual design for representing the meditating mind and creating meaningful aesthetic visualisations with commercial devices.

Literature Review

Meditation and Mindfulness

Meditation has been an integral part of pan-Buddhist Asian cultures for the past 2,500 years (Otani, 2003, p. 97). It is utilised by various religious and spiritual groups throughout the world, in particular by Buddhist monks for spiritual training. Meditation is thought to be a useful skill to learn and use to discipline and heal the mind and spirit. Buddhist meditation encompasses a variety of meditation techniques that aim to develop concentration, tranquillity, and insight (Fernando 2010). More generally, meditation is considered a form of mental training. The word *meditate* stems from Latin *meditatum*; to ponder. Meditation promotes concentration and relaxation, to help manage emotional states through focussed attention.

Increasingly, around the world non-Buddhists are adopting Buddhist meditation techniques; these techniques are progressively used by psychologists and psychiatrists to help alleviate a variety of health conditions such as chronic pain, anxiety and depression, sleep apnea and stress management (Gotink, Chu et al. 2015). Currently, the most widely researched is the secular form: mindfulness meditation (Kabat-Zinn 1998, Hofmann 2010).

Measuring Brainwave Data in Meditation

EEGs capture biological data from, and record, the electrical activity of the brain. An EEG measures the way brain cells communicate by producing electrical signals. In 1924 Hans Berger recorded the first human brain activity with an EEG (Collura 1993). The EEG was adopted by clinicians and scientists to observe brain wave patterns. Human brainwaves have been classified into five types: Gamma, Beta, Alpha, Theta, Delta.

The change of consciousness through meditation is recognisable by its brainwave status. Brainwave

readings taken during a normal day and during normal activities show the beta brainwave status to be dominant (Teplan, 2002, p. 3). Alpha brainwave activity is induced by closing the eyes and by relaxation. It is diminished by eye opening or by mental activity such as thinking or calculating. When people close their eyes, their brainwave pattern significantly changes from beta into alpha waves (Teplan 2002, p. 3). The most dominant effect in the majority of studies on meditation is a state-related slowing of the alpha brainwave rhythm in combination with an increase in the alpha brainwave amplitude (Fell et al., 2010, p. 220).

Researchers have found that low amplitude alpha brainwaves may reflect stressed states. Unpleasant acoustic stimuli reduced the amplitude of low alpha brainwaves by approximately 20% (Nishifuji et al., 2010). A similar observation was made in our preliminary study, where decreased amplitudes of alpha brainwaves took place at times of external distraction such as an unpleasant sound.

The key scientific findings we applied in the design of our visualisation tool were the increase in alpha brainwaves during relaxation and meditation, both in terms of a slowing down or decrease in frequency, and an increase in amplitude. In a study of mindfulness meditation, alpha brainwaves have been linked to an increase in internal attention and an increase in theta brainwaves to relaxation (Haupt and Fell 2007). We used this distinction between relaxation and meditation as a key parameter in our model of meditation, by employing the ratio between alpha and theta brainwaves as a threshold indicator between calculated states of relaxation and meditation.

Artistic Visualisation of Brainwave Data

Although historically, EEG devices were used in psychiatry and neuroscience, these devices are now being employed by artists and designers to visualise brainwave data. Currently, there are only a few examples of artistic visualisations of brainwave activity related to meditation. We discuss three projects that use bespoke software programs and commercial EEG headsets to visualise brainwave data in meditation, and focus on the aesthetic aspects of the artistic works.

Andreas Borg's *Alhambra Mandalas* (2012) is an artistic visualization developed using Islamic patterns found in the Alhambra castle in Granada, Spain. Similar to Narcissus Brainwave, the work was inspired

by the idea of mandala patterns, which are created when the user achieves a specific state of mindfulness meditation. Users can interact with the artwork by wearing a Neurosky Mindwave headset. The result is a continuously evolving tapestry varying according to the values of brainwave data. The parameters used are raw signals of brainwaves and attention and meditation values provided by the Neurosky device. It creates symmetrical patterns depending on the values of brainwave status. Whilst the artwork is visually sophisticated, it does not include any user evaluation nor provide users with insight into their meditation practice.

Visualise Your Mind (2015) created by Zhepeng Rui is an example of a visualisation that represents participants' brainwaves in meditation using the Neurosky Mindwave headset. It has a Mind Painting feature, which creates unique abstract paintings in real-time based on brainwave data. The colours of the seven chakra centres were used to convey different states of meditation. Whilst the coloured lines are aesthetically pleasing and convey some level of abstract information about the nature of brainwave activity recorded by the Neurosky headset, they fall short of providing more precise and insightful information about the nature and quality of meditation. More details of this work can be found at de Bérigny et al. (2016).

George Khut's *Behind Your Eyes, Between Your Ears* (2015) is an example of the use of visual and sonic representation of brainwaves in meditation. This artistic work invites a participant to sit down, put on a wireless Muse EEG sensor and relax in meditation. Changes in the amplitude of alpha brainwave activity recorded from four electrodes along the front and side of the participant's head, are used to modulate sound textures and layers of graphics. The work aims to help the user to enter into a meditative state, and to explore and reflect on their ability to sense and then move voluntarily between these two states. Participants interact with the work with their eyes closed in meditation, whilst observers can watch a video of the participant overlaid with the graphics being modulated by their alpha brainwave activity. The visual material references "photographic idioms from sci-fi, to 70's aura-photography and 19th Century spiritualist imaging" (Khut, 2015) and provides observers with some indication of the meditator's state of mind, but in a non-didactic, evocative manner.

All three examples discussed above illustrate the variety of approaches to using brainwave data to

generate artistic visualisations. They reveal to various degrees through

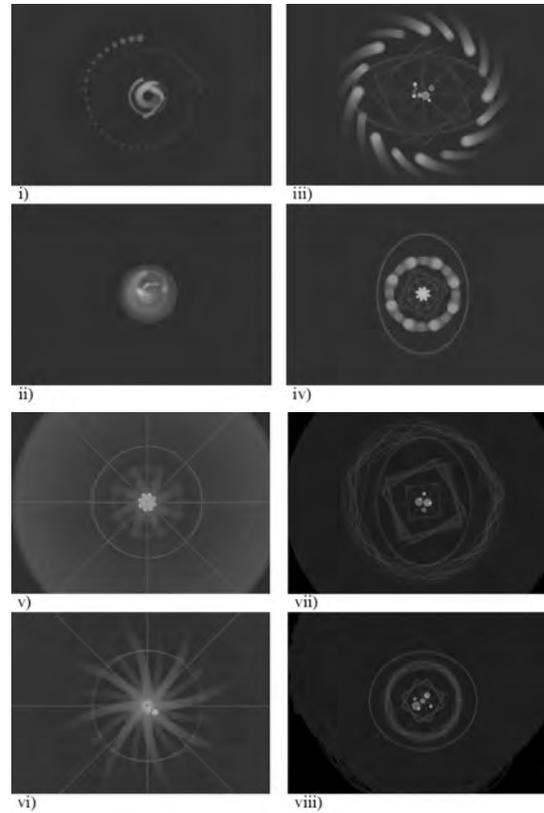


Figure 1 The visual patterns related to each stage of the meditation model

abstract patterns, the ever-changing mental activity of the mind, and offer new ways of understanding and influencing states of consciousness through the application of aesthetic strategies. Now we turn to the development of our aesthetic visualization tool, *Narcissus Brainwave*, where we explore some of the challenges of visualising the meditating mind.

Developing Narcissus Brainwave

Narcissus Brainwave is an aesthetic visualisation, allowing users to observe their brainwave data in different states. It is composed of a custom-built software program, implemented in Processing (processing.org) that takes EEG data and creates a dynamically changing visualisation. We used the Neurosky Mindwave

headset, a commercially available non-invasive type of brainwave sensor that is attached to the forehead and ear of the user and wirelessly transmits raw EEG data to a computer.

In this section, we first present and explain the visual design based on the Buddhist Mandala symbology. The underlying model of meditation is then introduced. This is followed by the key phases of development of the visualisation tool through a series of user studies, including how the model of meditation was modified as a result of the findings from the user studies. The technical description of the visualisation tool and development process is limited to providing sufficient information in order to comprehend the model of meditation and the design of the visualisation tool.

The Buddhist Mandala Symbology

Symbols derived from Buddhist mandalas were chosen as the primary visual metaphor to visualise dynamic changes in brainwave activity during meditation. The third author who was responsible for the technical development of this tool has a Korean cultural background, where Buddhism is the primary spiritual practice. The word Mandala in Sanskrit means circle. Mandalas and circles symbolise the cycle of life (Laine 2009). Even though not all mandalas are circular, they are traditionally symmetrical, and believed to inform the wisdom behind sacred geometry. Traditionally, Mandalas are circular diagrams enclosing a square, which are used to 'support of an act of spiritual concentration' (Stutley and Stutley 1977). The circle represents unity and the square the essence of Buddha. Mandalas are also used as images for reflection in meditation. Mandalas in Eastern traditions are believed to represent the cosmos, the universe, and people, in which bodily, psychological and spiritual aspects are represented. This signifies the journey of the individual toward wholeness (O'Nuallain 2009).

Tibetan monks spend approximately two weeks creating sand Mandalas from grains of coloured sand, whilst the act of destroying the mandalas takes only a few minutes. Monks divide the Mandala circle into eight parts and sweep the grains of the Mandala toward the centre. The coloured sands is swept away and destroyed. The process of creation and destruction of the Mandala ceremony illustrates that all form is impermanent, by highlighting the Buddhist concepts of non-attachment. This ritual symbolic practice underlies the visual design

and dynamic behavior of Narcissus Brainwave.

The Visual Design of Narcissus Brainwave

The model of meditation was translated into a specific visual design, incorporating the visual metaphor of the Buddhist mandala. The key stages and rules of the visualisation are illustrated and explained below, with reference to Figure 1.

Normal Status During normal status (non-meditation-like status), as complex brainwave activity was observed, this was illustrated in the design by circles moving in a spiral towards the centre at a fast pace (see Figure 1 (i)). The amplitudes of each type of brainwave are displayed as a distance from the centre. Each colour represents each brainwave (blue: theta, red: low alpha, green: high alpha, purple: low beta, dark purple: high beta, yellow: low gamma (see Figure 1 (ii)). This visual appears when the EEG sensor receives over the threshold amplitude of theta brainwave.

Meditation Status As the user gets into a continuous meditation state, shapes begin to appear. Fast orbiting patterns morph into a slower paced mandala pattern (see Figure 1 (iii)). The rotational speed of all elements slows down to reflect the calm state of the mind in meditation. When the outer circles are red, they represent a low alpha brainwave. When the alpha brainwave frequency increases to high alpha range, the red circles change into green circles. The size of the pattern is determined by the ratio between alpha brainwave and theta brainwave. If the alpha amplitude is registered higher than the theta, the mandala patterns are larger than if the inverse occurs. The brainwave signals (excluding alpha and theta) are visualized as circles inside the large square. The smaller circles' size and colour are dependent on the amplitude of brainwave data. Another square was added that rotates at a different speed from the first square to develop more dynamic visuals.

Deep Meditation Status There is a significant parameter, sustainability. When meditation status is sustained without any distraction, the sustainability value will be increased. If the sustainability value exceeds a certain level, the lotus appears in the centre (see Figure 1 (iv)). This lotus state expresses a deep meditation status. The size of the lotus changes in proportion to the time in which this deeper status is maintained. The colour of the lotus changes, depending on the amplitude of brainwaves in each frame (low beta, high beta, low gamma and mid gamma). The lotus

colour appears followed by a gradient colour from the highest brainwave to the lowest. Eight circles between the outer red (low alpha) or green (high alpha) circles were added to create a more circular image.

Distraction Status Distraction causes the Mandala pattern to move back to the normal brainwave status. The mandala breaks into eight divisions indicated by blue lines emerging from the centre (see Figure 1 (vi)). The whole pattern shrinks down to the centre and expands outward with a blue hue (see Figure 1 (v)) - this symbolises the dissolution of the Tibetan sand Mandala at completion.

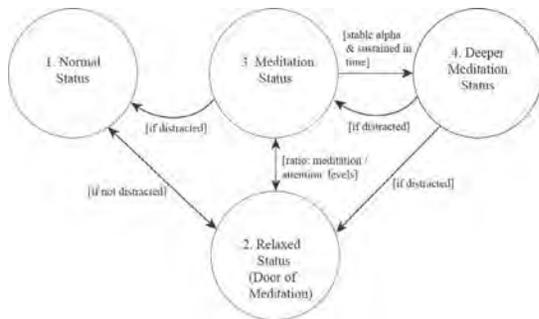


Figure 2: Model of Meditation State Diagram

Relaxed Status This status is the Door of Meditation. It can be interpreted as a shallow meditative status or a relaxed status without any distraction. The noise effect of the wavy circular lines will appear as the brainwave pattern eases closer to the meditation status and it slowly changes into the Mandala pattern (see Figure 1 (vii)). In this status, there is no distraction, but attention level is equal or higher than the meditation level. The outer circles in the mandala pattern would morph into a circle with noise. As the meditation level increased, noise in the outer circle would settle down into solid round lines (see Figure 1 (viii)).

The Model of Meditation

A model of meditation underlying the visualisation tool for *Narcissus Brainwave* is presented below. It emerged through a process of iterative technical prototyping and a series of two user studies. The state diagram in Figure 2 illustrates the key stages of the model of meditation. Each stage (or status) is defined in Table 1. The attention and meditation levels are designed as key parameters to determine the timing of transitions, the size of the

pattern and elements within it, and the stage of the model. The relative levels of alpha and theta brainwaves play a critical role too. See Table 1 for details of how these parameters are used to define, and transition between, the stages of the model.

Stage	Status	Interpretation	Attention and meditation level
1	Normal	State of intellectual activity, quite sensitive to external stimuli, and the opposite state of meditation.	Attention > meditation Theta brainwave > 32uV
	Normal - Attention	Occurring in normal status, it is caused by concentration.	Over 150000 ASIC EEG power units of theta brainwave.
	Normal - Distraction	Occurring in meditation status, it is caused by internal or external stimuli.	Over 150000 ASIC EEG power units of theta brainwave.
2	Relaxed (Door of Meditation)	Attempting to meditate, relaxed, not particularly interested in anything. Intermediate state between normal and meditation status, low level of alpha and theta brainwave.	Attention >= meditation Theta brainwave < 32uV
3	Meditation	State of freedom from thoughts, alpha brainwave status, low level of theta brainwave.	Meditation > attention Theta brainwave < 32uV
4	Deeper meditation	A deeper level of meditation indicated by stable alpha brainwave activity, for a sustained period of time.	Meditation > attention Ability to not get distracted

Table 1. Stages in the model of meditation

Developing the Model of Meditation

For the user studies, trained meditators and non-meditators were recruited to explore the nature of brainwave activity during stages of meditation, and to inform the model of meditation and corresponding rules for the visualisation tool.

Understanding Brainwave Data

In the first study, brainwave data was gathered from six meditators and six non-meditators. Participants were asked to perform two activities: i) Read a book, and ii) meditate for 10 minutes using their usual technique, or if a non-meditator, to perform the Zen technique of counting from 1 to 10 and back on each breath. Participants were asked to fill in a questionnaire so we could understand what was happening during their meditative experience for interpretation of the brainwave data.

Analysis of the brainwave patterns identified differences between the two groups (meditators vs. non-meditators), and was used as the basis to formulate a preliminary set of rules for the visualisation tool. The key findings are summarised here, with a view to informing the model and rules. It should be noted that our interpretation of the different types of EEG data may not correspond to those of scientific studies, as it is shaped by the limitations of the Neurosky Mindwave headset (see Discussion).

We can see from the graphs in Figure 3 that during the activity of reading a book, participants' brainwaves were seen to be more active than during the meditation activity. The most dominant brainwave recorded each second when not meditating was mostly the theta brainwave. The amplitude of theta (blue) brainwaves reduced when participants were meditating. During the meditation activity, red (low alpha) and green (high alpha) are the most dominant brainwaves, as expected from scientific studies.

When external distraction (especially noise) occurred, an increase of theta (blue) brainwaves was observed (the spikes in the graph). On examining the graph in Figure 3 (ii) we can see that the participant with no meditation experience was distracted several times, however this participant's brainwave was fairly constant in meditation status as indicated by the levels of high alpha (green) brainwaves. In Figure 3 (iv) the participant's (5 years experience) most dominant brainwave is high alpha (green) brainwave, which was relatively stable despite the occurrence of distractions. In Figure 3 (vi) the participant's (13 years experience) most dominant brainwave is low alpha brainwave (red). More distraction stimuli (loud sound) occurred for the 13 years experienced meditator, however that person never got fully distracted, and the alpha brainwave amplitudes were very high and constant. After the meditation session was completed, the participant of 13 years experience

was asked about the distraction and answered that it had been felt as a vibration, but did not affect the participant because the Mantra practice created a buffering barrier in the mind deflecting the distraction. It can be observed

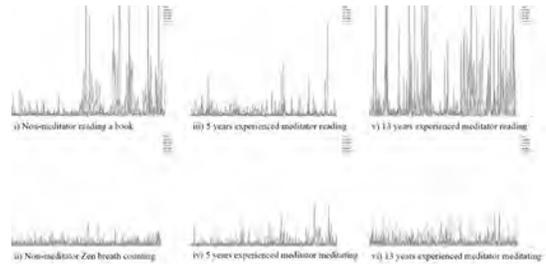


Figure 3: Graphed brainwave data of participants of varying meditation experience, either reading a book (i, iii, v) or practicing a meditation technique (ii, iv, vi)

therefore that the more experienced meditator's brainwaves were more stable than those less experienced.

These observations would indicate that – in the context of this study - the theta brainwave is connected to attention and distraction levels. When the attention level increased in normal status or distraction happened in meditation status, then the theta brainwave amplitude also increased over a threshold (150000 ASIC EEG power units, about 32.9 micro volts). Typical amplitude of the basic human theta brainwave is higher than 30 microvolts (Sařabun, 2014). Also the ratio between the peak level of alpha brainwave and the peak level of theta brainwave recorded each second, differs according to the level of experience. The more experienced meditator's ratio between alpha and theta waves was larger, inferring that meditation status could be calculated by the ratio of alpha to theta – this became an important parameter in our model.

This first user study informed the first version of the model of meditation. The rules of the model were focused on representing 'sustainability' of a meditative state of mind, and 'distraction'. Participants were sensitive to external stimuli such as noise if it occurred during meditation. This was applied to the 'distraction' effect and it was interpreted as a negative moment and not in the meditative state. For the purposes of creating a working model of meditation for the visualization tool, we mapped theta brainwaves to attention. In the non-meditation state, attention is interpreted as a positive factor in this research. However, attention is interpreted

as a negative factor and called ‘distraction’ in the meditation state.

In psychology and cognitive neuroscience, ‘attention’ is a polar opposite concept to ‘distraction’. Both fields use the definition of attention, which was first defined by William James in the late 19th century (James 2007). Attention is defined as focusing on one thing whilst ignoring other things happening at the same time. In our model of meditation, we decided to work with levels of attention and distraction as represented by theta brainwaves. The choice of theta waves was related to how the Neurosky Mindwave measured brainwave activity via the single electrode attached to the forehead. It is possible that other headsets or higher-resolution devices may produce different readings, leading to a different mapping between types of brainwaves and categories of mental activity.

User Evaluation of Visualisation Tool

In the second study, 11 participants were asked to evaluate recorded sets of brainwave visualisation patterns, generated by the initial version of the visualisation tool using the data from the first study. The aim of this study was to find out how well the visualisations enabled the viewers to differentiate between trained meditators and non-meditators. The majority of participants (7 out of 11) were able to discern the differences in the patterns of data from meditators and non-meditators. They perceived scale, colour and the rate of change as the most important variables to differentiate visualised patterns representing the different stages in the meditation model.

Regarding scale, most participants found expansion of the shapes to indicate a deeper level of meditation. In the design, expansion represents a deeper meditation status and lower level of attention, which is considered as a positive status in terms of meditation. Contraction means opposite to expansion. As a variable, both expansion and contraction are the same criteria used to describe two opposite statuses.

In the mandala patterns, there are colour changes between red circles, and in certain frames several circles were blue. Participants interpreted the blue colour as distractions because of the breaking apart effect it caused in the mandala pattern. The colour code has been changed to eliminate the blue (in RGB colour code to avoid this misinterpretation, blue value goes from 0 to 125 and never exceeds red or green values).

Some participants encountered difficulties in

discerning between the stage of meditation and the stage of deeper meditation, because the difference was only indicated by the size of the whole pattern. This confusion led to changes in the model and visualisation rules to enable clearer differentiation between the two stages.

Adding the Door of Meditation The participants were also asked to contribute their brainwave recordings, obtained in the same way as the first study, in order to increase the sample size for data analysis. One important observation led to a major change in the model of meditation.

When participants opened their eyes after meditation, in the first version the mandala pattern would typically break into particles, symbolising a level of distraction. Surprisingly, several participants did not break the mandala patterns; even when they opened their eyes they appeared to remain in a state of meditation. Their status remained relaxed and they did not have any high values of attention or distraction. Even if there was no distraction, the outer mandala circles shrank down to minimum size. This was interpreted as the meditation level decreasing to less than the attention level (size is determined by the ratio between meditation level and attention level). As a result, one more variable was added in the code to measure how relaxed people are.

Through the observation of the brainwaves becoming calm in the state where there was no distraction right after the meditation, this was considered as a relaxed state, which is not actually in the meditation state itself. This state was described as the ‘Door of meditation’ and it was added to the model; to signify the door to enter a state of meditation. Previously participants could create the mandala patterns if they stayed calm and relaxed with low amplitude of brainwaves. After the Door of Meditation was added to the model, it was not as easy to create mandala patterns as before. This may not be an entirely accurate representation of the meditating mind, but it is a first approximation to a working model of meditation for visual design exploration.

Evaluation by Meditators of Their Own Data

In the third study, 10 participants were invited to meditate for 10 minutes whilst having their brainwave activity recorded with the visualisation tool. The aim of this study was to evaluate how well the visualisations reflected the personal inner experience of the meditation session, by the meditators themselves. After the

meditation session, the participants watched four minutes of the visualisations they created with their own brainwaves and then filled in a questionnaire related to describing the quality of their current body/mind state and sense-making of the visualisations. The final task was a video-cued recall in which they were asked to interpret and match the displayed imagery with their just experienced meditation session.

The participants were able to easily differentiate between the four stages of the meditation model, however they found it difficult to distinguish the meaning of the different stages. Most of the participants had no prior knowledge of the rules for the visualisation. Personal preference of the colours and visuals was the major factor when interpreting the meaning of the stages. P2 and P8 correctly interpreted stage 1 as a distracted state and felt that the red and green colours of the circles and squares in stages 2 – 4 represented a calm meditative state. In contrast, P4 and P5 described the blue flash in stage 1 as a calming presence, which represented in their opinion a meditative moment or state. This is contrary to the intent of the visual design for the blue symbol to represent distraction.

The shapes in stages 2 – 4 were also interpreted differently. P4, P5, and P7 thought that the squares represented thoughts and conflict, while achieving a state of meditation was represented with the circular shapes. For example, P7 depicted the squares as work, circles as life and the blue pulse as his children, while others such as P5 interpreted the squares as thoughts and the round objects as representing his meditative states.

Generally, participants found it difficult to align their personal meditative experience to the visualisations, with only P8 and P9 stating that the visualisations represented their inner meditative process very accurately, and only P4 felt that watching the recorded visualisation was somehow like meditating again. When watching the visualisations, 3 out of the 10 participants found their curiosity increased when they focused on the mandala patterns.

The expansion and contraction of the mandala patterns were obvious for almost all of the participants and they understood that the adjustment in size was a change in state. However, similar to the colour and shape opinions, participants had contradicting ideas about the meanings of the change in size. Some of the participants, such as P2, expressed that the smaller mandala patterns represented a need to concentrate, while P3, P4, and P6

thought the smaller pattern represented concentration and calmness.

Visualising the Meditating Mind: Challenges

Now we discuss the challenges revealed through our studies in creating aesthetic visual designs for representing the meditating mind. Of particular interest are the findings from the third user study, where we probed participants about their interpretations of the visualisations and whether the choice of pattern designs reflected their personal inner experience of meditation. As described in the previous section, there were conflicting interpretations of what the symbols, shapes and colours were supposed to represent. The major issue revealed through this third study is the tension between users' personal interpretations of the quality of their meditation and how it should be depicted through the visualisation, and what the brainwave sensor data is telling us about the meditating mind.

Although many participants in the second study could logically infer the meaning of the visualisation and link the visual parameters to concepts of meditation such as slowing of speed representing a tranquil mind, and expanding circles as representing going deeper into meditation, most participants in the third study found little connection between their own experience of meditation and the interpretation of the visualisation. Two aspects of the visual design stand out as contentious.

The first aspect is the use of the Buddhist mandala symbol, and the associated shapes and colours. Central to the mandala symbol is the combination of the circle and the square, representing unity and the essence of the Buddha, respectively. These shapes and the various colours found in Buddhist mandalas were incorporated in the visual design. For those participants not familiar with the cultural and spiritual meaning of these symbols, they found the geometry of the square jarring with their idea of how the qualities of meditation should be visually represented. The colours of bright red and green often appear in mandala illustrations, and thus were mapped to low and high alpha brainwave signals. However, some people disliked the use of these two bright colours and interpreted them according to Western convention as red meaning danger/heat. Thus, some participants found it confusing when red appeared in the stage of the visualisation representing a state of meditation.

This lack of consensus on what the patterns represent means the visualisation tool can be incorrectly

interpreted by participants. Therefore, it might be useful to note that either the participants should be aware of the mandala patterns' meanings or the participants should be able to customize the visualisations to their own preference.

The second aspect is the meaning of the blue flash as depicting a level of distraction. The observation that some participants interpreted the blue flash as a moment of meditation, instead of distraction, runs contrary to the assumptions we held in interpreting the sensor data. Interestingly, what this reveals about the personal experience of meditation, is that many meditators evaluate their own experience during the practice of meditation as having only fleeting moments of what they deem to be 'in a meditative state'. In contrast, from the first and second study, we could see relatively stable brainwave signals indicating the presence of alpha brainwaves, especially for experienced meditators. For most participants, a loud noise acted as a distraction, which registered as a spike in the theta brainwave signal, often accompanied by a decrease in alpha brainwaves. The relative interplay between calculated values of distraction, attention and meditation based on the sensor data were fundamental to the model of meditation we developed and the associated visualisation rules.

It should be noted that our model of meditation is contingent upon the reliability of the data provided by the Neurosky sensor. The error of the device is too high for clinical use (Roesler, Bader et al., 2014). Some important differences must be highlighted between the data from the single electrode of the Neurosky and scientific studies with full head coverage by multiple electrodes. Due to the positioning of the electrode on the forehead, the EEG data is limited to the frontal lobe of the brain – this will impact on the kind of data measured and how we can interpret the data. Scientific studies have shown that the alpha amplitude of the occipital region of the brain is bigger than that of the frontal lobe. However, when we recorded normal status and meditation status with the Neurosky, the biggest difference between the two was the theta amplitude. This led to the decision to interpret the level of theta brainwave amplitude as an indicator of distraction, in combination with the levels of alpha brainwaves.

Commercial flexible sensors like the Neurosky or another EEG headbands do not have as many sensors as clinical devices. We are aware of this potential issue, but do not see it as an obstacle to a first step in

design exploration of appropriate aesthetic visualisation patterns to represent dynamically changing brain states in meditation. The knowledge gained through this design exploration process can be applied to future improvements, and adapted to the type of data provided by different brainwave sensors.

Conclusion and Future Work

Our paper explored the design of a visualisation tool by examining the aesthetics of brainwave data in the creative process. We presented the results and findings of the development of the visualisation tool that aesthetically represents brainwave data of meditators using a commercial EEG sensor. Despite positive results in the second user study regarding the ability of viewers to discern between meditators and non-meditators, a third user evaluation study revealed some issues regarding how well the visual design aligned with the inner experience of the meditators.

More investigation is required into the effect on brainwave data of longer (than 10 minutes) durations of meditation, which could lead to a revision of the meditation model. Future development of Narcissus Brainwave will include a fourth user evaluation to determine if changes in the visualisation can better assist participants to understand the states more clearly, and more authentically reflect the complexities of the inner experience of the meditating mind.

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Bag-Bug: Adaptive Horizontal Transfers

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Abstract

Integrating biological data and phenomenon in the creative process, and proposing a transversal reflection considering the subthemes for ISEA 2017, “Bag-Bug: Adaptive Horizontal Transfer” is an invitation to reflect on the intersections between biocreation and heritage from a cross-scale perspective. Beyond media, does bioart have the capacity to preserve heritage? The ongoing project is a tribute to the Brazilian artist Helio Oiticica’s work “B50 Bólido Saco 2 ‘Olfático’ (1967; plastic and coffee)”, consisting of a series of apparatus exploring genetic information horizontal transfers due to the eventual molecular scale superficial contaminations/transferences. Customized sleeping bags – plastic, coffee beans and electronics (sensor module, microcontroller and displays) – and the whole body of someone from the audience gets involved in a cross-scale conversation that can potentially consist in a “Horizontal Gene Transfer Session (HGTS)”.

Keywords

Horizontal Gene Transfer (HGT), Bioart, Biocreation and Heritage, Metagenomics, Helio Oiticica, B50 Bólido Saco 2 Olfático.



Figure 1 A close-up view of the coffee berry borer. (Image source: <http://newscenter.lbl.gov/2015/07/14/microbes-coffee-pest/>)

Introduction

Horizontal gene transfer (HGT) involves the nonsexual transmission of genetic material across species boundaries. Although often detected in prokaryotes, examples of HGT involving animals have become commonly detected. In 2012, Ricardo Acuña from Cenicafé - Centro Nacional de Investigaciones de Café, in Manizales, Colombia, studied a case of adaptive horizontal transfer of a bacterial gene to an invasive insect pest of coffee by analyzing the genes that are switched on the little bug’s guts – the coffee berry borer (figure 1). One of them – HhMAN1 – creates a protein called mannanase that breaks down galactomannan, one of the major carbohydrates in coffee beans. The bugs in question aren’t meant to have mannanases.

Beyond the natural occurrence of gene transfers, through bioengineering techniques scientists are able to simply insert genes from one microorganism into another. A team of scientists from the University of Austin, as an example, developed a portable caffeine degradation operon by refactoring the alkylxanthine degradation (Alx) gene cluster from *Pseudomonas putida* CBB5 to function in *Escherichia coli* (Quandt et al, 2013).

Bacteria and humans have been swapping DNA for millennia. Studies suggest that gene transfer events can and do occur in human tissues, sometimes with devastating consequences. The human body external and internal surfaces can be seen as constantly open doors for molecular transit – and sometimes this ‘transit’ implies the interchange and recombination of genetic information between species.

Most of microbiome studies have been focused on the health implications of gut microbiome. As a recent phenomenon, a crescent number of labs and companies are running research experiments interested in the microorganisms that populate our glands, hair follicles and epidermis. As an example, as reported by Julia

Scott for the New York Times (Scott, 2014), L'Oréal has patented several bacterial treatments for dry and sensitive skin. According to Doctors Elizabeth Grice and Julia Segre, in a paper published in 2011 at Nature Microbiology, viral communities, as an example, have the potential to modulate states of cutaneous health and disease. Dr Grice collaborated in an effort to establish a resource for the cutaneous research community to guide experimental design in characterizing skin microbiota, presented in a paper in January 2016 (Meisel et al, 2016).

Bug! How dangerous an Olfactive Sleeping Bag can be?

Integrating biological data phenomenon in the creative process, and proposing a transversal reflection considering the sub-themes for ISEA 2017, “Bag-Bug: Adaptive Horizontal Transfer” is an invitation to reflect on the intersections between biocreation and heritage from a cross-scale perspective. Beyond media, does bioart have the capacity to preserve heritage? Additionally, ISEA 2017 can be taken as a call to connect our reflection as artists and its hosting region in Colombia. Accepting the challenge, the work here presented explores metaphorically potential microbiome genetic information horizontal transfers in the specific region in Colombia known as the Coffee Cultural Landscape, declared as a world heritage site by UNESCO

Considering the importance of the sub-theme Bio creation and data, in the Project that is a tribute to the Brazilian artist Helio Oiticica's work “B50 Bólido Saco 2 ‘Olfático’ (1967; plastic, and coffee)” (figure 2), the artist is working in the design of a series of apparatus exploring genetic information horizontal transfers considering eventual microbial and molecular scale superficial contaminations/transferences. Plastic, coffee beans and electronics (sensors, microcontroller and displays) and the body gets involved in a cross-scale conversation through the approximately 2 million holes and surrounding microscopic scale neighborhoods of our epidermis. Considering the fruition of the artwork, the intention is to have 2 ‘bagbugs’ set up in an open space – that could be a collective exhibition space, where several apparatuses – the ‘BagBugs’ – will be setup on the ground allowing the audience to lay down on it. The dimension of the ‘BagBugs’ is 2,0 meter x 1,2 meters x 5 to 10 centimeter high.



Figure 2 Hélio Oiticica, B50 Bólido Saco 2 ‘Olfático’ (1967; plastic, coffee). (Image source: <http://espacohumus.com/helio-oiticica/>)

The term ‘bólido’ is used in astronomy to refer to an extremely bright meteor that explodes in the atmosphere. According to the TATE Modern (2016) web archive, Hélio Oiticica “[...] discussed the title of the Bólido series in 1979, stating that it was inspired by Brazilian director Humberto Mauro’s 1933 film *Ganga Bruta* (Brutal Gang)”.

According to Angela Varela in her master thesis about Helio Oiticica's Bólidos, there is not a fixed definition for a Bólido – it has as many definitions as its realizations (Varela, 2009). According to the researcher, if it is considered as an ongoing process more than an object, a Bólido offers open possibilities for a creative behavior. According to Hélio Oiticica (Oiticica, 2017) the B50 proposes the discovery and experience of the smell. Our proposition critically extrapolates the intention of the B50, considering an arts and science approach, and invites to a whole body experience since the audience gets immersed in a cloud of invisible particles-microbiome that can be perceived and recognized through the sense of smell and that can be distributed along the body surface – like a coffee microscopic snowstorm.

Adaptive Transfer: Cross-scale heritage

According to Cordero and Hogeweg, horizontal gene transfer is one of the most dominant forces molding prokaryotic gene repertoires that can be as small as ≈ 200 genes in intracellular organisms or as large as $\approx 9,000$ genes in large, free-living bacteria. As the researchers defend, long-distance horizontal gene transfer (dHGT) can have a cumulative impact, increasing nonlinearly in large genomes (figure 3). Caffeine imparts a bitter

taste that inhibits insect feeding and can also intoxicates insects by inhibiting specific cellular activities.

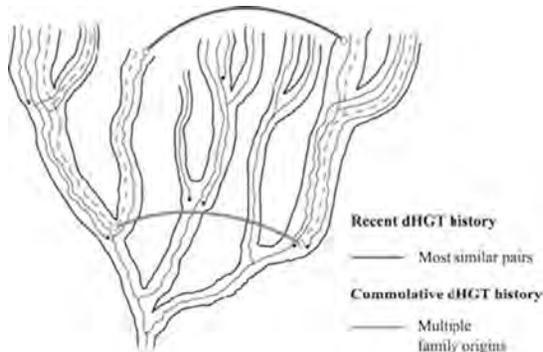


Figure 3 Illustration of the ancestral and recent dHGT events. (Image source <http://www.pnas.org/content/106/51/21748.long>)

Caffeine toxicity is also related to its negative effects on DNA repair and recombination. Because of its demonstrated negative effects on insects caffeine is considered a natural pest repellent. According to Ceja-Navarro (Ceja-Navarro et al., 2015), while over 850 insect species can feed on other parts of the coffee plant, and a few of them occasionally on the coffee seed. As reported by the researchers, “[...] only *Hypothenemus hampei* (Ferrari) (Coleoptera; Curculionidae: Scolytinae) has developed the ability to feed and complete its life cycle solely on the economically important caffeine-rich coffee bean” (Ceja-Navarro et al., 2015). The coffee berry borer *Hypothenemus hampei* is now present in most coffee-producing nations (figure 4) and the cryptic life cycle inside the berry makes insect control extremely difficult.

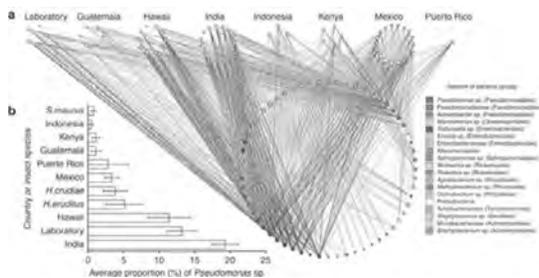


Figure 4 The core gut microbiome of *Hypothenemus hampei* specimens collected from multiple coffee-producing countries. (Image source <http://www.nature.com/articles/ncomms8618>)

The hypotheses present by some scientists is that HGT between the bug and a specific kind of bacterial is the responsible for the bug ability in digesting caffeine, that, before this transfer, was toxic for the animal. According to Ceja-Navarro (Ceja-Navarro et al., 2015), caffeine degradation in *Hypothenemus hampei*, is primarily mediated by the activity of its gut microbiota. He and his lab team present an interesting study of the microbiome of *Hypothenemus hampei* and its role in the detoxification of caffeine in the insect, documenting the discovery of a microbiota component to the transformation of caffeine and subsistence of *Hypothenemus hampei* on coffee beans.

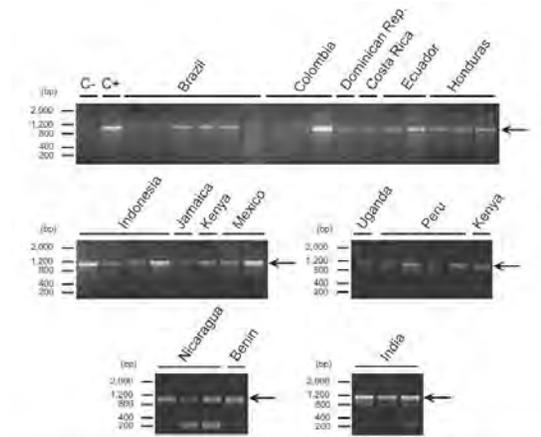


Figure 5 Detection of HhMAN1 in genomic DNA from a geographically broad range of *Hypothenemus hampei* accessions. (Image source <http://www.pnas.org/content/109/11/4197.full.pdf>)

It is important to remember that it was in the paper published in 2011 in the Proceeding of the National Academy of Sciences of the United States of America (Acuña et al., 2011) that the study was the gene HhMAN1 from the coffee berry borer beetle was identified showing clear evidence of HGT from bacteria since HhMAN1 (Figure 5) encodes a mannanase, representing a class of glycosyl hydrolases that has not previously been reported in insects.

Bag-Bug: HGT-Bólide

The human body external and internal surfaces can be seen as constantly open doors for molecular transit – and sometimes this ‘transit’ implies the interchange and recombination of genetic information between

species. According to a study on microbial horizontal gene transfer in humans, HGT candidates in a human microbe may originally come from either external microorganisms or from other microbes within the human body (Li Liu et al, 2012). The research show that horizontal gene transfer occurs between human microbes from different sites of human body. In the panel presented below (Figure 6), the microbial communities C2, C3, C6 and C9 contain high fractions of gastrointestinal microbes, but also many microbes from the skin and urogenital system. Oral microbes are mainly distributed on communities C1, C2 and C5, and frequently transfer and receive genes among themselves and to and from gastrointestinal and urogenital microbes. Skin microbes were mainly found in communities C10 and C12, and interact with gastrointestinal, oral and urogenital microbes.

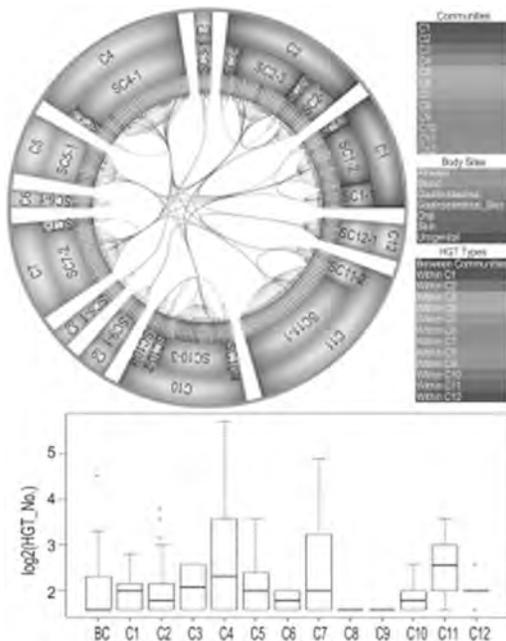


Figure 6: Horizontal gene transfer network of the human microbiome. The panel shows the hierarchical structure of the HGT network composed of 165 reference genomes. The 12 parts represent microbial communities with their respective subcommunities. (Image source: <http://www.sciencedirect.com/science/article/pii/S0888754312001577>)



Figure 7 Bag-Bug: Adaptive Horizontal Transfer (Digital COLLAGE by the author)

Considered as a contribution to the reflections on biocreation and heritage for ISEA 2017, “Bag-Bug: Adaptive Horizontal Transfer”, consists in a series of sleeping bags filled with Colombian coffee beans from the region known as the Coffee Cultural Landscape. Considering that the superficial molecular transfer is a fact, the audience will be invited for a ‘contamination session’ or, better to say, a “Horizontal gene transfer Session (HGTS)” where the whole body surface – external and internal (mouth, ears, eyes, nose) will be exposed or suitable for microbial and molecular scale interchanges.

Despite the evident metaphorical character of the work, HGT from coffee beans and powder microbiota can potentially happen since some of these microorganisms can be integrated in the population that inhabit different parts of the human body, including the skin, mouth, and intestinal tract. Considering that coffee is one of the human foods and beverages that are made from mixed microbial fermentation, Pectolytic enzymes from *Erwinia dissolvens* and *Bacillus* sp., and yeasts in the genera *Saccharomyces* and *Endomycopsis* are involved in the process as are lactic acid bacteria (*Lactobacillus*, *Leuconostoc*, and *Streptococcus*) (Hock, 2001). A considerable microbial population is persistent in the commercialized coffee beans and powder. This population can nowadays be documented thanks to the use of next generation sequencing (NGS) such as metagenomics, phylobionics, and metatranscriptomics (Tamang et al, 2016).

In “Bag-Bug: Adaptive Horizontal Transfer”, the electronic part of the apparatuses will be constantly collecting data from the air near the apparatuses surface that is in contact with the human body using a DSM501A (Dust sensor module) for Arduino (Figure 7). This

way, the microbial-particles' cloud can be digitalized and visualized as numerical information, feeding the imaginary of the audience with 'quantitative information related to the possible actual 'microbial and molecular scale transfers'. Both actually and metaphorically, the microbial population that is integrated with the coffee beans that has inhabited the Colombian landscapes for millennia, carrying an environmental biological heritage, will be in a cross-scale transit – potentially changing the audience microbiome configurations and possibly producing recombinant genetic scenarios that will be shared and spread all around the world.

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Hello, World. The Artist's Palette Using New Media among Atoms, Bits, and Connectivity

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Abstract

The present work looks into the specificity of the artist's palette with new media, focusing the analysis on the association between bits and atoms within the artistic field. The concepts of materiality, immateriality and neomateriality are examined to describe the particular features assumed by the dichotomy tangible/intangible in Art with New Media. Through the analysis of a corpus of works, we present a set of possibilities, issues and questions from our times, examined in context under the light of artistic movements from the 20th century like Conceptual Art and Pop Art. Finally, we explore the role of computer code—and the datum—in the expansion of the expressive palette.

Keywords

Bit, Atom, New Media, Expressive Palette, Artist, Materiality, Immateriality, Neomateriality, Data, Poetry

Introduction

The word 'Multimedia' emerged to designate a new practice mediated by digital and electronic devices. Formed by the prefix 'multi' and the noun 'media', this term focuses its meaning on the idea of a multiple set of media somehow articulated in a convergent way. It is proposed as a descriptive concept, emphasizing the quantitative dimension.

In relation to the name of the discipline, it is important to mention the concept proposed by Dick Higgins from the Fluxus movement in 1965, who coined the term 'Intermedia' to designate the production of those times, which seemed to fall in between media, without being encompassed by any of the rigid categories marking off boundaries between artistic disciplines. As Higgins (1966) explains:

For the last ten years or so, artists have changed their media to suit this situation, to the point where the media have broken down in their traditional forms, and have become merely puristic points of reference. The idea has arisen, as if by spontaneous combustion

throughout the entire world, that these points are arbitrary and only useful as critical tools, in saying that such-and-such a work is basically musical, but also poetry. This is the intermedial approach, to emphasize the dialectic between the media. A composer is a dead man unless he composes for all the media and for his world. (Higgins, 1966)

In 1995, Higgins created a chart to represent these zones of disciplinary intersection. We should also note the out-line he drew in 1981 in relation to the Fluxus proposal from the 60's.

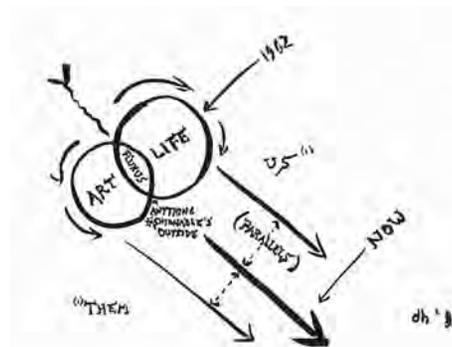


Figure 1. Fluxus Chart. 1981. Author: Dick Higgins. Source: George Maciunas Foundation Inc.

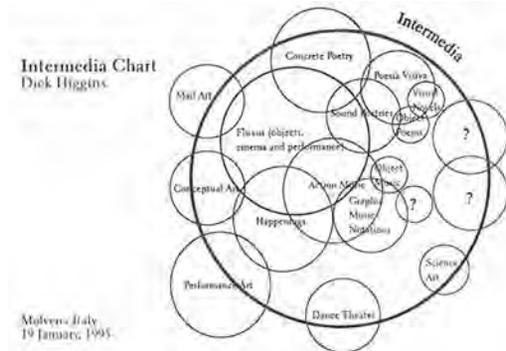


Figure 2. Intermedia Chart 1995. Author: Dick Higgins. Source: George Maciunas Foundation Inc.

Both terms—'Multimedia' and 'Intermedia'—underscore the material constitution of the works, i.e. the media they form part of as they are created, as a consequence of belonging to a certain type of disciplinary practice. Nevertheless, the 'Intermedia' concept may be extended beyond a quantitative description to establish, through the prefix 'inter', a certain focus in the association between media, an aspect that is materialized in the chart and the overlapping zones indicated.

Multimedia in the Era of Personal Computing

Multimedia from the 90's appeared with the emergence of the personal computing paradigm and the desktop metaphor. Thus, the first multimedia productions were made in CDs or DVDs, constructed by the combination of images (both fixed and moving) + sound + interactivity. In this scenario, experience was always circumscribed to the monitor limits and to conventional interfaces (keyboard and mouse). Atoms (the physical) and bits (the virtual) were presented as clearly separated. An example of this model may be found in the work «Eve», by Peter Gabriel, developed in 1996: a 360° environment which offered a tour through different spaces presenting playful challenges.

Emphasis on the visual character of multimedia, in the first place, and on sounds, in the second place, was a constant feature. The next prevalent feature was interactivity and the possibility of swapping images and sounds, creating a particular journey in each interaction, which exalted nonlinearity and choice as distinct features in these multimedia experiences. Even though these experiences and configurations are associated with

the beginnings, the current Internet browsing model follows the same principles: we get in contact with contents—primarily images, sounds, and text—through a screen where we focus our attention.

In this sense, the first phase of multimedia would focus on its construction through the combination of preexisting media, prioritizing two-dimensional images—now built out of pixels—and acoustic stimuli. This first phase, on the other side, was characterized by a break from other artistic practices. Analogical disciplines would see in image production based on pixels and audio files an irreconcilable difference between the world of analogical technique and the enigmatic world of hardware and software. This is the reason why digital artists and artists working with analogical materials believed they spoke different languages and were even in different dimensions—two-dimensional and three-dimensional, material and immaterial.

Multimedia in the Era of Ubiquitous and Physical Computing

At the beginning of the 21st century, in addition to this monitor-based practice, a new expansion of the Computing field towards the three-dimensional space was incorporated. The Interactive Installation was one of the genres that were strongly impacted by this change, where the monitor screen was not the exclusive space for multimedia experience.

Almost at the same time as Gabriel's project, other artists experimented with different formats. A work like «Genesis», by Eduardo Kac, already envisioned in 1998 different paths for the discipline, in the intersection between Art, Science, and Technology.

The work takes an extract from the Bible, which is translated into Morse code, and this in turn is translated into DNA pairs. Bacteria are placed in a Petri dish and exposed to ultraviolet light (operated by the public), which accelerates the mutation process of the "artistic gen" applied to the bacteria. Once the experience is over, the DNA pairs are back-translated into Morse code to finally get back to the Bible extract mutation.

A more recent work, "Data Falls" by Domestic Data Streamers from 2014, proposes to take data from public behavior in an exhibition into the material plane. Measuring the time people stand before the works of art, collected data are turned into sand grains that fall within large hour-glasses with the intent of materializing something as imperceptible and subjective as spectatorial delight.

Both this work and the preceding one—and some

examples we will mention later in this work—introduce different modes of articulation regarding Multimedia through the monitor.

These differences may be understood in the wider landscape of changes in the field of computing development and interfaces. Specifically, this line of work may be interpreted under the light of technological eras proposed by Mark in the 90's:

The important waves of technological change are those that fundamentally alter the place of technology in our lives. What matters is not technology itself, but its relationship to us. In the past fifty years of computation there have been two great trends in this relationship: the mainframe relationship, and the PC relationship. Today the Internet is carrying us through an era of widespread distributed computing towards the relationship of ubiquitous computing, characterized by deeply embedding computation in the world. (Weiser, 1996)

We are immersed in the era of miniaturized devices, which get more and more powerful, capable of surpassing the boundaries of the monitor. "Ubiquity" is a hallmark of our times regarding computing devices. These changes require reflections on materiality and the dematerialization processes.

Materiality, Immateriality, Neomateriality

Art, from a classical perspective, from Plato to the present day, resonates with the idea of materiality—sensible matter as a substance to mold. This implies combining and recombining atoms in multiple ways. In 20th-century Art, many of these considerations are reformulated, though running in parallel and under different forms.

In his 'Six Memos for the Next Millennium', when analyzing the principle of 'lightness', Calvino (2008) states:

Today every branch of science seems intent on demonstrating that the world is supported by the most minute entities, such as the messages of DNA, the impulses of neurons, and quarks, and neutrinos wandering through space since the beginning of time. (p. 24)

In the reference to the idea of scientific paradigms there is matter dialoguing with a more subtle, invisible dimension. If matter may be perceived through the

senses, thinking about the imperceptible leads to revising the role of materiality in the world and in Art.

The advent of computing devices introduced the notion of 'Bit', a neologism that condenses the words Binary Digit.

It is defined as a digit which is capable of assuming either of two states: 0 and 1; on or off. It is the base principle for computer calculation. Its disruptive emergence introduced conscience about an immaterial dimension, with a marked focus on abstraction.

Philippe Dubois (2001) states that, in terms of image production machines, we are witnessing a growing dematerialization process, which with the synthetic (digital) image has reached its peak. When defining this state of affairs, he affirms:

We are far away from the matter-image of painting, the fetish object of photography, and even the dream-image of cinema which comes from a tangible still image. It is more of an abstraction than an image. Not even a spiritual vision, but the product of a calculation. (...) From there undoubtedly arises, as a compensatory reflex, the particular impulse in that sphere towards everything that comes from the reconstitution of materiality effects. The lack of materiality in computing is such that every aspect related to touch is of uttermost interest. (p. 28)

The image still constitutes the point of reference; the visual element is the main basis for analyzing the changes that take place in terms of media. Acknowledging Dubois lucid argumentation, we could wonder if this immateriality aspect has any precedents in the artistic field, in order to find threads in history that may allow us to understand continuities and disruptions in contemporary art.

In this sense, we believe it is important to recover some of the ideas developed in the 60's, particularly the idea of 'dematerialization of art' introduced by Conceptual Art. Lucy Lippard (1968) states:

During the 1960's, the anti-intellectual, emotional/intuitive processes of art-making characteristic of the last two decades have begun to give way to an ultra-conceptual art that emphasizes the thinking process almost exclusively. As more and more work is designed in the studio but executed elsewhere by professional craftsmen, as the object becomes merely the end product, a number of artists are losing interest in the physical evolution of the

work of art. The studio is again becoming a study. Such a trend appears to be provoking a profound dematerialization of art, especially of art as object, and if it continues to prevail, it may result in the object's becoming wholly obsolete. (p. 31)

Lippard's statements are in agreement with Dubois (2001) who describes the process of progressive image dematerialization as becoming "less and less 'object,' and more and more 'virtual'" (p.28)

Arthur Danto (2000) points out: "(...) conceptual art demonstrated that there need not even be a palpable visual object for something to be a work of visual art" (p.35).

The gradual loss of interest in" the physical constitution of a work of art and the emphasis on the conceptualization process allowed the emergence of an Art trend which enabled immateriality to become an instance of artistic modeling; art would not only be performed on the sensorial plane, but also on the intelligible plane. Participation aesthetics and digital media constitution may be interpreted as the continuation of some of these principles.

North American group Swamp created the work "Spore 1.1" and put to the test the promise of a company—Home Depot—to provide an unconditional 1-year warranty for the plants they sell. The work creates an ecosystem composed of a plant bought in Home Depot, and a system with Wi-Fi connection that monitors the company stock values in the market. If values increase, the plant is watered and, therefore, it can grow at the same rhythm as the company's economics. On the other hand, if values go down, the plant dies and is returned to Home Depot for replacement.

Another interesting work that is worth noting in this sense is «Drawing with Global Technologies» by Andrea Di Castro. Movement through air or sea is registered by tracking coordinates via GPS and then converting them into visual strokes. As expressed by the author (Di Castro, 2015), "movement is turned into a stroke, with nature as its medium". Thus drawings can become as large as hundreds of kilometers.

In the examples referred to above we can observe a material form sculpted by an immaterial principle that is a consubstantial part of the work: stock exchange values representing a volatile and immaterial financial system; movement by earth or air across long distances; the degree of interest in a certain work.

If 'bits' are associated with dematerialization and 'atoms' with materialization, it may be interesting to think about what happens when both dimensions, far from presenting fixed or clear-cut boundaries, connect with each other, in new forms or formations.

In a recent article, theorist Christiane Paul (2015) reflects about materialities in the context of digital technologies and art, and proposes the term 'neomateriality' as a current condition of matter and objectuality:

Neomateriality describes the embeddedness of the digital in the objects, images, and structures we encounter on a daily basis and the way we understand ourselves in relation to them. It finds different kinds of expression within contemporary culture and artistic practice in the form of objects or artworks that 1) use embedded networked technologies, reflecting back their surrounding human and non-human environment; 2) reveal their own coded materiality as part of their form, thereby becoming them-selves a residue of digital processes; 3) reflect the way in which digital machines and processes (seemingly autonomously) perceive us and our world. (p. 1)

We could mention the work «City Rythms» as a manifestation that responds to this condition of the present times. Artists Mar Canet and Varvara Guljajeva take geolocalized data from Twitter, Flickr, and YouTube activity as raw material and translate it into various metronomes moving to the beat of content flow uploaded from different cities around the globe. As the authors themselves explain:

Our concerns are about the malleability of the digital world to the physical one, and the interpretation of social data for artistic purposes. (...) The installation is a sonic and at the same time visual interface for perceiving the urban life and culture of different locations. Moreover, it gives an alternative meaning and purpose to the location-specific invisible online data. (Canet, Guljajeva, 2011)

This is an explicit manifestation of the particular malleability that the digital world may impose on the physical world, and the possibility of using—as raw material to be molded—social data, which are invisible as statistical results about collective behavior in cyberspace but which are operated from specific physical coordinates.

In this sense, the object—the materiality—is transformed and, in the pendulous regularity that characterizes it, a wedge is introduced: it responds to the bits flowing in from an invisible torrent, a force that informs the form.

This neomateriality, according to Paul, responds to a post-digital and post-Internet stage in art. In these terms she refers to “a condition of artworks and “objects” that are conceptually and practically shaped by the Internet and digital processes yet often manifest in material form” (Paul, 2015, p.1).

This is where, within the field of Art, we may recognize the presence of the Ubiquitous Computing paradigm as the era following the Personal Computing era. In order to understand the depth of the changes that have taken place and the potential changes in the aesthetics sphere, we need to dive into the scope of this neomateriality, the constitution of the digital medium as such, and its relationship with atoms.

Digitalization as a Metamedium

In his celebrated book “Expanded Cinema”, Gene Youngblood suggests that all the phenomena of life on earth will constitute the artist’s palette. While all the phenomena of life on earth have always been incorporated into the work of art in terms of topics and partially in material terms, the current state of art offers a new landscape regarding materials, in which literally all phenomena may be part of the artist’s expressive palette.

We should also mention a second interesting idea introduced by Youngblood when relating this possibility to technological advance. Of course, computing tools in the 70’s were completely under development but, if this is what he could observe at the time, we might imagine how this perception would have been expanded almost half a century later, with a growing and more fluent association between bits and atoms.

The radical novelty lies in the medium allowing the connections: potentially all analogical differences can vanish in the sphere of mathematical modeling and binary representation. It is this common layer that makes the poetical approach to everything that exists in this world a real possibility, the potential of having the world as content: thus we are able to associate stock exchange values to the regulation of a watering mechanism in the installation “Spore 1.1” by SWAMP; to convert movement in space into a stroke, as in the work of Andrea Di Castro’s “Drawing with Global

Technologie’s”; to have social media posts from some unknown location mark the rhythm of a metronome in some other location; to turn the time one stays in a certain space into sand grains being proportionally released and falling, under the force of gravity, into a container as in “Datafalls” by Domestic Data Streamers.

In his book «Software Takes Command», Lev Manovich (2013) makes use of the metamedium notion to express the profound cultural changes of our times:

[The computer] is a medium that can dynamically simulate the details of any other medium, including media that cannot exist physically. It is not a tool, though it can act like many tools. It is the first metamedium, and as such it has degrees of freedom for representation and expression never before encountered and as yet barely investigated. (Lev Manovich quoting Alan Kay, p.91)

It is precisely the scope of this metamedium that generates a growing connectivity.

It is time we started thinking in terms of not only the substance of matter, but also the patterns that govern matter.

Gregory Bateson coined the term ‘the pattern which connects’ as a primary value when studying life—beyond the study of external differences among species—which becomes absolutely relevant and operational in connection with the field of relational aesthetics. Bateson (2002) states:

In truth, the right way to begin to think about the pattern which connects is to think of it as primarily (whatever that means) a dance of interacting parts and only secondarily pegged down by various sorts of physical limits and by those limits which organisms characteristically impose.

The Bit constitutes a link that connects and creates the neomateriality postulated by Paul. One of the steps in this direction was taken by Hiroshii Ishii from Tangible Media Group, whose main purpose is to provide physical form to digital information. One of the last concepts they have been working with is that of ‘radical atoms.’ Hiroshii Ishii (2012) affirms:

Radical Atoms takes a leap beyond tangible interfaces by assuming a hypothetical generation of materials that can change form and appearance dynamically, so they are as reconfigurable as pixels on a screen. Radical Atoms is a vision for the future

of human-material interactions, in which all digital information has physical manifestation so that we can interact directly with it. (p. 38)

Code as a Material Esperanto and the World's Brush

It belongs to the very character of the creative mind to reach out and seize any material that stirs it so that the value of that material may be pressed out and become the matter of a new experience.

John Dewey

So far in this paper we have examined the uniqueness in the combination of materialities and immaterialities; we have established that the digital code acts as a metamedium and is responsible for the creation of new relational, intersubjective, rhizomatic experiences.

In computing practice, there is a program which is used as a first approach to a new programming language or environment. It is called 'hello, world'. This greeting to the world is the crystallization of the first contact with everything that is beyond code. From a certain perspective, it could be interpreted as a group of words with high symbolic content. The code becomes an abracadabra, an open sesame for the connection of phenomena in the world, in the sense that it is configured as a common layer that encompasses both the substance and the pattern.

Youngblood's aspiration is literally reflected on this initial programming statement. Dewey (2008) also provides an interesting look in relation to materials, society, and their implications for the work of art, as follows:

The materials of nature and human association are multifarious to the point of infinity. Whenever any material finds a medium that expresses its value in experience—that is, its imaginative and emotional value—it becomes the substance of a work of art. The abiding struggle of art is thus to convert materials that are stammering or dumb in ordinary experience into eloquent media. Remembering that art itself denotes a quality of action and of things done, every authentic new work of art is in some degree itself the birth of a new art (p. 258).

This notion of dumb materials in ordinary experience resonates with Pierre Levy's idea about the role of the new artist who sculpts the virtual:

It is less a question of the artist interpreting the world than of allowing existing or hypothetical biological processes, mathematical structures, social or collective dynamics to speak directly. In this sense art no longer involves the composition of a 'message' but the creation of a mechanism that would enable the still silent component of cosmic creativity to give voice to its song. (Levy, 1999, p. 117)

The voice which may leave dumbness behind is, in this context, a product of a connection between bits and atoms. Code would act—in a metaphorical sense—as an Esperanto on the material plane, as a codification which may universalize languages and be proposed as a point of contact among the vast differences in language, media, form, formation, and genre.

The work "Keep Alive" by German artist Aram Bartholl takes a rock and fire as actions to give life to the virtual world of a local network that allows the download of survival guides in PDF, as well as the upload of files to be kept in the network (not the Internet, but a local network).

It is interesting to see how the artist connects two situations that are so distant in time: the ancestral rock and fire regulating the existence of a technological network by turning heat into electrical energy. Here we see a world that is reconciled in space and time—the ancestral is a portal to the contemporary tool, and to survival guides, in a world where technology, apart from its obvious benefits, reveals some sharp edges.

The title makes reference to a code—Keep Alive—which is used to send empty messages among network terminals as a way to maintain connection. What is expressed here—once again, in symbolic terms—is the close link between technology and life.

In this sense, we may reinterpret the chart created by Higgins in relation to the Fluxus proposition from the 60's, a movement that occupied a place of intersection between Art and Life. Considering that Fluxus highlighted the process, we may observe a continuity in relational aesthetics, under different forms, of the principles which pulsed in the imaginary of 20th-century artists.

We may also note how code enables us to work flexibly with the micro and the macro, amplifying or attenuating phenomena, connecting materialities and immaterialities at different scales.

The world is revealed in all its dimensions, and it

is even possible to create a story based no longer on the pixel but on the atom in its constitution as such, positioned in space. This development entitled “A boy and his atom” was carried out by IBM in what they described as the world’s smallest movie. There each atom is part of the constructed image.

This code as Esperanto is what also enables multiple translations. When analyzing various works connecting bits and atoms, we will find this dynamic of passages among different materialities, and fundamentally the association between the intangible and the tangible, in two-way trajectories.

The ‘Datum’ and the Work of Art as ‘Being Made’

When speaking about the end of art, I do not dismiss the possible emergence of unimaginable technologies which could be at the artists’ disposal and have the same spectrum of creative possibilities as easel painting and computers. Seriously, how could I?

Arthur Danto

Bearing in mind the tensions that have arisen throughout history in relation to the place occupied by the *idea* and the *form* in artistic creation, it is time we consider that—in relational aesthetics—a new entity has emerged between *idea* and *form*: the datum, information. Neomateriality implies a set of differential resources in the field of art. Regarding relational aesthetics, Nicolas Bourriaud (1998) states:

The form that each artist gives to this relational production is not unalterable. These artists perceive their work from a threefold viewpoint, at once aesthetic (how is it to be “translated” in material terms?), historical (how is to be incorporated in a set of artistic references?) and social (how is to find a coherent position with regard to the current state of production and social relations?). These activities evidently acquire their formal and theoretical marks in Conceptual Art, in Fluxus and in Minimal Art, but they simply use these like a vocabulary, a lexical basis. (p. 46)

In 2011, Kevin Slavin—in a conference from the series TED Talks—gave a presentation entitled: “How algorithms shape our world”. During his exposition, he analyzed the different ways in which algorithms and data analysis impact various scientific and cultural fields,

warning about how little is known about the effects of lines code. By means of a metaphor, he endowed mathematics with a seismic power:

And the landscape was always made by this sort of weird, uneasy collaboration between nature and man. But now there’s this third co-evolutionary force: algorithms (...). And we will have to understand those as nature, and in a way, they are. (Kevin Slavin, 2011)

At this point, it becomes evident that the datum is acting as a binder connecting the different phenomena in the world. These potentialities open up situations where image and sound, together with all the possibilities of space-time articulation, are no longer univocal resources in artistic creation. On the contrary, the artist’s palette is extended to include a wider set of phenomena encompassing previous resources and incorporating the voice of those phenomena which remained materially dumb, as human behavior, for example. Lucy Lippard (1968) postulates “Dematerialized art is post-aesthetic only in its increasingly non-visual emphases. The aesthetic of principle is still an aesthetic, as implied by frequent statements by mathematicians and scientists about the beauty of an equation, formula or solution” (p.31).

The datum may be born mathematical, that is, begin its existence through its own abstraction or intervene in the process as a derivation of an analogical process turned digital.

The flexibility or fluidity acquired by the atom or bit may be framed within a wider context where liquidity seems to be a hallmark of our times, as Zygmunt Bauman (2004) postulates:

The extraordinary mobility of fluids is what associates them with the idea of ‘lightness’ (...) These are reasons to consider ‘fluidity’ or ‘liquidity’ as fitting metaphors when we wish to grasp the nature of the present, in many ways novel, phase in the history of modernity. (p.8)

The idea of a flow process, modeling the interaction between the solid and the evanescent (the Fluxus movement was a clear example in this sense), acquires a renewed relevance. In addition, if Pop Art recognized that every material could be part of the artistic work, a continuity may be established between Duchamp’s concept of ‘*ready made*’ and the idea of ‘*being made*,’ a

work of art as a process in Present Continuous, flowing between the intangible and tangible dimensions and manifesting itself in the most varied forms, with no frames, no clearly defined boundaries.

Conclusions

The Personal Computer as an initial support for multimedia practices favored the appearance of a rift in traditional procedures and materials when it entered the world of Art, and divided practices in terms of analogical and digital procedures. The idea that bits and atoms can merge more and more and become integrated into various physical media, beyond the image and the sound, would provide a new layer for the creation of interactive media but also fundamentally a layer connected with previous—nondigital—disciplines like sculpture, plastic arts, industrial design, music, theater, etc.

A wide variety of contemporary genres evidence a trend that seems to lead algorithms toward the physical realm and open up a fruitful field of application for finding in bit-augmented atoms new resources to expand the expressive palette of contemporary artists and designers.

In this sense, the concept of neomateriality offers a new point of view, no longer opposing the physical and the virtual, but proposing a scenario of mixture and fluidity between both states.

If Conceptual Art and the notion of dematerialization of art as an object prioritized the thinking process, these days another abstraction process—like the digital medium itself essentially is—can transform matter, endow it with properties that are unimaginable in the purely analogical field.

The concept or the materiality of the work are no longer the two unique and exclusive realms where poetic gestures can be sculpted: the pattern of interconnection between abstract/concrete, analogical/digital phenomena is incorporated as a third factor and, together, they all offer artists working with new media ever-wider resources for the creation of symbolic universes.

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Fluid Processor Design for Ecological Computing - a new Techno-Ecological Computing Paradigm for Sustainability

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Abstract

This paper proposes ways of designing processor like devices operating with nothing else than natural flow of water to execute basic physical computing. Such types of fluid processors carry the potential to form the fundament of future fluid computing devices allowing for complex forms of ecological computing integrated directly into our environment. The proposed design works on natural principles of physics, uses no electricity at all, lasts almost forever and can literally be thrown around. That might sound like a radical, game- as well as life changing form of computing. And it will be. If we up-engineer the many and proven designs of old mechanical, analogue and physical ways of doing computing. So, what is the solution? Future and emerging computers will be carved out of and into stone. Their ornamental design will be more than environmental aesthetics, it will enable physical principles known from fluid and liquid dynamics to interface and interact with our world in multiple and -for now- speculative ways.

Keywords

Fluid processor design, ecological computing, Informed Matter, discursive Design, Environmental Aesthetics, Sustainability.

Introduction

Why construct ecological computing devices? There is an urgent, ontological and existential need for new computing paradigms. Current computers and chip architectures are built on highly un-ecological designs that super-consumes global resources such as electricity and non-renewable resources like rare-earth metals and minerals. How can we change this non-sustainable, high impact and senseless use of natural resources? How to develop alternative, low impact, environmentally friendly, eco-sensing and purposeful ways of computing? Our world needs new forms of computing that use renewable energy as its power source and that aims at improving both the human condition and our environment. The increasing concern for the well being of the human race in the age of the Anthropocene

is a major push towards a responsible onto(logical)-ecological politics.

Techno-Ethically Unsustainability

The current production methods of electronic and digital technologies present us with serious ethical challenges. The Techno Ethics surrounding digital technology is not just the concern for the individual, but it is rapidly becoming an ‘ethics of the globe’ or the globosphere. We need a global ethics to become a synonym for environmental ethics. From this techno ethical point of view, contemporary chip designs are completely unecological. Even if the digital domain appears clean and green, it is far from so.

“The Internet seems clean because its ecological footprint is elsewhere”.

- Jane Anne Morris (Morris, 2016)

Current use and developments in computing appears increasingly unsustainable both from an ethical and ecological point of views. The term *ecology* stems from the Greek *oikos*, meaning home. Consequently the techno-ecological world should provide a situation where we are at home as humans, safe and sound, and healthy. It does not appear to be so. Google alone uses 2,3 billion kWh per year (2013). That is enough to power up to 200,000 US homes for a year. One Google search costs about 10 Calories per search. That is less than a cookie, but the enormous number of searches adds up, not to mentions up- and down-loading of files. Just the sheer daily manufacturing of millions of computers and smartphones for a seeming insatiable world market chips away the world’s resources, slowly and surely. Their production is an extremely material- and energy-intensive manufacturing process.

The enormous global computing infrastructure supports many technologies; from the many mobile phone networks to the all-pervasive internet consisting of countless server farms, routers, switches, optical equipment and the like. This creates a “monster footprint of digital technology”. (Lowtechmagazine, 2009) Estimates of the current 2016 power consumption of the computing industry and Internet are up to 10% of global power production. It is expected to at least triple over the next decade, putting an enormous strain on our power consumption and infrastructure. (Independent.co.uk, 2016) Even if all the power should come from renewable resources it will take an enormous effort to build the necessary future infrastructure, not to mention the catastrophic environmental impact it will cause. We need not follow down this path. There are other and much more sustainable ways of doing computing, even without electricity.

A Brief History of Mechanical and Analogue Computing

The origin of computing could be as old as human have been counting. Our earliest documented example come in the form of Tally sticks that are (still) used to both count and record numbers in relation to everyday life, such as number of livestock, debts etc. The tally stick known as the Ishango bone, dates most likely at least 20.000 years back. (Pickover, p. 26, 2009) The world’s oldest known mechanical analogue computer is the Antikythera mechanism from approx. 100 BC. It was most probably used to calculate astronomical positions and calendric data. Another famous example is the Difference Engine made by Charles Bab-bage in 1822. It was used as a mechanical device to calculate polynomials. After the invention of the transistor that led to the construction of the computer chip in the 50ies, analogue computing and problem solving has been more or less completely replaced by digital technologies. Surprisingly there remains one much used analogue computer today. That is the flight computer, also known as the ‘whiz wheel’ used by many pilots for flight planning.

Other examples of analogue ways to solve physical computing related tasks are found in ancient irrigation techniques. For example clay pot irrigation has been used for millennia to water plants precisely and sufficiently over longer periods through the use of osmotic pressure. (Bain-bridge, p. 79, 2001). Surface irrigation through controlled flooding by contour laterals and channels also

represents a form of practice-based computation through hands-on problem solving with fluid pathways cut along and shaping the surface of soil.

More examples are found in historic garden designs. The garden of Villa d’Este, Tivoli, can be likened with gigantic water computer with all its layers, pipelines, meanders resulting in spectacular flow of water and fountains (Trevi, 2013).

These mentioned analogue ways of doing physical computing remain little if at all used today. The reason for this can be many and lack of speed is one. Another reason can simply be that our culture has unlearned the analogue and often tacit knowledge of the past as the invention of the transistor blinded us with the promise of digital perfection. The knowledge to build fluid processors is around. What we need to do is to piece together the various knowledge and resample them into new devices.

Principles for Future Fluid Computing

In 1964 Stanley W. Angrist describes Fluid Control Devices and how they perform various amplification and switching operations in a mechanically rather than electrically manner, see Figure 1. For some purposes they are more reliable than their electronic counterparts (Angrist 1964). This is nothing less than a description of a simple water based computer whose functionality is solely based on the design of carved channels in combination with the flow and force of liquids. This represents the first principle of how to make liquid processors.

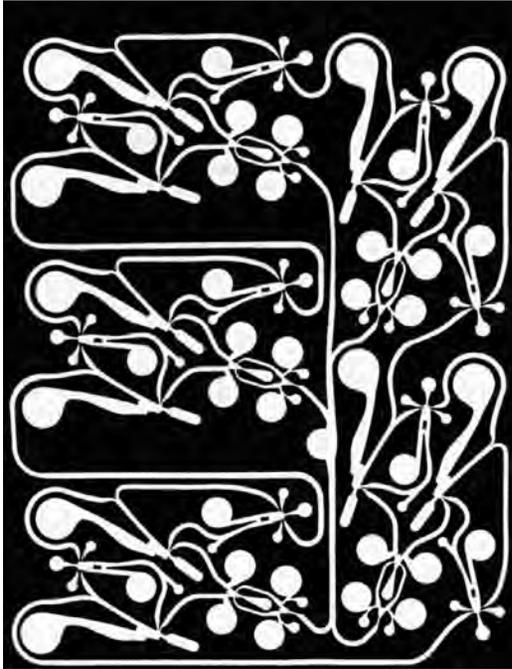


Figure 1. The image shows a fluid circuit that “performs the operation of dividing by 10 in an all-fluid digital computer: for every 10 input pulses circuit delivers one output pulse” (Angrist 1964). ©William Vandivert

Angrist also describes the fluid amplifier consisting “of a solid block of material in which shallow channels have been cut to allow the passage of a fluid”, see Figure 2. When a high-energy power stream hits the splitter directly, this will divide the stream in two. However, the slightest introduction by a control jet from either side will deflect the power stream in the opposite direction. Such fluid amplifier designs represent a second principle of how to precisely control and steer liquid processors.

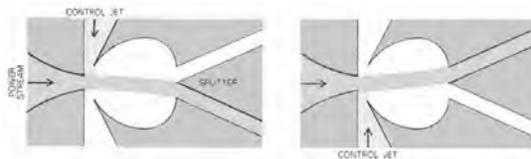


Figure 2. Basic layout of a fluid amplifier (Angrist 1964). © Angrist

Basic Fluid Processor Design

As Angrist describes above, the way of making a functional, precise and lasting processor is principally as simple as carving pathways and channels into solid

material. This basically means we can upcycle into a new Stone Age where processors can be literally carved into stone -or any other hard material- to accomplish physical computing tasks.

Another example that foresees fluid processors was demonstrated by Mertaniemi et al. (Mertaniemi, 2012) In 2012 they carved superhydrophobic channels in a copper plate. By letting small water droplets move down the channels they created a superhydrophobic droplet logic forming an AND/OR gate. Such logic gates arise where droplet collisions affect their output path. This forms another basis for future and alternative electricity-free computing devices. This experiment showed how the droplets can be simply controlled and converted to informed matter. In the context of ecological and speculative computing, what if future rain became exactly that: informed matter? That is ‘information’ as inherently embodied in the water -as well as other natural elements- itself. How could that impact and change weather control and watering of the earth?

Other principles and approaches relevant for the design of fluid processors can be found in the fields of surfactant transport (Leal, 2007, p. 493), cytoplasmic streamings (Wayne, 2009), hydroponics (Licker, 2005, p. 1110), Lagrangian and Eulerian specifications of the flow field (Kiselev et al, 2012), molecular dynamics and not to forget the foundational principle of capillary action and capillary motion where liquid flow in narrow spaces without the assistance of, or sometimes in opposition to, external forces such as gravity.

As this paper only represents an initial approach to the topic, questions that need to be explored are how to practically shape such processors through forming channels in terms of profile, depth and materials. Other issues influencing the functionality of fluid processors are choices of production such as carving, casting or 3d printing. Material choices greatly influence for example durability and duration in nature. Figure 6 shows a cube shaped fluid processor sample printed in bio- degradable corn-starch based PLA plastics. Such a cube is expected to decompose within a few months in hot and humid conditions such as the Amazon.

Discursive and Speculative Design

To explore the principles of building fluid processors and its possible uses, several designs and initial experiments have been conducted inside the Amazonian rainforest. During the Lab Verde Art Immersion program in 2016

(www.labverde.com) I was able to explore some of the principles of fluid computing described above and realize them as environmental sculptures. My approach was practice based, using the methodology of discursive and speculative design (Dunne & Raby, 2013 p.11.). The purpose of this methodology is to ask speculative questions of both how things can function and how/if we want them. Dunne and Raby are proponents of such making and thinking as the odds of achieving desirable futures increase if we open the debate and discussion of what kind of future we want – or not.



Figure 3. Leaf Connector, draft for Liquid Processor distributing water between plants using crafted capillary channels and forces. ©Stenslie 2016

In this context my open and speculative research question was how basic fluid processors could impact the growth of plants in the nutritious poor soil of the Amazon rainforest. My assumption was that they would create fertile microzones where they were placed, increasing, regulating and ensuring growth over time.

Two of my draft designs for fluid computing are he i) Leaf-connector letting different plants share and distribute liquids, securing chances of better growth, see figure 3, and ii) the Fluid Cube (figure 4) where different pathways and channels for the flow of liquids are carved into a solid cube, making up a fluid circuit channeling water in various ways related to its placement in the terrain.

The Leaf-connector is designed to distribute water flows between leaves, thus ensuring a mutually

beneficent and symbiotic growth environment. The initial design and testing confirms basic flow and distribution of water, but micrometer precise shaping of channeling down to the super-hydrophobic levels as well as further tests insitu and in real-life settings are needed to improve design and applications.

The experimental Leaf-connector and the Fluid Cube represent initial approaches to emergent eco-computing based on fluid processors and fluid processing.

Future Applications

For what purposes and ends can these techno-ecological devices be used? The basics of fluid processors are not fit for running smartphone displays or ultrafast computing. These eco-computing devices function differently. They function in ways that give our thinking and action other perspectives. Eco-computing functions not by mechanically trying to reproduce the precision of digital calculations, but by adapting to nature's own way of supporting living structures. Techno-ecological computing is deeply rooted in ecological consciousness, working towards a change in both the mind- and bodyset of humanity. A first line of applications could be using the fluid processors to build complex hydroponic system, collecting and diverging natural available liquids such as rainwater into various chambers and channels, each purporting a different growth and living rate within the same biotopia.

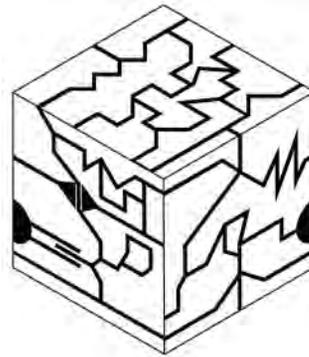


Figure 4. The Fluid Cube: layout of a cube-shaped Fluid Processor showing channels carved into solid material. ©Stenslie 2016

The Fluid Cube is designed to literally be thrown away to function, see figure 5. The flow of liquids and impact on soil is dependent upon how they fall and how

the different sides orient themselves.



Figure 5. Example of how multiple Fluid Cubes can be tossed around on forest floor, liquid flow and functionality depending on the relative position. ©Stenslie 2016



Figure 6. A Fluid Cube: example of Fluid Processor cubes that have been CAD constructed and 3D printed in corn starch based PLA. ©Stenslie 2016

Outlook onto Sustainability and Durability of Eco-Computing

How to make a computing device that is both environmentally friendly and that lasts -if not forever- beyond current life cycles? Present-day computers have an extremely limited timespan, lasting only for a couple of years and over-consuming natural resources. Electronic components and media invariably decay over a lifespan of up to max ten years due to chemical reactions such as oxidation, magnetic fields, variations in temperature, mechanical

components etc., not to mention the rapid change in incompatible software formats. Computer chips can easily be burnt for example by electromagnetic waves. Hard disks tend to become mechanically unreliable after a few years and the new SSD disks are based on electric charges to store information; lasting in best-case scenarios between two to ten years before data retention becomes a serious issue. The consequence is that data decay is increasing at an alarming speed unless continuous and electricity based updating is constantly applied. As the fluid processor design demonstrates, there are alternative ways of thinking computing and information flow. Throughout the relatively short records of art history there is one medium that particularly has resisted decay of information to such a degree that is naturally presents itself as a solution to the pursuit for a new, malleable, representative artistic medium. That medium is stone. As both the Rosetta stone and the rune stone of Harald Bluetooth – the Jelling stone- in Denmark demonstrates, data and artistic expressions inscribed in stone outlast electronic media with literally thousands of years. Similarly, a fluid processor is likely to retain its computing abilities throughout and over the millennia.

Summary

The proposed fluid processor designs represent an alternative way of thinking applied environmental aesthetic by constructing fluid computing devices that respond to everyday and emerging environmental challenges. Carving functions directly into stone and hard materials presents a basic design principle for a future computer chip like architecture that enables an analogue way of computing completely integrated into our environment and natural habitat. Furthermore, the fluid processor carries a potential of turning natural elements such as water into informed matter.

Although such processors function according to known physical principles and liquid dynamics, more practice-based research is to develop fields and application of future use.

The proposed design blueprint for fluid processors as exemplified in the Leaf-connector and Fluid Cube is a bid for a device ecology that enable novel devices to be made, devices that facilitate new, onto-ecological, symbiogenic and sustainable relationships between humans and our environment.

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He has been exhibiting and lecturing at major international events (ISEA, DEAF, Ars Electronica, SIGGRAPH).

His PhD is on Touch Technologies, see virtual-touch.wordpress.com

**Critical Perspectives on the Use
of Technology for Peace**
Papers

Image Manipulation Practices Through the History and Evolution of Photography

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Abstract

Etymologically, photography can be understood as an image painted with light, but in a more complex view, its definition has evolved from the analog processes used since its early days to the digital practices we witness today. Industrialization and new technologies applied to visual arts have affected the way people see these practices, have changed its values and pushed its boundaries, forcing artists and amateur performers to reevaluate the limits and possibilities of their disciplines to approach new territories through innovation and exploration. This paper is intended to make a brief description of the evolutionary process of photography from a historical and technical view, and the transformation of this concept, from the early analog cameras and systems in the 19th century to the digital advances in the 21st century, analyzing the idea of visual manipulation, as an inherent activity to the different cameras and technologies, based on the definition of photography as a form of art. Supported by the case of the Bang Bang Club and the artwork of Kevin Carter, this reflection analyzes different forms of visual manipulation, not intended as an ethical judgment, but as recognition of a constant phenomenon through the history of this practice.

Keywords

Photography, Analog Photography, Digital Photography, Photojournalism, Photo Editing, Graphic Design, Advertisement, Visual Arts, Visual Manipulation, Image Manipulation.

Introduction

Since its origination in 1839 the concept and the idea of photography, as a social, artistic and academic practice, has evolved with every new invention or advance. Industrialization and new technologies, applied to different kind of arts, have affected the way people see these practices, have changed their values and have pushed their boundaries, forcing artists and amateur performers, to reevaluate the limits and possibilities of their disciplines, to approach new territories through innovation and exploration.

Every new invention appears to affect a previous

practice or discipline. Just to name a few examples, photography apparently displaced painting, cinema seemed to displace theater, compact discs displaced vinyl records and in the last two decades digital photography displaced and reduced analog photographic creation to an extreme; it was a common belief that this practice was taking its last breath and had just days left to die.

Same as theater, painting, vinyl records and analog illustration, to name a few antecedents, analog photography has fought for its existence, finding a new place in society, as an artistic practice for consolidated artists looking for a specific style, grain, textures ethics and aesthetics, or aficionados, with a nostalgic approach and feelings for an old practice that seemed to be forgotten.

According to Archundia (2012), from a physical point of view; there's a strong connection between the photographic camera (analog or digital) with the human eye, which focuses and captures different images from its surrounding space.

On a deeper analysis, Archundia (2012) affirms that a picture can tell a story, express feelings like joy or sadness, bring back some strong memories or basically mean nothing to the audience. Therefore, although the picture can be considered as a visual construction, only the perception process gives the image its real value and meaning; as stated by the traditional refrain, the beauty and significance is on the eye of the beholder.

As expressed by Archundia (2012), photography captures a moment through time and space, and its composition and framing are inherent qualities, regardless the analog or digital process, the image only get its real appreciation, meaning and value, while being observed and appreciated by the spectator.

Following a similar direction, Chaparro (2015) considers photography as "...an instrument for the reproduction of frozen realities..." from family stories

to politic and violent events, describing the wide-ranging nature and diversity of this practice, which can be associated with assorted areas like art, graphic design, advertising or journalism among others.

As a whole, this research's purpose is to describe and analyze the evolution and reevaluation of the notion of photography, from different perspectives, approaches and points of view: Academic, conceptual and practical. This paper focuses on this conceptual evolution, exploring the wide range of definitions around it, understanding at the same time the action of manipulation as a permanent practice, same as an inherent and evolving quality of the photographic discipline.

Historical Referents

Photography cannot be understood as a single invention, but as a series of findings, advances and discoveries, evolving from the *camera obscura* or dark chamber, studied by different scientists between the 9th and 10th centuries, to the digital full frame digital cameras, available these days, including chemical, optical and electronic related studies, leading this practice to what we have today.

As explained by Wooters & Mulligan (2010), photography as we know it, is born in the 18th century, from previous light-based processes and scientists like Étienne de Silhouette, Gilles-Louis Chrétien and William Hyde Wollaston, looking for a simple, accurate and easy way to create and reproduce portraits, based on the process of drawing contours or silhouettes from shades and projections of the human shape. All these drawing techniques, as the previous dark chamber, used light projection as support to recreate different shapes efficiently, but requiring in every single case some advanced artistic or drawing skills to generate these pictures.

With the discovery of photosensitive silver compounds, added to the dark chamber and other light based practices, two photographic systems were born: Niepce and Daguerre's Daguerreotype in 1839 and Talbot's Calotype in 1841. These photographic systems were improved through time, making it easier, closer and more accessible for people to get a camera and portray reality, essentially what cameras were initially intended for.

Amid the 20th century industrialization, a new debate was born about the cons and pros of handcrafted and industrialized production. Bhaskaran (2005) & Eskilson

(2011) explain this process, describing this confrontation between the Arts & Crafts movement, promoting and defending the value, the beauty and the character of the artisan's artwork over the serial, minimalist and reductionist production of the *De Stijl* style, bringing to the table a never ending argument about art and technology, a debate that has evolved during the last centuries, from the effects of industrialization on artistic production to a debate between analog and digital technologies, which is not about photography exclusively, but music, design, illustration, etc.

From its early days, photography had a merely representative and figurative purpose, capturing and exposing a physical reality, from landscapes to human portraits, with a totally realistic and precise approach. Meanwhile this technique was growing, evolving and becoming more accessible, previous fine art expressions like drawing or paintings were displaced by these new technologies. A similar phenomenon could be witnessed years later with the invention of cinema, displacing theater and other performing arts, records displacing live performers, digital recording displacing analog recording processes or digital photography displacing the analog process throughout the last decades.

An Evolving Concept

As explained by Fontcuberta & Costa (1988), etymologically speaking, the concept of photography comes from the key words *phos* (light) and *graphein* (trace). So basically, the authors remark the importance of light capturing in the process of making a picture, defining it as a "Graphic made with light" and assuming this last element, as the substance and "...physic action produced over conveniently prepared and light-sensitive surfaces".

The Royal Academy for the Spanish Language RAE (2015) used to define photography as the "Art of fixing and reproducing by chemical reactions, over conveniently prepared surfaces, the images captured in the back of a dark camera". This concept seemed to be outdated and not coherent with the new technologies and digital processes, dominating the discipline since the early 2000's. By 2016, this definition was reconsidered and adjusted, to keep up with this new form of graphic production and pointing reality as constitutive factor of the process, describing photography as a "Procedure or technique that allows to obtain steady images of reality through the action of light over a sensitive surface or

sensor” (RAE, 2016). Another traditional definition can be found on The American Heritage Dictionary (2013), describing photography as “The art or process of producing images of objects on photosensitive surfaces”, similar to the original previous concept proposed by the RAE. This concept was eventually and necessarily revalued on dictionaries and related sources, understanding that photography as a technical practice, had evolved and renewed, as new technologies were available.

New Webster’s Dictionary (2010) defines photography as “The art or process of capturing images, either on lightsensitive film or electronically in digital form, from which viewable pictures can be produced; activity of someone who uses a camera”. Definitions for this discipline have evolved from the traditional and outdated concept of photography as an exclusively chemical and optical process.

For Freeman (2005), digital photography throws away the idea of a “flawless honesty”, formerly attached to the analog process, thanks to its realism and accuracy, but allows an easier technical exercise and faster copying process, cutting down costs, reducing materials and democratizing the discipline.

Despite the fact that it was already possible to improve or enhance the quality of the pictures by analog and chemical laboratory processes, technological improvements like digital design software, photo-editing tools like Adobe Photoshop or Light Room, added to the mass production and technical rise on digital cameras, lead to a new wave of image manipulation, specially applied to advertising, product photography and fashion photography, controversial and habitually debated in recent years, partly due to the intentional alteration of reality, regarding the size and quality of food products and the almost unreachable stereotype of a perfect body, particularly on teenage women.

During the last decade, improvements in smartphones, mobile devices and photography apps, have helped popularize this practice, allowing users to edit, modify and manipulate pictures easily, with no need for any studies or intricate software.

Supported by a series of academic practices and learning activities, Chaparro (2015) remarks the importance of traditional or analog techniques to highlight the value of photography as an emotional experience and potentiate the digital production in different areas by a stronger comprehension of fundamental concepts associated with creativity, storytelling, color, form and light.

According to Freeman (2008), the quality of a picture goes beyond the technical advances and inventions, considering a strictly necessary equilibrium between technology and sensibility and supporting the idea of a teaching for the discipline, based on composition, framing, lighting and graphic design basics, instead of an education focused on digital tools and software like Photoshop or Light Room, just to name a few, leading to reinforce common conceptions like photography understood as a computer based exercise, an act of manipulation, and even an easy task, which takes no more than some editing skills, without theory or a formal education involved.

Fontcuberta & Costa (1988) propose the concept of *Fotografismo* (Photo-graphics) to characterize the interventional process to combine, manipulate and modify the photographic image, according to a free expressive finality and a specific message that it’s going to be communicated, mostly as a form of art. As explained by the author, it’s necessary to tear the term apart from the concept of *Foto-diseño* (Photo-design) in which the photographer and the graphic designer join forces and give birth to a new graphic project. These different applications have in common the use of photography with communicative purposes, but in the first case there’s an alteration of the picture, justified by its expressive finality.

Manipulation Through Editing, Concept and Composition

According to Fontcuberta & Costa (1988), photography has evidenced an evolving nature, opposed to the original idea of the discipline as a faithful portrayal of reality. This new determination attempts to modify reality, displaying new aspects beyond the evident and identical exposure of the environment. Alteration of reality by framing or decontextualizing can be considered wrong or inappropriate, according to disciplinary or ethical standards like the National Press Photographers Association, NPPA’s codes. Despite these varieties of regulations, photographers’ artwork and behavior are not restricted or censored.

The NPPA (2016) insists: “Be complete and provide context when photographing or recording subjects. Avoid stereotyping individuals and groups. Recognize and work to avoid presenting one’s own biases in the work”. This concept could be debated and could become subjective, assuming that the practice of photography,

specially as a way to register and capture reality and social subjects, inevitably implies a framing procedure where the artist or journalist, according to his personal decision and vision, reunites certain items or actors into one whole composition, possibly leaving other elements outside to create a visual concept, to express a feeling or an idea.

As a part of its Code of Ethics, this organization has pronounced related standards to be considered, such as:

- Be accurate and comprehensive in the representation of subjects.
- Resist being manipulated by staged photo opportunities.
- While photographing subjects do not intentionally contribute to, alter, or seek to alter or influence events.
- Editing should maintain the integrity of the photographic images' content and context. Do not manipulate images or add or alter sound in any way that can mislead viewers or misrepresent subjects.

Bacon, as cited in Panzer (2007) proposed: "The contemplation of things as they are without substitution or imposture without error or confusion is in itself a nobler thing than a whole harvest of invention" (p.9). Even though Bacon produced his writings centuries prior to the invention of the first photographic systems, this particular statement has become a consistent quotation through different texts and disciplinary approaches, almost as a credo, to remind us of the importance of honesty and ethics inside a discipline, where manipulation and alteration of reality becomes a debatable subject during its almost two centuries of history, regarding digital and analog editing or other forms of manipulation through framing, staging, composing, etc.

For Barthes (1986) photography and visual arts have a denotative aspect, regarding the image itself and the evident composition elements of the picture, and a connotative aspect concerning the meaning, ideas and feelings, perceived by the audience. According to this author, this concept only applies to "artistic" photography, excluding photojournalism from this specific category. This statement could be understood as a disciplinary separation, rejecting the idea of any artistic or subjective intervention in the practice of photography, as a social, reality-exposing tool, with no place for second messages or hidden concepts.

As expressed by Barthes (1986), the idea of

photography as a totally objective and denotative practice, could become "mythic", as this discipline is in risk of becoming subjective, considering press photography as a "chosen, composed, prepared and processed object, following professional, aesthetic or ideological rules, turning into connotative factors" (p.15). While photojournalism is expected to be totally accurate, denotative and objective, the human intervention and the idea of the picture as a message to be read by the spectator, make this expectation almost utopic.

As stated by Fontcuberta & Costa (1988), long before digital editing procedures, there were European artists like Futurist and Dadaists exploring different forms of manipulation like collage and montage, embraced by his concept of *Fotografismo* and the *Mec'art* or Mechanical Art, that spans across different photography and printing related practices.

Beyond the technical process, it has to be considered an intellectual operation that expands the possibilities of the device itself and seizes the human practice of abstraction; an exclusively human and mental process that uses the camera as a medium to elaborate a subjective and artistic approach to the material world around, a world that can be and must be explored, described and reconstructed by the vision of artists, journalists and photographers in general.

The Bang Bang Club

From 1990 to 1994, Kevin Carter, Joan Silva, Greg Marinovich and Ken Oosterbroek, a group of photojournalists AKA the "Bang Bang Club" witnessed and captured the horror, the violence, the sadness and the humanitarian tragedy surrounding the civil war in South Africa, prior to Nelson Mandela's presidential election.

In 1991 and 1994 respectively, Marinovich and Carter were awarded with the Pulitzer Prize in recognition of his graphic work during that period. In the last case, his winner picture's main character was a little child chased by a vulture, causing a big controversy when the media and general public inquired about the child's fate and the actions taken by the author to help her, as described by Marinovich & Silva (2000). Debates, questions and criticism surrounded the award, judging Carter's behavior and questioning the journalist's role in the middle of tragic and violent events.

Maybe what makes a great picture is one that asks a question, you know? It's not just a spectacle, it's more

than that. I think mine was like that, and Greg's too. You go out and you see bad things, evil things, and you want to do something about it so what you do is you take the picture that shows it. But not everybody is going to like what they see, you have to understand that they might want to shoot the messenger (Carter, as cited in Lang, 2014).

In 1994, when asked about what would he consider to be a good picture, Carter highlighted two polemical examples; Marinovich's and Carter's Pulitzer awarded pictures, exposing the horrors of the civil war and hunger crisis in South Africa by the early 90's. These photographs brought a controversial debate to the table, regarding the responsibility of the photographer and his role within tragedies, emergencies, violent conflicts, disasters or humanitarian crises.

The NPPA (2016) recommends: "While photographing subjects do not intentionally contribute to, alter, or seek to alter or influence events". Although, when Kevin Carter made its famous Pulitzer winner picture, he tried not to interfere or alter the scene itself, through framing and composition he created a particular and subjective representation of reality, grouping these specific characters into the same picture, isolating the whole situation from a bigger and affecting context.

Carter's picture, beyond his actions and responsibility, could be analyzed from a different angle, considering that the journalist frames and captures two separate and particular elements like the child and the vulture, extracting a subjective vision from a wider scene and from a specific reality, decontextualized in time and space. Apart from the photographer's actions, when Carter took its famous picture, he included some elements and left others aside, focusing on an apparently fatal event, ignoring the events and context surrounding, which could affect the whole story and the picture's connotation.

Archundia (2012) considers photography as an arbitrary practice, while the objective nature of photography seems to be affected by two factors: the technical elements and the artist's intervention. The visual range becomes unavoidably limited, contrary to the human eye and the graphic result is restricted and determined by the photographer's own vision, framing, angle, focus, emotions and interests; even the decision itself, to frame specific elements and making a picture, becomes a form of manipulation. Within the concepts exposed by the author, considering the human factor

as an inherent and primary aspect of the photographic production, the idea of an altered, processed or intervened image, turns out to be recurrent and unavoidable, almost normal, separate from the kind of process involved, whether it is analog or digital.

Conclusions

Throughout its history, photography has been developed from its complicated black and white rudimentary origins, with low-quality results, to the modern high-definition production available these days. As an artistic and social practice, this discipline has evolved on a technical and quality level, making it easier to capture, improve, manipulate and print or even publish different sorts of products, thanks to social media advances, apps and mobile devices.

During almost two centuries of discoveries, advances and improvements, photography has hugely evolved technically and creatively from its analog bases to the digital process, which dominates the graphic production today. As a part of this evolutionary process, visual manipulation has been a fundamental practice, inherent to the discipline. It doesn't necessarily have to be interpreted as a wrong or unethical practice, but as an essential quality that must be considered as a parameter for self-regulation in the capturing and editing process, concerning reality, as a matter of respect for the truth, the objectivity, the audience and the journalism or advertisement profession.

As a form of expression, it has been popularized and democratized, allowing common people or amateurs to get a camera and create original high-resolution material, on a low budget in a short time.

Popularization and democratization processes, tend to devaluate photography as a professional and artistic practice, while being so easy for more people to exercise, create and offer their services, without a theoretical foundation or basic knowledge about optical, chemical, compositional or formal concepts.

Understanding photography as an art form, subjectivity becomes an inherent quality within this discipline, therefore, this practice involves a human and expressive factor, which inevitably affects the visual result and becomes a personal interpretation of a surrounding reality, affected or interpreted by the author, who observes a series of elements, individuals and situations, as a part of an environment, but not necessarily including the context as a part of the final

product. The decision of shooting and the process of framing, necessarily involve a personal vision of the artist, photojournalist or general photographer.

Even though there was always an unquestionable honest quality attributed to the practice of photography, there has always been some kind or level of intervention or manipulation involved in any form.

From the individual and subjective decision of capturing certain scene or moment at some specific context, the act of framing or focusing selected characters, actions and elements, allows the photographer to reflect, comprehend and manipulate his surrounding visual environment and express his point of view, in relation to the world he sees.

Considering Kevin Carter's artwork as an example, there's got to be considered that, photographer's decisions, points of view and personal interests, are going to influence and affect the graphic result, not necessarily with a manipulative purpose but creating a restricted or framed portrait of reality, which in the worst scenario could easily be misleading to the observer and used as a scamming tool for dishonest ideals and agendas.

Different authors agree about the subjective or arbitrary nature of photography and its connotative dimension; it's up to the photographer to be responsible about his creative exercise and to the spectator to be critical and analytical concerning the images he observes through the mass media, art displays and different supports or formats.

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Video Art, Artivism and Photography as Tools for Subverting the Patriarchal Indoctrination of Advertising

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Abstract

This text is a conceptual and formal analysis of works of video art, photography and activism in defense of women's rights. It contextualizes the theoretical concepts of feminism, desire, liberty, reality, subversion or spectacle, in the framework of art and feminist critique in order to articulate an analysis running from the XXth to the XXIst century based on the theories of thinkers like Flusser, Lacan, Barthes, Debord and, more specifically concerning women, Lagarde, Beauvoir, Butler and Amoros. The aim is to show that art has had an important role in the diverse feminisms, contributing significantly to the improvement of the number of women in art and society, and that it continues to do so, being an accessible medium for reaching the dissident sector of the population, a medium that is creative in its confrontation, a medium whose duty is to communicate history and ensure that it is justly told, a tool for struggle camouflaged under the umbrella of art.

Keywords

Subvertising, Videoart, Performance, Artivism, Women, Artistic, Revolution

Introduction

Your Numerous uncertainties subsist ever today about feminism, its origin, its objectives and even its meaning. Even though studies of feminism in postmodernity begin with Simone de Beauvoir and continue in the United States with the movement led by Judy Chicago, amongst others, we need to go back much further in time to give a context to the term. The first known female philosopher was from the Balkans, in Tracia, and was called Hipparchia, a woman who fought to be able to do what men did, to devote herself to cultivating her mind rather than a family. Her reply to widespread criticism of her stance was "Do you believe that I have come to a wrong decision, if I devote that time to philosophy, which I otherwise should have spent at the loom?"¹

From the classical period in Greece onwards we can

see how representations of women became stereotypical, reflecting how women were relegated to the home. How we live now is determined by what we have learnt about ourselves through images from the past, which is why it's so important to be careful with images and even more so with how we represent ourselves in the world. Every form of representation of women in current society is a reference or model for minds that have not yet developed critical thinking capable of distinguishing between good and evil, beyond their own customs and desires.

We are not talking about anything strange, nothing that is not contemplated in the majority of national constitutions, we are talking about simple human rights. In order to amplify the context, we will analyze the following key moments: The Middle Ages, the Enlightenment, the Seventies and, lastly, the Nineties up to now. Women have been robbed of their freedom as human beings and neoliberal advertising has robbed them of their values, fostering an alienating vision that defines women in terms of domestic roles.

Art was previously the principal tool for communicating history, now it has become more conscious of the importance of its role and has focused more on questioning how we communicate history and what kind of history it is. It is a critical art that stems from an interest in human rights and the observation of society, that is not unmoved by inequality and that tries to provoke changes in consciousness, in other words, a political and revolutionary art that, at the same time, preserves its "basic" function of entertaining, telling stories and generating aesthetic pleasure.

Now we ask ourselves, if women artists have been active in cracking the hegemony of patriarchy, why does advertising still maintain a canon of beauty from the 1960's? can feminist art influence advertising? what are the most efficient tools in art for fighting patriarchy? how can new models of femininity be constructed in a medium, advertising, dominated by men? and, can

¹.Diogenes Laërtius, vi. 98

humor be a tool for subversion?

The works that we are going to analyze use the same tactics as advertising does; audiovisuals, invasive advertising, and physical pieces like web pop ups on legs. In artistic terms these are equivalent to video art, photography and street actions. If advertising is the subtlest form of indoctrination then we understand that art can subvert the message using the same tools, being easily received and assimilated by a public already accustomed to the medium.

We have decided undertake this analysis of artists who criticize patriarchy using video art, photography and actions, by taking two references for each medium, from the beginnings of the feminist struggle in art up to the selection of videos that were shown in the International Festival Fem Tour Truck 2016. In video art, we have chosen Martha Rosler and her piece *Semiotics of the Kitchen* (1975, United States) and Nadia Gomez Kenier with her piece *Macho sobre todas las cosas* (2015, Argentina). In the field of photography, we will examine Cindy Sherman and her piece *Untitled #153* (1985, United States) and Marisa Benito and her work *Artificio* (2015, Spain). And lastly, in the category of actions, the career of the Guerilla Girls collective (United States, 1985) and the work *Soy prostituta según la RAE* (Euskadi, 2016) by Nerea Lekuona.

All the proposed works criticize the representation of women in advertising and the audiovisual medium, using the body as a strategy for undermining the patriarchal system, appropriating elements of visual culture from the past and present with the aim of breaking down patriarchal thinking and social organization.

Questioning gender in art and advertising

To analyze feminism we need to start by analyzing its enemy: Patriarchy, defined in the Merriam-Webster dictionary as a “social organization marked by the supremacy of the father in the clan or family, the legal dependence of wives and children, and the reckoning of descent and inheritance in the male line”, and, in general, “control by men of a disproportionately large share of power”. This definition reveals the primitive condition in which we live, where there is no room for evolution. Despite centuries of feminism we have made few advances, the most important being the now almost universal right to vote.

In order to talk about feminism, we will focus on the writings of Marcela Lagarde who analyzes the concept of

feminism, woman and sorority². In addition, for second wave feminism, we will take Simone de Beauvoir and her book “The Second Sex”, and its well-known slogan “One is not born, but rather becomes, a woman”, statement with which we totally agree and in which advertising has a fundamental role. We will also look at Celia Amorós’ work on identity, for whom “woman” has been constructed as a single subject, lacking individual identity. In this text, we will always speak of women in plural, recognizing their diversity and plurality.

As far as advertising is concerned we are going to work with the vision that T.H Qualter proposes in his book “Advertising and Democracy in the Mass Age” (Qualter, 1994), where he defines it as the homogenization of thought, which returns us to the theme of woman, not women, and how we are the product of a society influenced by innumerable factors. In order to better analyze the influences over women we are going to refer to various works of social science and studies of public opinion from where we will extract ideas such as “agenda setting”, which is the media structuring what to see and what to think. In the area of philosophy, we will use the ideas of Barthes (2009), with special attention to his reflection on the relationship between image and text, and Lacan (2006), the concepts of desire and object, to speak of the desire that produces images that are the mirror of the other, and how individuals want to fulfil expectations in order to gain the affection of the Other, theory he names the Mirror Stage, a display of exhibitionism which is regulated by an imposed symbolic order. The theory was further developed by Jacques-Alain Miller who considered the body of the Other as symbolically more important than the subject’s own body. Ronald Berman’s studies of the effects of advertising contribute the idea that it shapes our society, as a reflection of our desire for the utopia that we would like to inhabit while maintaining us in a constant state of trying to be what we are not. It is a path towards the utopia of happiness, towards an idealized and heteronormalized (social, political, economic and cultural regime that imposes heterosexual practices and norms) model for this primitive social organization.

The main concept that unites the works of art that we will be analyzing is that of artifice, an artificial product of human creation and synonym of falseness, revealing how our subjectivities are constructed on the longing to be what we are not.

²Sorority is solidarity and mutual aid between women.

“It would be easier to understand if we would simply confess our infinite fear, which leads us to populate the world with images that resemble us or how we imagine ourselves to be, or maybe, on the contrary, this obsessive effort is the result of courage, or just stubbornness to avoid the emptiness, to not give meaning to what doesn't have meaning. Probably, the emptiness cannot be filled by us and that which we call meaning is nothing more than a fleeting combination of images that appear harmonious for a moment or on which the intelligence, prisoner of panic, tries to impose reason, order, coherence” (Saramago, 1986)

According to Nietzsche artifice is just as intrinsic to human life as reality: “illusion . . . begins with the organic world”; “Humanity and all organic beings have done it thus; they have organized the world by action, thought, imagination, until they have made it something they can use, something they can depend on”; “the ability to create (make, invent, imagine) is the fundamental ability of the organic world”; “great inventions and interpretations tore us from simple animal happiness of the past” (Nietzsche, 2001: 69).

Feminist becoming through technology and internet

Currently, one of the principal media for anti-patriarchal activity is the intangible universe of the Internet, where feminist, trans, queer, intersexual, lesbian and gay collectives have found a space for representing themselves outside heteronormative institutions. Internet is a medium for us to recognize ourselves and to experiment with our bodies, from the material of virtual environments we generate our own cyborgs, as Donna Haraway (Haraway, 1983) calls them, trying to justify her intention to abolish gender in order to abolish inequalities. Her theory, that never loses sight of humor, is built on the idea that the union of human and machine would eliminate the strict coding that limits bodies to stereotypical roles. I can think of a lot of artists who work with the body and feminism in art but I am going to make a small selection to illustrate how these themes are being explored from a technological perspective. I will then relate these works to two videos that were selected in the Fem Tour Truck festival to show how videoart is uniting proposals that come from photography, installation, performance and technology. I often tell my students that nothing is original, inspired by Kirby Ferguson's ongoing video series “Everything

is a remix”, so I encourage them to express themselves freely, just as these videos do, they aren't inventing anything, they are compendiums of ideas taken from the feminist revolution in art, politics and society, they are narratives of untold history, a revolution in which communication through visual images has transcended and narrated itself, from the first photographs to complex transmedia works. These videos are a cocktail of media and ideas, uniting photographic, audiovisual and action based processes, interactive projects, network projects and installations in the single medium of video.

Of all the projects of art and technology that question gender I always begin with Lynn Hershman, known for her feminist focus, and her work “DINA” (2000-2006), an artificial intelligence that evolves in time, precursor of systems like SIRI which, through online search programs and generative software, are driving the evolution of artificial intelligence. There is a great variety in how women have related to technology in art, for example Quimera Rosa create performances where their bodies become interfaces, questioning the role of different and at the same time useable hybrid bodies, provoking the transfiguration of the body to produce new non-essentialist identities.

“Roberta Breitmore” (1973-1979), another work by Lynn Hershman, explores female sexual identity in the virtual space of internet where it is easier to break the formal limits of the body thanks to the dreamlike and fantastic space of virtual environments, the artifice which we commented earlier. The Colombian artist Jocelyn Bernal has a piece which uses tools appropriated from the hacker movement or discipline, the so-called hacktivism which pirates webs, carries out DoS (Denial of Service) attacks or creates encrypted private networks. Actions which remind us of the story of Wikileaks where DoS attacks were common. Bernal combines John Cage's piece 4'33” (1952) and DoS attacks to carry out a work that moves between art, activism and hacktivism, something we could call activism. The work consists in attacking the servers of artistic institutions in Spain and Latin America during four minutes and thirty three seconds in order to denounce the resistance to change of the classical systems of representation or the silence to which dissident art forms are condemned.

Other net projects are aimed at fighting against the micro-violence of the networks in a humorous way, such as “Alerta Machitroll” (2015) by the Karisma collective from Colombia, which manages an online observatory

of sexist practices in internet, offering fun manuals for defusing macho troll violence.

In the Fem Tour Truck 2016 open call several videos were received that focused on this feminist becoming through technology, like Lauren Valley's "Picture this" (2016, USA) in which a girl in a 3D environment explains to the viewer how to avoid attacks from men through different mechanical extensions of her body. Myrte Van der Molen, in her work "I want to be selfish again" (2016, Holland), deals with the same theme of implanted mechanical devices to resist sexual attacks, but in a cold aseptic manner, a long way from Valley's humor. The other work I wish to refer to isn't actually a video but rather a video game called "Homozapping" (2015; Mexico), available online, which tests the knowledge of the users of their own bodies and questions social conceptions of the forbidden, the sexual, the strange, the exciting... showing us a reality that we either don't know or don't want to see. This game created by PlayLabXY01 in a laboratory organized by ARSGAMES was exhibited in the Fem Tour Truck Festival as an interactive video installation.



Figure 1. Screenshot from the video game "Homozapping"

Politico-artistic artifice in video art vs. advertising

Templates The audiovisual image is the most consumed in postmodernity and its powerful ethical and social role in the structuring of society cannot be ignored. In the case of Ecuador, the country has laws which legislate what can be shown in the media, if these laws are obeyed they end up structuring the collective imaginary and thus influencing how individuals behave, but Internet is a jungle of information that is very difficult to control.

Advertising continues to perpetuate the woman/housewife, man/hero dichotomy, while remaining

obsessed with idealized bodies which can only be real in virtual reality, bodies made into objects, into things. In videoart we find the other extreme where household advertising and empty models are strongly criticized.

According to Martha Rosler, the early use of video in art was a critical position against the structures of the artistic institutions because video was still not accepted in art circles and neither were women. So, working from the periphery and with excluded media they created critical work that was aimed not at entering into the system but at changing it by "mixing art and social life [...] in an effort to open a space where the voices of the voiceless could be articulated" (Rosler, 1990: 31, 32).

We cannot lose sight of the fact that audiovisual media have an intrinsic narrative quality which has become essential as a vehicle for feminist protest and as a tool for change (Juhasz, 2001: 3). Video, cinema or documentary films offer different forms of struggle which are in themselves pedagogical actions.

At the end of the sixties two important events took place: the launch of the video recorder by Sony and the feminist revolution in the United States. The artists used their own bodies to talk of what had been prohibited and discovered an escape route in audiovisual media. Several decades later came distribution by Internet which is still, for the moment, the least monopolized and politicized medium. The pioneers of the exploration of female imaginaries in video art are artists like Valie Export, Pipilotti Rist, Tracey Emin or Sadie Benning.

In the Latin American context, there are now many artists who define themselves as feminists but the movement arrived later than in the United States where it started in the sixties, in Spain in the eighties, and in Latin America in the nineties (with notable earlier exceptions such as Monica Mayer in Mexico), peaking from 2000 onwards. Regina José Galindo, Rocío Boliver or Marta Amorocho are some of the contemporary artists who question the inequality of gender, appropriating strategies of communication that use action and reaction as means for provoking movement towards equality (Irene Ballester, 2013). The visibilization of gender based violence is common to many artists involved in feminism and especially in Mexico, world leader in femicides. This word was imported into Spanish as *feminicidio* by Marcela Lagarde, sociologist and anthropologist, from the writings of Diana Russell and Jill Radford who use the term to refer to violent crimes against women for the mere fact of being women.

**“Semiotics of the kitchen” by Martha Rosler and
“Macho sobre todas las cosas” by Nadia Gómez Kenier, a domestic artifice**



Figure 2. Demonstration of the ironic use of a rolling pin. “Semiotics of the Kitchen” (Martha Rosler, 1975)

Let’s start by analyzing this video performance realized in 1975 by Martha Rosler and now part of the collection of the Museum of Contemporary Art of Barcelona (MACBA). We see the artist in a domestic setting, in the kitchen, in a carefully composed image with her in the center, echoing the domination of a system that leaves nothing to chance. Rosler then begins to show us the kitchen utensils in alphabetical order, saying its name first and then giving an example of how to use it. Her attitude is resigned and angry and as the piece progresses this becomes more marked, revealing the aggressivity generated by domination and seclusion in the kitchen, oscillating between drama and humor. She writes the names on a blackboard in a very rudimentary way, showing her anarchist and revolutionary spirit in a struggle against the system.

In the video Rosler also converts her body into a utensil by using it to form the initial letter of each utensil evoked, visualizing the patriarchal assignment of women to the domestic space. From now on we are going to take into account the analysis of the body in feminist artistic practices, where the body is a battlefield, a political body, and above all the resignification of woman and her struggle to decolonize her body, reclaiming women’s ownership of their own bodies. The use of the body is a recurrent theme in art and not only by women artists, Vito Acconci, Andy Warhol, Marcel Duchamp or, more recently, Marcellí Antúnez have delighted us with works focussed on the body but it is from another point of view that “video performers like Marina Abramovic,

Yoko Ono, Linda Benglis, Joan Jonas, Gina Pane, Martha Rosler or Valie Export show, through parody, fragmentation of the social order, criticism of language and inversion of roles, another reality of women through the use of video.” (Bouhaben, 2015)



Figure 3 A man reproducing the advertisement of a shower gel for women. “Macho sobre todas las cosas” (Nadia Gómez Kenier, 2015)

Continuing with our analysis, we have the piece “Macho sobre todas las cosas” (Kenier, 2015), a playful video that mixes media reality and real life. Kenier divides the work in four scenes, each of which uses an advertisement aimed at women, appropriating the visual part of the advertisements by reenacting them with male actors and keeping the original audio. “Macho sobre todas las cosas” criticizes the image that is expected of women and calls attention to the gender disparity of these expectations, that a man is ridiculous in these advertisements shows that they do not face the same demands as women. We return to domestic space and to a whole series of preconceptions associated with women and their representation, like in the last scene where the artist appropriates an advertisement for diet food. This is clearly an exercise of subvertising which attacks the patriarchal concepts embodied in audiovisual media, breaking the “agenda setting” of the patriarchal system by changing the relation between sound and image, disconnecting and decontextualizing the situation in order to articulate a critical vision, once again situated between drama and humor. But this humor shows the drama of the relation subjectobject of consumption, that it is not the object that is being sold but the desire for what she lacks, in this case a perfect female body, because if we change her for a man the advertisement no longer makes sense.

By definition human beings are unsatisfied,

permanent happiness does not exist and this is the key to consumption, we know that we will always want more and advertising is there to remind us. Consumption in itself is neither good nor bad, advertising offers services, health, education... the problem is the values that are trampled to obtain it. In the line of pedagogic videos focussed on this question we would like to draw attention to “Consume hasta morir” (Consume until you die) by *Ecologistas en Acción* (2005), a documentary film that was created to reveal what is behind the multinationals and their advertising strategies to attract and identify the masses.

Politico-aesthetic Artifice in Artistic Photography vs. Advertising

Another of the principal tools of women’s art is photography, expressed from the body and understood as subjectivity, the mechanical eye that connects us and initiates us in technology and our cyborg becoming. In the sixties, the first consumer cameras appeared but photography was still not considered as an art, which meant that women had the “right” to use this minor medium to express themselves. Artists like Nan Goldin or Sally Mann subvert the system with their photos, generating new representations of women in the images. Goldin centers much of her work in showing the normality of gender violence through self-portraits in which she exaggerates the marks of violence while maintaining a heteronormative narrative. Once again we see the rupture between desire and reality, the image of what is desired or hoped for and the reality, so close to the experience of many women. Mann on the other hand follows a different path, she explores a model of woman (in this case girls, her photographic subjects are always her daughters) without intervention or poses, as close as possible to reality, even leaving it up to chance to decide when to press the shutter. Once again we are breaking molds as chance is not part of the system, the State cannot permit leaving things to chance, everything must be programmed.

Both artists question the norms of beauty shown in advertising and elicit a reconsideration of reality and fiction. It is the struggle of artifice and reality; humans don’t want to see what they really have but rather desire what they don’t have. We don’t live in the present or in reality, we live in the hyperreality of the media, in man-made artifice, where our struggle for equality often becomes a war of the sexes.

If we observe how photography has been analyzed from

its origins up to the present we can see how much the understanding of its objectivity and relation to the truth has changed. At the beginning, it was seen as a technique that would liberate visual arts of all subjectivity due to its objective depiction of the real, “photography arrived in time to liberate painting from the anecdotal, from literature and even from the theme” (Banzin, 1945: 14). Vilem Flusser goes even further by suggesting that we are trapped in the relation between image and reality, in order to represent a reality, we make an image of it which is then projected and becomes an intermediary between people and the world, “a person ex-ists, that is to say they don’t have direct access to the world but only imagine it through images” (Flusser, 2001). For Flusser images are an obstacle that prevent people from living in reality because all they do is disfigure it. The photographer and writer Joan Fontcuberta talks about the idea of “disreality” (Fontcuberta, 2012: 18) to express the idea of photographic fictions and destructure the hegemonic models of the real. So the concept of photography has completely changed, it is no longer the real that is shown but what we would like to be real. Flusser calls this “idolatry”, “the omnipresent images that surround us are magically restructuring our reality, converting it into a global scenario of images that orient us in the world”. (Flusser, 2001).

Advertising, in its eagerness to appropriate reality and sell the consumption of identity, has created a stereotyping of male and female bodies. Fashion photography has taken the question of beauty even further than the reflections on the objectivity of the image or the camera because of the importance of post-production. Here it is not only the artifice of the photographer that is implicit in the image but the skill of the post-production which contributes to the construction of “disreality” just as much as the theatricality of the stage props and the makeup.

To wind up our reflections about photography we should mention the theories that Guy Debord proposes in his book “The Society of the Spectacle” where he maintains that reality has taken a backseat to the image, resulting in the “spectacle” which is “not a collection of images, but a social relation between people mediated by images” (Debord, 1967). In his writings, he criticises the secular society of consumption that is organized for the minority of beneficiaries included in the Welfare State.

“Untitled #153” by Cindy Sherman and “Artificio” by Marisa Benito, an aesthetic artifice.

In this section we are going to analyze two works, a photograph from 1985 by Cindy Sherman (United States), an artist who ridicules the concept of beauty as transmitted by the cinema by taking photos of herself in different poses and disguises, part of her second phase in which she abandons eroticism in favor of the grotesque. We will also analyze a piece of video art from 2016 by Marisa Benito (Spain) which appropriates the images of archetypal women from the imaginary of cinema in order to resignify them as artifice, word which gives the piece its title.



Figure 4. Cindy Sherman disguised as a woman from a magazine. *Untitled #153* (Cindy Sherman 1985)

Once again the body becomes a critical tool, in this case to reveal the artificiality of female representation through photography. In this case Sherman lets us see the illusion of the reality captured by the camera

in order to ridicule the aesthetic rules of patriarchal society. Sherman tries to reproduce fashion photos while exaggerating everything, breaking stereotypes and pushing the image towards the grotesque to reveal the stigma of the female body, her body.

The somatization of criticisms in the body puts the artist in the position of a martyr who takes on the guilt of their own body, captured and expropriated for financial gain in the society of consumption in response to the eroticized gaze of men. The Lacanian theory of being seen to be desired is upset here, for in this case we wish to be seen in order to question the gaze of the viewer. Artists like Sherman, Mary Kelly, Ana Mendieta or Marina Abramovic have made a canvas and a battlefield of their bodies where “they try to visibilize the objectification and vilification of women in a phallogocentric capitalist system: the body is projected as the consciousness of being, as a subversion of the daily body” (Coccoz, 2012). The artist, both in her work and life, began to contribute to the feminist movement in the sixties when the phrase “the personal is political” was pronounced and assumed by many artists and cultural agents. Sherman after starting with the female cinema stars of the 30’s and 40’s, when beauty was the key for selling tickets, has adopted an endless variety of identities oscillating between parody and disguise.

Sherman’s photography reveals the wound and the disreality and explores female identity beyond the limits of advertising. Of course, she herself has become spectacle but it is the spectacle of the spectacle, a parody of the society of which Debord speaks, in which the artist seeks to offend us with her overacting and exaggerated decoration. Much of the sense that Sherman tries to give to the use of her own body in her work and her criticism comes from the idea that we are all part of the Society of the Spectacle.

The artifice, “a clever or artful skill, an ingenious device or expedient, an artful stratagem or trick, false or insincere behavior”³, in her work is clear, she is commenting the absurd human condition and humorously representing it from an artistic perspective, under the umbrella of art, capable of including everything from the beautiful to the twisted.

³. Definition from the Merriam-Webster dictionary <https://www.merriam-webster.com/dictionary/artifice>



Figure 5. Artifice of the representation of women in the media. Marisa Benito, *Artificio* (2015)

Marisa Benito's work is equally transgressive and also uses stereotypes of women taken from the cinema, working with the imaginary of beauty that these figures incarnate in their poses and surroundings. An artifice of romantic poses captured from the time that the surrealism of these images had not yet been understood but that Benito makes visible through her audiovisual post-production. A collection of images that come from visual errors, glitches, or from natural elements like fire, smoke or flowers are superimposed on the faces of these women who walk gracefully across the screen. In the words of the artist "Woman is not complete anymore: she is a fragmented body, a face without identity diluted in cosmetic artificiality. The invisible side of woman is shown as veiled in mystery and distance amongst natural elements which create a dramatic and disturbing atmosphere. The voyeuristic masculine gaze is part of the social construction of the perfect woman and what has principally generated and given form to the myth" (Benito, 2016).

"Artificio" is a reply to this masculine gaze and a criticism of the factory of dreams in which cosmetics are the principal actors of the farce. The new characters that Benito creates in this film are similar to those that Cindy Sherman interprets in her photographs, trying to explore the feminine psyche by questioning the glamor of the images, faces and identities of the 30's and 40's.

In her work Benito manipulates the image by distorting the frame itself, animating what was originally a still image with undulating or vibratory movements, breaking with photography as a static medium to augment the sensation of reality of the staging. In this procession of women, a solidarity is generated between

them, acquiring the sense of women-objects fighting to resignify themselves, a sisterhood of women as Marcela Lagarde would call it. The video ends with a woman holding a mirror in which another woman is reflected, an open invitation for us to feel part of this artifice and to know that we are also there, for, just like Sherman, both artists want to include us and make us feel part of the spectacle.

Institutional Artifice and Action Art vs. advertising formats

Activism and feminism have always been closely related and the relation with art wasn't long in emerging. Our first example is from the United States, the collective Guerrilla Girls, formed to draw attention to the inequality of gender in museums and the disproportionate number of women exhibiting in them. The first attack of an art institution by women took place in 1969 in the annual exhibition of the Whitney Museum, this led to the creation of WAR (Women Artists in Resistance) which made visible how few women were exhibiting. Another collective, similar to Guerrilla Girls, is *Mujeres Creando*, founded in Bolivia in 1992. This period emphasized the need for sorority and the creation of networks of resistance beyond the State. The majority of feminist artistic actions are carried out as groups of women but there are also individual revolutions like that of Nerea Lekuona, our second example, who extends her struggle from the personal to the social, carrying out an action on the border between performance and activism, "Soy prostituta según la RAE" ("I am a prostitute according to the Spanish Dictionary")

Guerrilla Girls and Nerea Lekuona, Fminist activism from the margins

The two works that we are going to analyze have different formats but shared strategies. On the one hand the Guerrilla Girls make visual work that functions as an activist tool due to its propagandist nature while, on the other hand, Nerea Lekuona carries out a performance that also functions as an activist proposal due to its inclusive nature and its use of public space. A performance in which she wanders the streets of Vitoria (Euskadi) wearing a sandwich board with the title of the work written in front and the dictionary definition of woman from the official Spanish dictionary behind and one of its meanings, "mujer del arte" which means prostitute. In her intervention

Lekuona distributes leaflets printed with the definition painted on the sandwich board that she is wearing. It's a very theatrical and critical action, the staging is a direct reference to street advertising with sandwich boards and the handing out of leaflets. She recorded a video of herself walking the streets on the way to the main library, in a cinematographic and televisual style rather than the usual style of simple documentation.

The famous Guerrilla Girls collective are notable for their anonymity, like Sherman they disguise themselves but in this case as gorillas, as they say, only their hairdressers know their identity. Their strength lies in the use of advertising style graphics and text, abandoning artistic formats in favor of the commercial style of the mass media. Image and text are combined in order to visualize the percentages and qualitative analysis of the gender inequality in museums. Although they began as a marginal group their boldness became so popular that they were soon included in the most elitist museum collections. The relation that they establish between image and object evokes the rupture of formats, they show a painting or a photograph of a woman, object of false representations, which they modify by covering her head with a gorilla mask, evoking the false identity that has been generated by art and the media, this "disreality" is humorously exaggerated to draw attention to the fact that the models represented by society are nothing more than unreal projections.



Figure 6 Frame from the video documentation of the artist's street walk. *"Soy prostituta según la RAE", Nerea Lekuona (2016)*

According to the distinction that Barthes makes of the relation between image and text, this is an anchoring

relation, where the text explains the image which otherwise would be decontextualized and end up as just an anecdote of subversion. In Lekuona's work the relation is different but the result is the same for she generates an image accompanied by a text, but in this case the image is physical and in movement, the image elaborates on the text, the definition, written by hand on a blackboard in the didactic style of Martha Rosler, is not critical in itself but hung on the artist's body it acquires the necessary significance and nuance. From the point of view of linguistic rhetoric, we can reflect on the meaning of hanging something from the shoulders, not just as pop up street advertising but also the incorporation of the criticism into the body itself, as we have seen in the work of Nan Goldin or Cindy Sherman in which the personal has an important role, visualizing the violence on themselves.

Both artists appropriate graphic and audiovisual advertising language to produce their subvertising of the academic and museum institution.

Reflections

In this feminist study of art, we have seen how the formulas of advertising are absorbed in order to counterattack, audiovisual language and graphical techniques are used as tools to criticize their origins and the guidelines that define advertising. In addition, due to recent technological advances the use of audiovisual media is now much more accessible. Art has the duty to relate, struggle and criticize, and by using the same tools and tactics as advertising it is thus in a position to easily reverse any positions that this may take.

Subvertising to the feminine models of cinema or the domesticity promoted in advertising has been produced since the sixties and there are now many collectives, like Adbusters, working with these practices. William Meyers has described advertising as a medium that plays with human weaknesses (Meyers, 1984) but every medium has its own weaknesses that can be subverted. Subvertising is a social revolution against the values that advertising promotes, as Chamizo (2006) proposes: "The media is known to be very influential, citizens as social subjects should know and be informed of social questions, carry out a critical reflection on the theme and their own position and be ready to act in consequence". Art appropriates advertising to inform and generate critical thought about patriarchy, a counterattack on the capitalist system and the market in favor of human rights.

Feminist subvertising has in its favor the capacity to play with situations, models and realities that are already assimilated by the public which results in easier identification. Another element shared by the works and the concept of subvertising is its revolutionary and provocative character, that it has in common with the figure of the guerrilla.

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Author Biography

Alejandra Bueno is a multidisciplinary artist who focuses her work on the visual arts and new media, with a gender focus. She was born in Vitoria, Basque Country, in 1987, she studied fine arts in Bilbao, afterwards, she studied a mastership in Valencia on visual and multimedia arts. Alejandra has produced works in different countries such as France, Germany, England, Italy and Ecuador, where she has held art exhibitions and lectures on art. And now resides in Cuenca, Ecuador, where she works as a teacher of arts education at UNAE. She is currently completing her doctorate in new media of cultural production through art and feminism. Last year she created the FEM TOUR TRUCK festival, a traveling exhibition of video art, presented in public spaces with workshops, performances, talks and video screenings, under the problem of gender violence, inequality of rights, medial discrimination, etc. This year 2017, will be held in Colombia, Ecuador, Portugal, Spain and Edinburgh.

POETIC INSTINCT – Aesthetic Experience as a Vital Function

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Abstract

This paper aims to discuss the concept of poetic instinct, considering the urgent need to reformulate the relationship between humans and nature considering technological ubiquity and its affective side effects. We start by analyzing the current process of disaffection and the impact of our intellectual, social and technical development on our abilities of perception. We approach Yuasa Yasuo's body theory that develops a comprehension of the body based on four levels of consciousness. We get inspired by his theory to discuss the process of perception, analyzing how we can understand the aesthetic experience as a vital function.

Finally, we present the performance "Avocado Tree, we'll follow your act" and the installation "Preamar" to discuss two approaches of the poetic instinct in an artistic practice and discuss the role of technology on this proposed poetic reading of the survival instinct.

Keywords

Aesthetic Experience, Survival, Body, Breathing, Perception, Connectivity, Technology, Poetic Instinct

Introduction

The survival instinct is an intelligence that seeks self-preservation, that is, the maintenance of life. The survival instinct exists within an individual existence but it also manifests in a collective sense, aiming toward the maintenance of one's existence through the reproduction of the species. That's why in many species the life cycle is directly linked to the reproductive act, and the individual dies after reproduction. Survival also depends on the food that connects different living beings to a single ecosystem by transferring energy from one (dead) being to another living being. It is also through the need for food that different kinds of relationships and modes of interaction between beings arises, such as symbiosis, mutualism, parasitism, and predation, among others. In this way, the survival instinct is characterized by a paradox between the individual and the collective.

Each individual must be deeply connected with internal and external processes and needs in order to ascertain their survival instinct.

For us, humans, the instinct for survival becomes highly complex due to our intellectual development, which allows us to create cultural systems. These systems are organized by social rules, where the motivation of social actions is mixed with our instinct for survival, resulting in a new understanding of life and our existence. The body of research within which this paper is located, posits the necessity of humans to reconnect with other living beings. The very definition of the Anthropocene, the hypothesis that we live in a new geological age that admits that man-kind has become a force of great impact on the biosphere of planet Earth, shows how we need to reflect our existence.

The Anthropocene obtained purchase in popular and scientific discourse in the context of ubiquitous urgent efforts to find ways of talking about, theorizing, modeling, and managing a Big Thing called Globalization. Climate-change modeling is a powerful positive feedback loop provoking change-of-state in systems of political and ecological discourses. (Haraway, 2016, p.4)

Although there isn't scientific agreement, the beginning of the Anthropocene is mainly accepted as the beginning of the eighteenth century, with the advent of the industrial revolution, but its impact became more potent in the twentieth century with techno-scientific advances and the profound transformation of the relationship between human beings and other living beings, and our continuous attempts to interfere in geological phenomena. There is a fatalistic connotation that the actions of humanity would be leading the planet to a biosphere crisis that could even lead to the extinction of humanity. Despite the intention of environmental awareness, we believe that the term Anthropocene

reinforce our constant desire for controlling other living beings and the planet. Is it possible to discuss these matters without replicating this narrative? Could we be drawing a process of involution? How can we discuss the role of aesthetic and affective processes and techno-scientific development on this context? Our intellectual capacity led our survival instinct to a techno-scientific quest for immortality that impacts our sensitive capacity and our very notion of life and existence.

Our current understanding of the human instinct of survival is directly related to techno-scientific development and the desire for immortality and our necessity to overcome our bodies' limitations. This desire is described by Paula Sibilia (2015) as the Faustian vocation in which this inconsequential necessity overlaps with genuine understanding and respect of otherness so we can live together as a society. Baudrillard (2000) also addresses the quest for immortality which requires a break in the connection between the sexual act and reproduction. Thus, in the first instance, the sexual act is released from the reproductive act, with the creation of contraceptive methods, and in the second, the reproductive act is liberated from sex, with the development of biotechnology and cloning. There is, in this search for immortality pointed out by Baudrillard, an impact on life and the body, in this Faustian vocation pointed out by Sibilia, in wanting to overcome also the sensorial limitations of the body that impacts the gradual transformation of our sensitive capacity.

Maria Tereza Cruz (2000) addresses this transformation of sensitivity within the art context by relating this process of technological development to the constant promotion and emptiness of aesthetic experience. The philosopher relates the exacerbation of aesthetic productivity to the process of technical development in which machines are endowed with artificial sensory systems. The union of these two processes impacts the abstraction of "sensitivity" in a general process of disaffection.

This research is developed upon this background. What is the role of art and aesthetic experience in the survival instinct? If art implies a necessary process of affection in the refinement of the survival instinct, how can we address the disaffection process? This research acknowledges that the survival instinct can be directly related to aesthetic experience as a vital process that implies the possibility of connectivity present in affective and relational experience.

In this paper, we'll analyze vital functions and

the body to comprehend the individual aspect of the poetic instinct. For this intent, we'll discuss how the poetic instinct is reflected in corporeal consciousness and in the understanding of the aesthetic experience in vital functions.

Survival Instinct, Culture and Vital Functions

If the survival instinct is an intelligence that leads beings to certain actions, we should notice that there are several ways of understanding this process in the context of humanity and its intellectual and cultural development. In a scientific approach, Darwin relates instinct to the actions of the pups, but also with the collective instinct.

An action, which we ourselves should require experience to enable us to perform, when performed by an animal, more especially a very young one, without any experience, and when performed by many individuals in the same way, without their knowing for what purpose it is performed, is usually said to be instinctive (Darwin, 1859, author translation)

Instinct can also be understood as an inherited intelligence, as a memory that is passed on through generations of the same species. In the context of humanity, it is common sense that instinct is related to a primitive intelligence. It is understood as a natural, bodily, animal, wild intelligence that humans possess before acquiring complex socio-cultural knowledge. Hence, the question of the human instinct for survival is somehow transformed when it acquires this degree of complexity.

Hannah Arendt (2007) also addresses vital instincts and functions within the human existence. Arendt separates human activities into three categories Labor, Work, and Actions. Labor are activities of the biological process such as spontaneous growth and metabolism. These are activities that sustain the survival of the individual, understood as vital functions. Work are the activities in which humans relate to other living things and things. Actions concerns the activities that occur between human beings, language, discourse, society and political activities in the condition of human plurality. We notice that the activities included in Labor do not represent the voluntary action of the human being. These are functions that occur within our body in an autonomous way with a reduced degree of consciousness. There is, in the thought of Hannah Arendt, a level of separation between activities influenced by the living being and

the body, such as Labor and the activities impacted by culture in Action and Work.

In this respect, we sense an affinity between Arendt's theorization and Suely Rolnik's (2015) thoughts the production of subjectivities. Rolnik discusses two types of experience. The cognitive experience is structured in language and cultural repertoire and the attribution of meanings. The second is the "out-of-the-subject" experience that is based on the affections and percepts of the living body. This is the difference between the subjective experience of the subject and the subjective experience as a living being. The psychologist points out the process of loss of connection with this "body knowledge". This loss of connectivity causes the malaise of individuals in contemporary society, because we base our experiences only on our cognitive ability and we discard our body knowledge.

It is fundamental to understand the dichotomy present in the understanding of biological and cultural existence, since our understanding of the survival instinct tends to consider only the biological needs as vital functions. However, if we are trying to understand aesthetic experience as a vital function, we must consider how it may be present in the two spheres of human existence. The aesthetic experience can occur in our contact with cultural production, but it also conforms the general production of affects and perceptions. In this sense, we understand that there is an organic-biological-animal instinct and there is another social-rational-cultural instinct. We do not think there is a clear line between these two instincts, but we claim that there is another instinct in this mix, that is a poetic-aesthetical instinct.

We do not believe that the aesthetic dimension of the survival instinct is exclusive to us, humans. Our research started from the concept of *sensibilia* (Deleuze, Guatarri, 2010, p.217), which deals with the contamination between organic and aesthetic functions based on the need for emergence of sensitive qualities for the survival of various species, such as the João-de-Barro bird that needs to "sculpt" its house. For them, the emergence of these sensitive qualities arises especially at the moment of the establishment of the territory-house.

Although we recognize how this sensitive quality is inherent to the existence and survival of living beings in general, we focus on understanding how it occurs in the human instinct of survival. Additionally, if this sensitive emergence occurs especially in the formation of the territory-house, we understand that this construction

begins in the individual experience of consciousness of our own body as our first house. Therefore, in this article, we elaborate upon the poetic instinct from the understanding of our body, as we can see next.

The Mind-Body Dichotomy

The dichotomy between biological and cultural being is close to the mind and body dichotomy established by the *cogito*. Throughout this text, we pointed out some of the impact of the intellectual development, and cultural and scientific knowledge on the gradual transformation on the human survival instinct. By remembering the disaffection process pointed out by Cruz, we can also recall the dual subjectivity theory and the disconnection from the "body-knowledge" described by Suely Rolnik. However, our intellectual capacity that supports the structuring of our cognitive ability should not be seen as prejudicial and harmful for our existence. Rather, we should recognize how the poetic instinct can reconcile our cognitive and sensory abilities. In order to accomplish this, we get inspired by reading the body theory of Yasuo Yuasa (1987), a Japanese philosopher who presented a western view of the Japanese thinking by showing parallels in an in-depth study of Eastern and Western philosophies

Yuasa's body theory divides the body into four circuits that present a gradual decrease of the level of consciousness and awareness. The first circuit is the sensory-motor, which is responsible for the perception and the process of transformation of sensorial information into action. This circuit is associated with the field of everyday experiences. The second is the circuit of *coenesthesia*, responsible for the sensory impressions within the body and the visceral organs. The perception of this circuit is already a bit vague and it is less evident when the body is healthy. These two circuits form the conscious cortex of the body.

The emotional-instinctive circuit is responsible for the neural processes where the nervous system turns a stimulus into an emotional response. The last one is called the "unconscious quasi-body", which has no equivalent in western culture because it is based on the meridian system of Chinese acupuncture. This circuit incorporates a flow of energetic activity of psycho-physiological nature. This flow cannot be perceived in ordinary circumstances. It's somehow difficult to understand Yuasa's theory as a scientific knowledge in our traditional occidental comprehension, because the

oriental culture blends medical science with a spiritual understanding of the body.

The flow of *ki* energy can permeate through several bodies and expand the connection and understanding between individuals beyond what we understand as a direct interaction. In Yuasa theory, *ki* energy flows in abundance among living beings and is essential for the overall balance and survival of the ecosystem. Yuasa proposes a method of *self-cultivation* through conscious breathing to access this energy and increase our capacity to perceive the fourth circuit. For him, the breathing is the only function that can simultaneously be conscious and unconscious/autonomous. Therefore, to breath consciously is a way of achieving a greater body awareness and increase an environmental connection.

Yuasa emphasizes the importance of conscientious breathing in spiritual practices of meditation, but also in practices of artistic performances. We understand that an aesthetic experience is a way of reaching this level of consciousness to manage the *ki* energy through this conscious breathing exercise. Yuasa proposes a method to connect with other living beings by practicing body consciousness and aesthetic experiences. It is important to emphasize the proximity between the intention of *self-preservation* present in the survival instinct and the intention of *self-cultivation* in the method proposed by Yuasa. Thus, Yuasa's theory allows an approach for the paradox of individual versus collective on our quest for a poetic instinct.

After studying Yuasa's theory and understanding the relevance of breathing in it, we asked how this could help us in our research of the poetic instinct. We tried to comprehend if it would be possible to analyze the relationship between the aesthetic experience and perception as a process similar to the breath analysis made by Yuasa. Breathing is a channel to sense the unconscious layers of energy that passes through all beings. Although breathing is an autonomous body function, it can be performed with awareness by turning your attention to inhalation and exhalation. We wonder if the same could be true to the general process of perception. That is, the body is uninterruptedly connected to our sensory system, which makes us live through our perceptions. However, we can also turn our attention and channel our focus to what we would be perceiving in a particular moment in an attempt to sharpen our senses. Thus, aesthetic experience transforms the objects of perception into aesthetic objects through contemplation,

imagination, fable, and creation.

To understand this phenomenon of perception and aesthetic experience, we must again turn to the question of cultural repertoire. Dufrenne (2008) points out two levels of perception. The *aesthetic perception* is similar to the "body knowledge" of Rolnik, because it belongs to the perception processes that are previous to the cultural repertoire. Dufrenne invokes this "alienation of the object" where the individual must detach himself from the cultural repertoire in order to experience otherness. On the other hand, *ordinary perception* would develop as we perceive the object intellectually. It is the perception processes that have access to representation, something that we understand as the cognitive experience pointed out by Rolnik.

Thus, a straight connection with the body is fundamental to reflect upon the poetic instinct because it is from the perception of ourselves and the other that we develop our instinct for survival through interaction with other beings. The poetic instinct addresses the awareness of sensorial processes looking for a straight connection with nature through aesthetic experiences. The instinct for survival guides our acts for food and reproduction through interaction with other beings and the environment. In this way, the affective and perceptual processes established in these interactions reveals why aesthetic experience is a vital function. It's through this poetic instinct that we can reconnect with other living beings and the balance of the planet. We understand this connection floats between the practice of corporal consciousness proposed by Yuasa and the aesthetic exercise of alterity proposed by Dufrenne. In the following topic, we will present two artistic works that establish relations with the concept of poetic instinct developed in this text.

Poetic instinct and artistic practice

We analyzed how aesthetic experience approaches the instinct for survival and vital functions. The survival instinct lies in the paradox between the individual and the collective, since it has a greater goal of preserving life through the protection of the individual and the spawn. In this sense, the survival instinct shifts between altruism and selfishness or between "to-myself" and the "for-everyone" (Morin, 2011).

For this reason, this paradox between the individual and the collective is one of the main points in the formulation of the poetic instinct. The poetic instinct

was elaborated after the performance “Abacateiro Acataremos seu Ato”¹ (Castro, 2016). This performance was based on the song “Refazenda”, composed by Gilberto Gil², which addresses the relation established with avocado trees, which provides their fruits for food. The song also addresses the perception of the cycles and temporality of nature. The performance began months before the public event when a dog brought an avocado seed to the artist and she decided to grow it up. She germinated that seed and kept the seedling alive for three months taking care of it daily. On the day of the event, the artist sang the song for the avocado while an interactive system collected data from her voice and from the plant to generate a visualization of the sensorial exchange. After singing to the seedling, she went to the outer side of the room and planted another avocado sprout in the garden.



Figure 1 “Abacateiro Acataremos o teu Ato” (2013). Performance by Barbara Castro in 2016

The performance began with the vital activity of other living beings – the dog eating the avocado. Here, the gesture of collecting the seed for cultivation does not refer to the instinct for survival, but it refers to the poetic instinct for the formation of affective connections with other living beings. Then, there was the accompanying and facilitation of the process of plant nutrition, as it involves the management of water and sunlight

1. Performance done in Hiperorgânicos 3 – OpenLab in Federal University in Rio de Janeiro in 2013. A video of the performance can be seen at <https://vimeo.com/barbaracastro/abacateiro>

2. Gilberto Gil, Brazilian composer and singer, 1942-alive.

for its growth. Yuasa’s body theory also mentions the importance of bodily vital activities, such as food preparation, as a meditative practice. The author does not include the cultivation of plants as one of these practices, but we believe that it fits into his thinking, since these are activities linked to survival that require a physical involvement into the action. In this way, this performance also addressed vital activities that link the relationship among several living beings and activate this vital flow into the aesthetic experience.

In the performance, Barbara sang to the avocado tree while a Kinect camera was filming the artist and the avocado seedling. The captured image was translated to a data visualization that used their silhouette as a guide path for a particle system. The movement of the particles was influenced by the artist’s voice and the size of the particles reacted to live data collected from the plant, such as humidity, galvanic response and a light sensor close to the plant. The whole system was coded by the artist using one Arduino with Plantronic³ and Processing.

The performance was not conceived in terms of vital functions, but it was created seeking the affective exchange that pervades and relates each of these functions. This performance addressed the poetic instinct, as it has several agents, moments, and aesthetic objects. The human being, the dog, the plant, and the machine contribute in different ways to the realization of a lasting aesthetic proposition that culminates in the performance, continues from then on in the sensitive exchanges that remain in the cultivation of that avocado tree until today and in the new fruits that the “Mother-Avocado-Tree” continues offering for the dog and all other beings that live around it. Therefore, this performance addresses this poetic instinct that comprises an experience of the cyclical temporality of nature, the vital functions and needs of each living being, and the affective exchange between them.

The machine and the data visualization occurred only at the moment of the performance to give visibility to this invisible exchange of affection. It discussed the connectivity and the language of this experience. By using sensors to transform the performer’s voice and the galvanic response of the plant into numbers in the same binary language, we could reflect on how technology can contribute poetically to this relationship

3. Plantronic is an electronic shield for Arduino created by Guto Nóbrega and the Nucleum of Arts and New Organisms (NANO) to collect live data from plants. See more at www.nano.eba.ufrj.br

between humans and nature, in this case the plant. In such way, the performance addressed the poetics of the paradox of the individual and the collective present in the survival instinct.

Another factor that helps us to think about the survival of life, that is, to understand how the interrelationship among the various living beings contributes to the survival of the whole, is the notion of scale. For this intent, we need to understand that an organism is a system, just like the planet is made up of several beings, formations and geological forces that contribute in many ways to the maintenance of life as a whole. Analogously, our bodies are composed of several microorganisms, flows and vital channels that collaborate to keep them alive.

These issues were addressed in “Preamar”⁴, presented by Barbara Castro in 2014. The “Preamar” installation consisted of an overlapping of two projections of a red tide of body data. The artist collected data on her and her mother’s blood pressure for 24 hours. The word “Preamar” in Portuguese sounds like pre-love (or love even before birth) and means high tide. The mother-daughter relationship is a way of thinking about the survival instinct through the reproduction and protection of the child. By alternating between choreographed and opposing movements, the two projections allow a glimpse of the process of (in)dependence established between mother and daughter and the dynamicity of fluid changes in the blood-affection relationship.

The heart data was used to create a data visualization that refers to the flow of a sea of blood. To generate the visualization, an algorithm maps the systole and diastole values to the height of a red oscillating wave. This data is also used to control a reverberation effect of the sentence “Amar é a maré”, which means “To love is the tide”, but it also sounds like “The Tide is to love”, because of the phonetics when sequential linking of the words love and tide in Portuguese.



Figure 2 Preamar, Barbara Castro (2014)

In this way, the “Preamar” installation related to the unstable nature of the emotions and their manifestation in the body through the metaphor of the tide as a manifestation of incessant, fluid, dynamic movement. The installation approached the body through the sea, and the sea that inhabits us. The tide also relates especially to the female body and how it is influenced by cycle of the moon, which is related to the periodicity of the menstrual cycle, which brings the woman’s existence closer to a blood cycle. Besides the connection between the emotions, the heart, and the blood, “Preamar” avoided the separation between mind and body.

“Preamar” was created from the understanding of the fluid and living nature of our existence, much alike of the Earth organism. As in the Avocado tree performance, we were talking about the affections established when experiencing the cycles of nature. Heart beat and circulation seem to be these poetic engines for a broad view of instinct and for a relationship with the planet.

We see in these two works how this aesthetic perception and the movement of contemplation of the body, living beings, environment, nature, and cycles are part of the process of artistic creation that guides the poetic instinct.

Conclusion

Throughout this paper, we discussed how aesthetic experience can be considered a vital function in the proposition of a poetic instinct. We discussed how two artistic projects used digital media to deal with this poetic instinct. We believe that aesthetic experience is fundamental in creating significant connections and affection with nature.

Despite the process of disaffection due to the

4. A video can be seen at: http://barbaracastro.com.br/qd_gallery/preamar/

aesthetic exacerbation and the increase of the techno-sensorial apparatus pointed out by Cruz, we believe that computational art has its role in this redesign of the poetic instinct because it may help us to imagine and to give visibility to different sensory processes beyond ours.

In addition, we must also consider the banalization of the term connectivity and the apparent superficiality related to the use of technologies as a tool for creating and maintaining social relations. However, we believe that technological ubiquity gives us the opportunity to experience the lack of empathy and affection with such intensity that allows us to problematize this question and to propose a poetic perception and interpretation of real connectivity.

Finally, if connectivity is the dissident issue of the paradox of the individual and the collective, we believe that artistic practice allows reaching the notion of survival by developing a poetic instinct by conscious sensorial experience with nature. The art process originates from the anguish and urgency of creation in an extremely personal, solitary, and intimate experience, but it also seeks to access and affect others.

Thus, even when dealing with very individual experiences, such as the relationship with the mother, the act of playing with a dog, or the habit of cultivating plants in her garden, artworks can intensify and multiply affective processes. Art can establish new relationships and aesthetic experiences with observers who get in touch with the artwork and it can raise awareness in new aesthetic experiences out of the legitimated environment of art. We hope that the poetic instinct can awaken the value of aesthetic experience and the contemplation and appreciation of nature, while also playing a conciliatory role in the ambivalence between the individual and collective experience.

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Barbara Castro is an artist-researcher and designer working in the fields of media art, experience design and data visualization. She is currently a PhD Candidate at the Federal University of Rio de Janeiro. Barbara

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In her professional career, Barbara participated as a data visualization designer in the Energy Database for Inter-American Development Bank and as a motion designer for TV-Globo. Recently, Barbara has founded the studio Ambos&& with Luiz Ludwig. Ambos&& is a creative studio that develops exhibitions and interactive projects for cultural institutions. Ambos&& has exhibited works in Museu do Amanhã, Oi Futuro and Centro Cultural Banco do Brasil.

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Transmedia as a Tool for the Reconstruction of Collective Memory in Post Conflict Scenarios in Colombia

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Abstract

In the context of Colombia's reconciliation process, and in light of the dynamics of country reconstruction in which post-conflict is framed, it is necessary to create spaces for the construction of collective memory and future scenarios that allow the rapprochement between the actors of the Conflict to be able to consolidate a new vision of its reality. In this sense, alternatives should be sought that, in the light of the new forms of representation, allow the formation of narratives and facilitate the participants of this type of process to understand the new scenario that they pose and of which they are art and part for the consolidation of Truth and trust.

The development of transmedia scenarios, allows the generation of a redimension of the reality of a collective, and thus build a proper sense of narrative that facilitates to the actors of this type of conflicts the search of the channels that more conform to their Situation, the media that actually identify them, and the possibility of varying the information systems that serve as a sieve for the evidence of situations that in themselves have been difficult and should be expressed for conciliation.

Keywords

Memory, Transmedia, Postconflict, Collective, Hypermedia Narratives.

Introduction

The impact sought in rural areas has as an objective not only to recover the memory of the groups involved, but also to achieve greater inclusion in the processes of technological democratization of the country, to serve as a model for other areas and for those who live in cities are also sensitized to a changing scenario that requires the understanding of the whole nation. All the above in the dynamics of truth and reparation not only between the actors who lived the war but between the city and the countryside that have progressively distanced themselves in the events of the last 50 years, generating implausible imaginary of the realities that occur in the environments of the deep province.

In the context of the armed conflict in our country, the report "Enough now! Colombia: Memories of War and

Dignity" of the National Center for Historical Memory (CNMH, 2013) reports the existence between 1985 and 2012 of a total of 5,712 .506 forced displacements, 27,023 abductions in the period 1970 and 2012, 25,077 forced disappearances between 1985 and 2012, 10,189 victims of antipersonnel landmines and 1,982 massacres in the same period (Amnesty International, 2013).

On the other hand, there are the demobilized of the different groups outside the law. The Presidency of the Republic shows in its statistics through the ACR (2011) that between August 2002 and October 2009, 51,992 people demobilized (individually and collectively). 61% of peace negotiations with self-defense groups. In addition, the Humanitarian Assistance Program for Demobilization (2011) indicates that as at 31 March 2008, 31,196 elders were active participants in the reintegration process. During this period, 15,242 persons belonging to illegal armed groups manifested their willingness to demobilize individually.

Colombia is currently in a process of peace and reconciliation with the FARC, but for these processes to be generated favorably it is necessary to restore trust between the victims and the perpetrators. One of the ways to recover it is to establish the truth of the facts, because victims need to know why, how and where their relatives are, but also be able to account for those events after the initial damage, i.e, those related to the search for truth, justice, and reparation. Establishing the truths will help the reconciliation and, therefore, the trust and solidarity between the direct actors of the conflict, as well as the society in general. To this end, institutions, programs, events, projects, resources and digital platforms have been created, among others, to generate the reconstruction of the memory of the conflict from its own actors.

However, when specifically reviewing the virtual tools and other technological means, it is observed that there are few in the country and all of them oriented

towards the memory of the victims and individual testimonies that have fragmented truths of the facts. In order to reconstruct the truth, it is necessary to exercise collective memory so that victims, excombatants, and society, in general, can help to establish the facts that have occurred from the many experiences of the actors. Equally, it is necessary for communities to begin to construct the possible scenarios of their future, to visualize their projects of individual and collective life, for the construction of trust and peace.

A Look at the Processes of Peacebuilding in Colombia and the Emergence of the Collective Memory Category

In the research process, it is important to recognize the construction of an information search of the antecedents related to the direction of the research problem, which is addressed by the construction and research for peace. This research has the purpose of making an approximation and deepening of the studies and investigations obtained in relation to the research problem, for this antecedent four investigations are taken: “The state of conflict research, post-conflict, reconciliation and Role of civil society in Colombia” (María del Rosario Guerra, 2005), “Studies on armed conflicts and peace: a field in permanent evolution” (Carlos Nasi, 2005), “Research for Peace: Representations, Imagery and Strategies in the Armed Conflict” (Paz-ando, 2013 vol.6), and “Scientific research for Post-Conflict” (Castillo, 2015) is based on a follow-up period from 2005 to today, understanding that in this period, significant new studies and related investigations have been carried out in the construction of peace, conflict, and post-agreement. This research is of academic and pragmatic interest in the sense of supporting the identification of the knowledge necessary for society in a post-agreement way, accompanied by more general reflections based on the knowledge and debates produced by the social sciences.

In the research by María del Rosario Guerra and Juan José Plata, entitled “Situation of research on conflicts, post-conflict, reconciliation and the role of civil society in Colombia”, it is this research explores the conditions of post-conflict studies, coexistence and the role of civil society, it is taken into account that there is a whole line of research on the alternative resolution of conflicts in educational media.

On the part of the central government, but also the

existence of non-governmental organizations that in the interior of the country have studied the processes of building a democratic culture in school or conciliation in school sponsored by NGOs such as CEPECS Foundation (Center for Economic and Political Economic Studies) and SOCOLPE (Colombian Society of Pedagogy). These studies relate how conflicts are handled, how conflicts are handled, adaptive processes, strategies, and imaginary conflicts, are the product of many institutions such as school, family and the context in which the subject is. This exhibition gives an account of a small field of research concerning the studies that have been carried out on the subject, in the same way, reveal that the dynamics is greater and even better knowing that the country has been consolidated for a community of Researchers.

In the same research by María del Rosario Guerra and Juan José Plata, they present a query in the ScienTI Network of Colciencias where information about the research groups presented to the 2002 group summons; by the word convivencia we found 5 groups; by the word democracy, 3 groups; by the word conflict, 8 groups; by the word violence, 7 groups and by the word political culture, 11 groups; which in total gives us 34, working on topics of interest for the public policy of coexistence and citizen security, as can be deduced from the topics of the declared lines of research. This indicates that the emergence of academic groups in charge of the subject has been increasing in recent years and research in relation to the political culture in the conflict scenario.

In the second study, his research work, Carlos Nasi and Angelika Rettberg, entitled “Studies on armed conflict and peace: a field in constant evolution”, the main objective of this study is to identify some of the main lines of research have developed in the field of armed conflicts and peace studies in the last decades. This suggests that over the years literature has become increasingly complex, diverse and sophisticated and has shown a remarkable capacity for adaptation and transformation to the new conceptual and empirical challenges. It also begins by showing the most relevant research on the Colombian conflict that has been legitimized for more than 50 years. This content shows that in Colombia there has been the desire to be able to classify the different typologies of the armed conflict that the country has or to think if the country suffers an internal civil war, the text informs that from the same Congress of the Republic arises the question of

whether the country suffers a terrorist threat (which would require a mainly repressive response), and not an armed conflict or a civil war (in which parties have political agendas that may eventually give legitimacy to become interlocutors, not simple enemies) from this point of view in a very radical position, the author maintains that Colombia must be considered in a state of civil war that gives an argument on the literary bases on the political economy of the armed conflicts developed by the Pioneering studies cited by Collier and Hoeffler (2000), David Keen (2000, 2001), Berdal and Malone (2000)), this literature is based on statistics produced from databases of hundreds of internal armed conflicts throughout the world.

In the third research entitled *Studies for Peace: "Representations, Imagery, and Strategies for Conflict"*, the central objective is to show the role that social research has played in the Colombian conflict process. Peace (irenology) is a new field of study as a novel in Colombia compared to studies that already have of war or armed conflict (polemology). Although both for one field and for the other, it would be misleading to argue that there are no studies to respect within the literature and production hitherto developed, like-wise it is not unknown that our intellectual and literary production is characterized by showing Polemological studies (armed conflict), while studies of ireneological (peace building) are scarce or very few. Stating this manifestation has led to support in the social sciences and by analysts that "our armed conflict is over-diagnosed, and that production has reached its peak in the attempt to try to account for all those elements characteristic of our internal war. Justifications about why one form of literature abounds over the other are abundant; However, two are usually the most recurrent. Those who are part of the field of knowledge itself and in which it is held that "to know peace it becomes necessary to know war" while, from the other side, "to know peace, it becomes necessary to study peace" (Paz-ando, 2013).

The authors conclude that in this way, since the field of peace studies is a relatively new field, it is clear that the volume of production, compared to studies on conflict and violence will be minor. In this way, we continue to study wars and violence, but peace, as an object of the study appears as something unknown and little considered within the academy.

In the fourth "scientific investigation for the post – Conflict" Humberto Librado Castillo of the Faculty of

Law of the La Gran Colombia University, he reports on the actions for peacebuilding that carry some methods and techniques, since it is necessary to build meetings in the different approaches existent for the construction of peace scenarios, with respect to the investigations there appears the challenge of not losing the objectivity on the part of the investigator, since it can fall in redundancy of uncertain information that affects the normative sense of the investigation for the peace and the resolution of conflicts. The ability to influence policy-makers is key to thinking about processes and evaluating their outcomes in a way that allows for an incremental development of policy. It is therefore necessary to strengthen not only instances of dialogue and more influence on government decisions, In this way the role of the researcher in the pursuit of peace plays an important role, since this work of investigating peace must be recognized as a commitment to memory, the gathering of information, the ways in which observations are made, narrating the victims without losing their objectivity.

In the light of the peacebuilding tracing for post-conflict scenarios, it is proposed for the Colombian scenario the need to advance processes of recovery of the collective memory of the peacebuilding initiatives that various actors are negotiating requires us to review some categories that are central: Collective morality is one of the fundamental ones.

Collective memory is part of living memory. Perhaps that is why Halbwachs (2004) affirms, advances paralleling it to official history and written history. It is a memoir that does not speak of a learned past, but of a lived past. In this sense, says the same author, is a memory that articulates our small inner world and the society that surrounds us. It is a memory that is distinguished by our state of consciousness on the place where we are located. Therefore, it is a reflexive memory through which we modify our ideas of the past. As Halbwachs himself says, memory is largely a reconstruction of the past with the help of the present (of information of the present). Indeed, it is a memory that can be opened even when it does not open; this is because it is marked by our memories and those of others. There is no need for other men in the immediate environment to remember, since we always carry with us and in ourselves a certain number of them, those others.

Although the debates are diverse, the fact is that collective memory as a category of analysis allows us to understand that our memory is never individual, or

at least not the only individual. We can't say that we are alone or we remember alone. The new images are outlined on other memories that remained, it is possible that some indecisive or inexplicable. We describe and explain what surrounds us from our experience and from those with whom we have lived. The memoir is enriched with each contribution, is rooted and finds its place. Hence the importance of others, of the group that welcomes us or of the community in which we live: we are able to fuse our past with theirs (Halbwachs, 2004). We carry them in our tracks and beyond them. These memories have the ability to slow, modify, break or accelerate the pace of life.

In this vein, we assume that the versions that subjects and communities elaborate on past events are a constituent part of social practices. For this reason, as Manero Brito and others (2005) affirm in speaking of memory, we do not refer to a constituted memory but to a constitutive memory. That is to say, we are faced with a memoir that is, in effect, a constructor of social reality that is involved in the same modes of the constitution of subjectivity and of the social processes that act in their social context. Hence, Manero Brito and his colleagues affirm the collective dimensions of memory (2005).

The Emergence of Documentary and Fictional Narratives for the Recovery of Social Stories in Latin America

The media have evolved in the last century to such a level that they are increasingly transcending the limits of their own technology. Lev Manovich (Manovich, 2002, p.4) in his text "The Language of the New Media" even suggests that this route marks a line of convergence that since the nineteenth century seeks to relate directly two phenomena historically separated as are the computer technologies and the media, coming to flow in what he calls new media, allowing the processes of communication and entertainment to achieve increasingly integrated associations in human daily life. Information representation technologies such as printing or photography, among others, affected in a very specific manner aspects of the media distribution or particular types of cultural communication, but the revolution of the computer media especially since the second Half of century XX in words of Manovich:

"Affects all phases of communication, and covers uptake, manipulation, storage, and distribution; As well as affecting media of all kinds, whether texts, still images and in motion,

sound or spatial constructions" (Manovich, 2002, p.4).

In the mid-1990s, it was common to see how the fusion of the print and digital media was well received, generating a different type of reading that in a romantic way was expected - within the so-called digital utopia - will solve as it mentions Scolari "... If not all, at least most of the problems of humanity - and experimenting with new forms of online communication" (Scolari, Claque: Toward a Partnersemiotic of Digital Interactions, 2004a, p.195). Over time, society has realized that in the idea of maturation of hypertext, it has only allowed it to be more evident and to be taken to a higher plane, the activity of interactivity that is already found in any process of reading (Scolari, 2001a in Scolari, 2004, p 211).

Although this research does not seek to determine if there are "new" or "old" media, or if only the evolution of traditional media to a new format is present, it is important to take into account that the forms of cultural appropriation they nowadays involve different ways of relating to information, managing it, constructing it and articulating it in communication systems which in turn no longer depend on a single channel of production and distribution, but have been appropriated by the users/prosumers, those who consume / produce content and link participative, creative, collaborative and contributory actions to their consumption process. The foregoing brings to the forefront a wellknown and accepted an assertion that every means of expression exists insofar as its users act or do not act in it and with it (Levis, 2009, p 221).

Under this space of techno-social hybridization, the construction of transmedia narratives can be translated as a process of cultural ensemble derived from the impact of new technologies on the forms of thought and generation of identity in the various emerging social groups at present. The multiplicity of channels of information circulation and convergence systems that have been gradually developed allow us to envisage an increasingly complex scenario in terms of the construction of stories that can be transmediated and the subsequent systems of appropriation by users. To design a strategic model for the construction of transmedia narratives that imply the character of interactive becomes a necessary topic in the development of a specific definition of the subject approach in the local, national and transnational context.

On the basis of this view, it can be said that Latin America is immersed in a significant search for its own

capacity for self-representation, without this implying disconnection from the current global context. Martín-Barbero (Martín-Barbero, *Memory and Form in the Latin American Soap Opera*, 2008, pp.2-7) argues that in the evolution since the late nineteenth century, through the “radial theater” in Argentina and groups Reading in the tobacco factories in Cuba, to the Latin American novel that took a toll in the 90’s, one can perceive the connection between the melodrama and the cultural history of our continent.

This type of productions that transferred different types of media - cirque theater, oral narratives, the radio novel and that come to impact the television and the cinema itself - have as particularity the fusion between the oral histories proper of the rural environments with the new urban dynamics, constituting the key to the national identity imaginaries, which, in turn, are presented as narrative systems of “open structure” in which the perception of the audience actually allows to modify the original script line, arrive to advocate what Martín-Barbero defines as (with) fusion of fiction and life:

“Whether individually and collectively the possibilities of being recognized, of being taken into account and of counting in the decisions that affect us depend on the ex-pressiveness and effectiveness of the stories in which we tell our stories, this is even more decisive in this permanent “laboratory of identities that is Latin America” (Martín-barbero, 2002, p.9).

The melodramatization of everyday life in fictional forms of representation has allowed us to generate a sort of narrative profile that has been appropriate from Mexico to Argentina, but which, in its globalized transit process, is permeated by archetypes that must be inserted in other areas, causing even the blurring of “Latin American” in order to integrate into new markets.

On the other hand, the written press, like the radio, has served as a diffuser of the narrative constructions throughout the continent, and its contribution is not only limited to the journalistic but in a chronic sense contributes to the generation of forms To tell our stories that progressively are mutating to the new digital platforms. In the last decade, the migration to these new formats generates doubts, concerns, conflicts and searches that make the consolidation of new forms of appropriation of the traditional systems of content construction still very complex.

The current forms of information appropriation constantly present new routes for the construction

of narratives that interact in much more accessible mediums in the region in the last 20 years than their comparable throughout the twentieth century. By making a preliminary sweep of transmedia productions across the different countries that make up Latin America, a strong tendency towards documentary over fiction can be perceived. This makes it possible to demonstrate the need for Latin American filmmakers to identify and represent the reality in which they find themselves, and that a system of communication such as the internet with the capacity to impact globally directly without being permeated by large Industries or governments also serves as a reporting system that demonstrates the “real” context of the cultural, political and economic situation in the region.

Countries such as Argentina, Brazil, and Colombia in transmedia aspects have widespread tendencies to social issues-environment, ethnics and childhood -, cultural and scientific when the projects originate in the academy. Nevertheless, the extensive tradition developed since the melodrama in the continent, allows a germinal base of narrative construction that begins to have enough exponents from the commercial fields like base of a new generation of productions that focus on this sort, and that can use the new forms of communicational convergence to make viable achievements that might otherwise be impossible to carry out. This impact capacity derived from digital systems and the hybridization between formats allows the exploration of devices of different nature as cultural interfaces of development and communication, which contribute a “calorific” socializing factor in our context.

In the context of the collective memory recovery process, two cases in South America have been emblematic, which have been supported by the development of transmedia platforms to consolidate a narrative collection of the facts, actors, victims, reconstruction and symbolic reparation of pain and the damage done to the social fabric in the face of war events. The proposals called “Malvinas 30” (<http://www.inter-doc.org/malvinas-30-un-documental-transmedia-interactivo/>) and “Walsh Project” (<http://proy-ectowalsh.com.ar/>), the first of They break with the traditional documentary scheme where the spectator sees an earlier event that is presented as if it happened in real time. In this narrative logic “Malvinas30” told what is happening, the present of the year 1982. A sort of virtual time machine that proposes a non-traditional

approach to one of the most controversial events in recent Argentine history. The social networks are a fundamental part of the project, they serve to narrate in real time the conflict, to publish voices in the first person and to generate participation and interactivity with the users. From the account @Malvinas30 were published on Twitter the alternatives of war and what the Argentine and foreign press commented, in addition, it was transmitted in streaming TV programs of the time so that the user could observe how Argentine society was informed at that moment. In addition, the project had interviews with journalists, historians, infographics, photo-galleries, a large press archive and special productions that were posted on the site.

The “Walsh Project”, for its part, is a periodic experiment that sought to remix or “remix” an outstanding work of classic Argentine journalism, Operation Massacre (by Rodolfo Walsh), with a modern vision of the discipline supported by various digital tools of publication “created by digital media researcher Álvaro Liuzzi and journalist Vanina Verghella. Walsh Project comprises three main axes, around which a great variety of narrative resources were grouped to count who Walsh was and to recreate the day to day of its investigation for Operation Massacre, “respecting the original times of publication that maintained during the years 1956 And 1957”. The website - which, among other things, offers a PDF of the original book - collects all the material produced by the project between 2010 and 2012, which includes interviews with journalists, documentalists and colleagues of Rodolfo Walsh, the record of chronological information and work which was done in social networks to create the effect of “present time”, and a detailed record of the impact of the project on the media.

For the national case, the most relevant project that has been consolidated as transmedia production is called “4Ríos” (<http://4rios.co/>), which narrates the events that took place in the so-called “Naya Massacre” in the Timba, Cauca. A massacre committed by the AUC self-defenders of the Calima block, led by the paramilitary Hébert Veloza, aka H.H. Where more than 46 peasants, indigenous and Afrodescendants were murdered; The platform has an interactive comic and animated short on the website, as well as the possibility of having the printed content, digital content triggers in applications and models with augmented reality elements that show infographically the events.

These experiences are considered as transmedia platforms for the recovery of collective memory because they make a historical narrative of the event, gives rise to the various actors of the conflict in the context of what happened and seek to generate a communicative-participatory processes with the users that allow them to build processes critical and reflective about the place of events in the context of war and peacebuilding.

Hypermedia Narratives and Collective Memory

What does the act of narration offer? The possibility of participating from a proper aesthetic, where you can best explain the reality. When narrating an event the narrator describes himself and in doing so, one can find his feelings, desires, and sufferings, making possible the approach to his thinking and his feeling. His narratives are then lexical, language games that show desires, lack, feelings, in short, a structuring of possible realities against a given context. This set of expression systems, enhanced by the process of collective reconstruction of memory, allows the ability to observe reality lived in perspective, and identify itself as a being that linked to it, now brings new moments of social reconstruction.

On the construction of realities, Norbert Bolz states that “instead of representation, today we find the concept of construction” (Bolz, 1998a, p299), both collectively and individually all the time are constructed concepts of “I am a subject, I have concepts and the best thing that can happen to me is to have with my concepts an adequate image of reality there” (Bolz, 1998b, p 299).

Information and communication technologies occupy a privileged place as a vital scenario for narrating and narrating, the inclusion of digital interactivity understood as the process through which people interact with other agents - people or systems - through of products of a communicative nature applied to digital interactive media, offers the possibility of constructing stories closer to the divergent forms of representation of groups immersed in a system that should not only be circumscribed to themselves, but also be a projection screen of the reality of others.

In this scenario of re-representation and searching for new forms of integration of reality systems, the concept of the calorific factor arises again (Vásquez Rodríguez, W. & Herrera, S., 2011), which is then given when the subject It does not conceive the interface as a software or hardware, or a conjunction of elements closer to the machinic than to the interacting, but as an

entity of effective communication and dialogue under common semantic and metaphorical codes between organisms. The interface gets a quality of transparency, which begins to communicate with the digitally encoded culture. In the words of Scolari (2004, p.40), the interface “is no longer considered a kind of membrane separating two spaces or proportions of matter, but a device that guarantees communication”, therefore understanding the interface as text implies analyze the interaction between the individual and the computer, as well as the exchange of information resulting from this relationship outside this dual agency.

Cultural interfaces allow the connection with the other, the connection to social processes of interaction that are not subject to the fact of being connected, processes that involve reading, listening or seeing the other that is re-represented through the interface. It is therefore that the character of virtuality is important to analyze it in the light of interactions between agencies, building then virtual spaces of an eminently

Having said the above talk of the “phenomenon of transmedia narratives” involves expanding the space regime and the interface frame, designing those leads to thinking in the first instance the construction of the story and its expansion, as well as the identification of the user. In addition, it is vital to identify the structural elements on the way to a construction of logical and hypertextual connections, generating narrative universes that are deployed in multiple media. That is why the importance of analyzing the interface not as a machine but as an agency. With regard to the construction and execution of a project designed from a transmedia logic Gallego (2011), states that the stories conceived can start from an event that happened on the plane of everyday life. By getting a group interested in it, look for information to identify its genesis, generate collective construction processes and additionally mechanisms or platforms are available from the media for their dissemination and feedback, it generates a narrative and transmedia experience.

The transmedia narrative undeniably is largely circumscribed in the processes of collective creation that are typical of the last three decades with the exponential emergence of the Network, which has explicitly favored distributed coordination, group production and the construction of knowledge fed by an endless number of cultural nuances, on the part of groups of people, regardless of their number or if they are distant from one

another (Casacuberta, 2003, p.10) (Levis, 2009, p.

It becomes a priority to understand the underlying processes within the generation of transmedia proposals, the development of scripts or the adaptation of the same, the structuring of systems of transmission and diffusion channels, to evaluate the real needs of each nascent proposal and the logistical feasibility and financial in the middle of an unstable socio-economic situation in many occasions, among other factors. It is there that the user emerges as co-creator and producer of new dynamics that not only oxygenate the stories and provide diversity, freshness and dynamism, but also participate in the collective expansion, including the budget contribution as in the crowdfunding projects, and the generation of a timeline that transcends the concept of information, consumption, the need for company, or the possibility of being part of a collective identity, and becomes a narrative universe that is enriched by the cultural nuances of those who become fans.

It is thus that the geographical origin, transited by the processes of globalization and cultural integration, influence decisively in the current systems of globalized information distribution, providing an egalitarian process of contribution and construction that lead to the emergence of a new informative culture (Casacuberta, 2003, p 53), which, as Pierre Lévy (2004) puts it, becomes the manager of his own sense of existence.

Currently, the common Colombian citizen, ignores the dynamics and structures of the armed conflict in the country, since those who have done research have focused on issues about the historiographical reconstruction of the facts, but have neglected to put in common in civil society the findings, and have tried to propose strategies for building peace in post-conflict scenarios ignoring the high degree of misinformation and apathy people have about what happened. The initial screening shown in this article reports on investigations into the nature of the confrontations on the national scene, but not on effective socialization alternatives involving the communities that are being harmed and the current and new generations that will be the subjects to be appropriated and to be proponents of the new scenarios of social co-existence in the post-conflict period.

Although the Center for Historical Memory has been carrying out documentary work that records and perpetuates the type of events that have been tried to show in this document, its scope remains limited because it has not permeated communication systems

and narrative forms that are closer to the groups prevailing in the national panorama, and which, have been influenced by media constructions drove even as a strategy of disinformation to precisely block the peace processes and reconstruction of the truth.

That is why the transmedia is considered as a distributed information system, not subject to the pressures and coercions traditionally possessed by the traditional media by political sectors or participants of the conflict, allowing the interaction and collective contribution, opening spaces of denunciation, exposure and evidence of violations of rights during the Colombian internal conflict by visibly violated actors, such as indigenous groups, afrodescendants, women and entire peoples, who have been invisibilized, thus generating a loss of collective identity that affects the possibility of reorienting the vital, cultural, ethnic and political projects of these communities, and that through these types of proposals, they can reconfigure the identity senses as collective subjects, and recognize themselves in the context of diversity and Plurality of the nation; fundamental step to think of a post-conflict society.

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The Sagamine Satoyama Plan

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Abstract

The Sagamine Satoyama Plan is an initiative underway in the Sagamine district of Nagakute City in Aichi Prefecture, Japan. This is a comprehensive undertaking, aiming at the preservation of the agriculture rooted in the natural environment of the area, the creation of a distinctive local culture and enhanced human interaction between local residents. The initiative is carried out on the understanding that the locality's natural environment and agriculture form a single ecosystem, along with such elements as local festivals, the internet, and renewable energies.

Keywords

Agriculture, Natural Energy, Art, Music, The Internet, Local Festivals, Local(ity), Recycling-Oriented Society, Ecosystem.

Introduction

Given the occurrence in Japan of large-scale disasters such as earthquakes and volcanic eruptions, and the terrible chain of events at the Fukushima Daiichi nuclear power plant, public fears about disasters and radiation are on the rise; unease about dependence on such dangerous energy sources as nuclear power is also growing. Also, in recent years the natural environment has been degraded due to industrial development, and valuable local indigenous plant life has been facing habitat loss. Harvestable fields have been declining in number, and agriculture has been dying out due to the ongoing loss of the local community which formed its basis. Local cultures are also being lost in recent times due to the impact of globalization.

The nuclear accident in Fukushima Prefecture contaminated large areas of land, and even now there are large numbers of people living as evacuees. All of this reminds us of the importance of the land we ourselves live on, and keenly aware of the importance of the local community. This awareness in turn makes us feel that surely we should build relationships of mutual support between fellow-members of the locality, working from our normal everyday lives – relationships

that stand us in good stead if disaster should strike, and that can help protect the locality's natural environment and agriculture.

What is the Sagamine Satoyama Plan?

Located in the Chuubu region along Japan's Pacific coast, Nagakute City in Aichi Prefecture lies between the major cities of Nagoya and Toyota. Nagakute has seen a large population influx in recent years, spurring on the city's development. The formerly rich natural environment is being progressively lost, and the local communities of old are vanishing. On the other hand, Aichi University of the Arts lies within the Sagamine district, and the zone around the school, which is protected from development, retains a rich natural environment. And because this locality is at the edges of the Nagakute City urban area and of the Sagamine mountain area, it takes on the exact quality of **undeveloped woodland near a populated area** – a terrain known in Japanese as *satoyama*.

Satoyama terrain, then, is a domain where human society and nature intersect; from time immemorial, Japanese people have gone there to do a whole range of things, like collecting firewood and berries, and raking up fallen leaves for compost. Preserving the ecosystem as they went, local residents reaped a broad range of benefits from their *satoyama*. Nature in its turn, moderately disturbed by human intervention, was activated into increased floral diversity, making the *satoyama* a location of symbiosis and coexistence.

The word "*satoyama*" also had the broader meaning of mountains and the rivers that flowed from them, along with ponds, agricultural water-channels, rice paddies and dry crop-fields; it expanded to cover the whole agricultural environment, including the culture of the country-dwellers. The rainwater that falls in the uplands of the Sagamine district still flows into ponds and through water-channels to irrigate rice-farming inside Nagakute City, connecting the Sagamine district

with the cultivated lands within Nagakute City as an agricultural environment.

In other words, the *satoyama* was a place which amply supplied all the requirements for people to live self-sufficiently in the locality – fuel and foodstuffs, compost and building materials, along with artistic, cultural and local-societal resources. People thus protected the *satoyama* carefully down the ages. This terrain was the basis of people’s lives and livelihoods, and its disappearance would have been tantamount to depriving the people of their means of subsistence.

Under the Sagamine Satoyama Plan, a wide range of initiatives are being undertaken both in the natural environment of Sagamine and inside Nagakute City. There are eight different activity areas – Mountain (Yama- 山), Woodland (Hayashi- 林), Grassland (No- 野), Flatland (Hara- 原), House (Ie- 家), Crop-field (Hata- 畑), Local Festivals (Matsuri- 祭), and Country (Sato- 里) – all of them hosting their own range of activities (Figure 1).

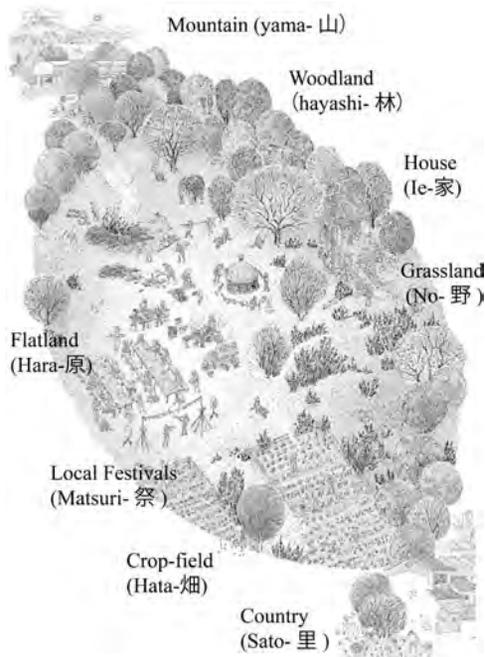


Figure 1. The Sagamine Satoyama Plan Map

Mountain (yama- 山)

The mountains of the Sagamine district still retain areas of untouched nature. The slopes are home to gentian and tri-dent maple, with white-flowered pipewort in the wetlands and Asarum nipponicum, Luedoehria japonica plants and Scarlet Dwarf dragonfly live in the woodlands. The area is home to a wide array of rare plants and animals unique to the locality. Under the Sagamine Satoyama Plan, local people, students and others take walks through the Sagamine upland areas, observing nature, surveying the fauna and flora, and creating craftworks using the resources of the natural environment. The Sagamine district’s uplands are also home to hand-dug agricultural tunnels (Figure 2), ponds (Figure 3) and water-channels, agriculture, an important surviving agricultural heritage. The Plan includes exploration of the agricultural tunnels by local residents and students, etc. Also, the water-channels are inhabited by rare fish species such as dark chub, and locals do an annual survey of these rare fauna and flora (Figure 4). The trees on the mountains, receiving the light of the sun, perform photosynthesis, producing oxygen. The waters trickle down into streams and flow into ponds, eventually getting used in the rice fields of Nagakute City. Water, then, is the source of our lives, and make sure that this mountain area is home to a range of important fauna and flora is also to make sure that the natural environment, which is the source of our lives, is being maintained in good condition.



Figure 2. Local residents and students exploring a cave in the outdoor experience workshop “Forest” (2007)



Figure 3. Local residents and students playing in a pond in the out-door experience workshop “Forest” (2006)



Figure 4. Local residents and students observing round- leaved sundew plants in the outdoor experience workshop “Forest” (2012)

Woodland (hayashi- 林)

The woodlands of the Sagamine district consist of wide-ranging copses of Japanese chestnut, harboring a wide range of nuts, berries and other foods – ginkgo-nut, juneberry, loquat, Japanese plum (Figure 5), bamboo shoots, propagule, chinquapin, mountain cherry, and Japanese pepper, among others. In the Sagamine Satoyama Plan, this natural bounty is picked by local people, students and others, and a work -shop on cooking foods making use of these woodland ingredients is held monthly. Fallen woodland leaves are made into compost (Figure 6), and logs and branches recovered from periodic forest thinning are used as cooking fuel in work-shops (Figure 7). As well as teaching appreciation for the bounty of nature, these workshops are also an effort to keep the

woodland environment in good condition by thinning the woodland’s trees. As well as this, the woodland provides cool shade in the summer, and a break against the cold northern winds of winter (Figure 8). And they serve as a play area for children and a spot for students and local people to take walks – a place where different people can get together.



Figure 5. Children picking plum in the outdoor experience workshop “Forest” (2012)



Figure 6. Student gathering fallen leaves to make compost (2014)



Figure 7. Parents and children using a saw to thin out the woodland in the outdoor experience workshop “Forest” (2016)



Figure 8. Children playing in the woodland shade in the outdoor experience workshop “Forest” (2012)

Grassland (No- 野)

The Sagamine district has wetlands where reeds grow, along with ostrich fern (Figure 9,10), horsetail, Japanese knotweed, butterbur and berries. A wide range of flowers of the field bloom according to season; and the area is home to varied animal and bird life – wild boar and field rabbits, raccoon dogs, snakes, pheasants and mountain turtledoves, among other species. The Sagamine Satoyama Plan includes nature-experience workshops, with walks through these grass-lands, picking the grasses and berries and cooking with them.

There are events to celebrate the grasslands’ grasses and flowers, which are also used both as ornaments at local festivals and as fertilizer for dry crop-fields. In this way, the grasslands bless us with a rich and varied bounty.



Figure 9. Parents and children walking through the reeds in the outdoor experience workshop “Forest” (2013)



Figure 10. Parents and children harvesting ostrich grass in the outdoor experience workshop “Forest” (2013)

Flatland (Hara- 原)

In flat places where relatively little grass grows, students and local people make various craft objects using the re-sources of the outdoor environment, with the wood, trees and grasses around them as materials – pottery, huts, and pizza ovens, among other things (Figure 11, 12). At a monthly workshop, using firewood from the nearby flatlands as fuel, they cook with vegetables from the nearby crop-fields (Figure 13). This area also sees the creation of artworks and dynamic expressive activities on a scale too big for a regular event schedule (Figure 14). Even if you have no money to spend, the natural environment provides us with a creative space and a wealth of materials. The flatlands of Sagamine offer nothing convenient, so people have the chance to work together and try out new approaches in making craft and art objects.



Figure 11. Children using the flatland soil to build a house in the outdoor experience workshop “Forest” (2009)



Figure 12. Parent and child using wild grasses to create a shape in the outdoor experience workshop “Forest” (2014)



Figure 13. Parents and children cooking in the flatland in the outdoor experience workshop “Forest” (2014)



Figure 14. A workshop for making pottery with the flatland earth, baked using fuel from the woodland (2008)

House(Ie- 家)

Under the Sagamine Satoyama Plan, students built a house in the grounds of Aichi University of the Arts, using locally gathered materials (Figure 15). Constructing a house together has allowed the students to have the experience of working as a team and to learn about many things, from forestry and architecture to the local environment (Figure 16). The finished house is used to store equipment for a wide range of activities, and also for workshops, exhibitions, concerts and other performances. It is equipped with solar panels, a wind-power generator (Figure 17). and batteries, etc., and the renewable energy is used to power local festivals and events. Rainwater from the roof is also stored in tanks and used to water crops.



Figure 15. Raising the house beams (2008)



Figure 16. Making the walls of the house (2010)



Figure 17. Solar panels and windpower generator (2016)

Crop-field(Hata-畑)

As part of the Sagamine Satoyama Plan, students and local people make crop-fields in the Sagamine district, growing crops such as pumpkins and cucumbers, tomatoes, egg-plant, okra, Japanese radishes, and carrots (Figure 18,19,20). The fertilizer used is a compost of grasses from the grasslands and fallen leaves from the woodlands, along with cow manure from the district's livestock farms. Local materials are used as far as possible. The vegetables and grains grown in these fields are eaten at nature-experience workshops, local festivals and so on. Recent years have seen significant crop damage from wild boars and other animals, so there is a need to develop a strategy to protect the fields.



Figure 18. Harvesting okra in preparation for a local festival (September, 2014)



Figure 19. A harvest of summer vegetables (September, 2014)



Figure 20. Students who participated in harvesting (2014)

Local Festivals(Matsuri-祭)

The Sagamine Satoyama Plan includes two local festivals a year, to draw the local community together. (Figure 21, 22, 23, 24) Through music and art, nature and food, these events are intended to provide local people with a forum for meeting each other. Cooking is

done at these festivals with seasonal vegetables brought by the local people themselves, and vegetables gathered locally. Branches are cut from the trees for fire-wood, and seasonal plants and grasses decorate the festivities. Local produce and materials are used as far as possible to create an atmosphere of the locality's nature and seasons. With cultural globalization, the area's distinctive local culture has been disappearing in recent years. The Plan aims to create a distinctive local culture for the area, witnessing the traditional local arts, crafts and performances (Figure 21) on display at these local festivals, and holding dance workshops with dancers from the area.

These events and local festivals are planned so that the people who attend them can also have a hand in cooking, setting up the meeting place, decorating the meeting place, joining dance workshops, and can get the opportunity to have a lot of different experiences together with the other participants. At present, social ties between people in the locality are becoming weaker, so these local festivals offer local people a chance to meet and get to know each other by having the same mutual experiences. By getting used to having fun and working together at festivals, they are simultaneously training themselves to offer each other mutual aid and support if and when a disaster strikes. After the Tohoku Earthquake of 2011, numerous artists and musicians went to the evacuation sites to create artworks and give performances as a way to encourage the victims of the disaster. In this way, art, music and local festivals can play a major role in offering psychological support to local people.



Figure 21. A performance of traditional women's dance at "Summer festival of Aichi Children's Art University" (2007)



Figure 22. A dance workshop at the "Fifth Nagakute Picnic" (March, 2016)



Figure 23. Participants joining in with the cooking at the "Sixth Nagakute Picnic" (September, 2016)



Figure 24. An outdoor live performance at the "Sixth Nagakute Picnic" (September, 2016)

Country (Sato- 里)

When the Fukushima tsunami and nuclear accident happened, the social infrastructure and systems failed, leaving local residents to help each other escape the dangers. It became clear that the social systems in place during normal times will be paralyzed when a disaster strikes, leaving the local community all there is to fall back on. But now that social ties between people in their localities are becoming weaker in Japan, it is possible that the local community will fail to fulfill its role. With this in mind, we first compiled a database to visualize what activities local residents of Nagakute City were getting involved in, and put it on a website to share this information with the local community (Figure 25, 26). Working with the local administration of Nagakute City and with community activists, we also set up the Civic Activities Exchange Assembly to provide local people with a forum to interact with each other.



Figure 25. Nagakute Yuimaaru Website. <http://www.nagakute-yuimaaru.com> (2014)



Figure 26. Nagakute Yuimaaru Website. <http://www.nagakute-yuimaaru.com> (2014)

Satoyama as an Ecosystem

In the Sagamine Satoyama Plan, mountain and woodland, grassland, flatland, house, crop-field and country mutually combine with energy sources, information, people management and art to form a single ecosystem (Figure 27).



Figure 27. Satoyama as an Ecosystem

- The sunshine pouring down on the mountains powers photosynthesis, giving growth to the trees of the forests and woodlands and the grasses and flowers of the grasslands, leading in turn to the generation of oxygen.
- The rain falling on the mountains courses through water-channels to be collected in ponds, to be used in the paddy fields of Nagakute.
- The leaves that fall in the woodlands are gathered and used as compost for the crop-fields.
- The small branches that fall in the woodlands and the trees that are thinned out from them are gathered and used as energy for cooking. And the woodlands, moderately thinned out, maintain a good environment.

- The edible wild plants harvested from the grasslands are used in cooking at events and local festivals, and the flowers and grasses are used as decoration.
- The grasses of the grasslands are cut and used as fertilizer for the crop-fields.
- The vegetables harvested from the crop-fields are presented in the meals eaten at events and local festivals.
- The energy produced by the solar and wind power generators at the house is stored in batteries and used to power lighting and sound at events and local festivals. Also, the water collected in the tank is used to water crops in the crop-fields and powers pumps, etc.
- The water falling on the roof of the house is collected in the tank and used to water crops in the crop-fields, etc.
- The music, art and cuisine at the local festivals draw the people of the country to the satoyama, and the local festivals become a forum for many experiences and encounters.
- The satoyama offers the people of the country the chance to engage in activities in the midst of nature, along with a wealth of knowledge and experience of the natural environment and the fauna and flora. It also gives people the chance to interact and find recreation and refreshment.
- Local communication is activated through the website and other information media, playing a useful role in the preservation of the agricultural and natural environments.

Conclusion

In presentday Japan, the many and varied negative effects stemming from colossal, vertically integrated systems such as mass media and nuclear power generation are becoming strikingly noticeable. On the other hand, personal information and distribution systems such as the internet and renewable energy are being developed. While the traditional local community – with its agricultural roots reaching back into time immemorial – is in the process of vanishing from the Japan of today, today's local community is arming itself with the smartphone, the internet and social net-working services – and this makes it possible to create a local community anew. In place of the fading, agricultural-based local community of old, the aim of the Sagamine Satoyama Plan is to create a satoyama for today, deploying traditional patterns of living and culture along with technologies such as natural energy

and the internet in combination with nature, agriculture, cuisine art and music in a comprehensive manner to create a recycling-oriented society.

Rather than partial approaches and strategies, a comprehensive approach combining solutions from a broad range of areas is required in order to resolve the diverse problems confronting modern society today. The farmers of pre-modern Japan were referred to as “peasants” (hyakushou). The Japanese spelling of the word includes the character for “one hundred,” implying that these were people who performed a myriad of different tasks. Pre-modern peasants were engaged in agriculture, but also in forestry, crafts, performance and culture – these were people of many talents. However, with the progress of industrial specialization, the specialized workers of the modern world lost the totality of perspective whereby they could see around them in a comprehensive fashion. Today, however, the progress of the internet, of multiple various systems of information and production, have made it possible for people to recover a broader viewpoint and equip themselves with diverse capabilities.

Large-scale systems such as nuclear power generation and the mass media lack the spontaneity which local areas and individuals have to think things through for themselves and to take action on their own initiative. The Sagamine Satoyama Plan will continue to strive for a self-sustaining, independent local way of life.

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Author Biography

Author is a media artist and design director who has been engaged in making interactive installations and design. He has made various pieces with a view to constructing an environment where anyone can participate freely without any restrictions. He is an Associate Professor in Aichi University of the Arts. His work has been shown at SIGGRAPH (93,94,96,98,99,01), at ARTEC (93,95,97), at ISEA (95,98), at Lovebytes(02), at Prix Ars Electronica(97,03), at European Media Art Festival(94,99), at sightsonic(03). He has made oral presentation at Japanese Society for the Science of Design (14,15,16), and presented poster at ISEA2016. You can visit his web site at <http://kankyo-media.com>, <http://sagamine-satoyama.com>, <http://forest.org>, <http://nagakute-picnic.com>

Open Estudio: Mapping Intercultural Dialogues through Art and Technology

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Abstract

This paper presents the continuation of our interdisciplinary work connecting art and technology at Purdue University (USA) and Universidad de Antioquia (Colombia). In particular, this presentation will analyze retrospectively the research, methodology and outcomes of the course experience “Open Studio / Estudio abierto: Interactive art and 3D animation”, during 2014 and 2015. We will also evaluate the course in order to provide improvements for the upcoming 2017 course. The academic exchange reflects on the topic of cartography in the digital era, introducing the concept of the journey as the starting point for reflection and artistic creation. Our methodology encourages cooperative work between students and professors, establishing a dialogical relationship without the traditional teaching hierarchies. The participants of the experience (students and professors of Purdue University and U.de A) create a bridge for an interdisciplinary, geographic and cultural exchange. The social and cultural projection of this pedagogical research experience is expressed in the resulting art projects, as well as in exhibitions of the results and reflections of participants.

Keywords

Art and Technology, Dialogic Pedagogy, Problem-based Learning (PBL), Intercultural Exchange, Teamwork, Programming, 3D Modeling, Journey and Cartography

Introduction

Open Estudio is an academic and intercultural research experience between Purdue University (USA) and Universidad de Antioquia (Colombia), created to facilitate reflection and creation towards art and technology. “Open Estudio”, is our hybrid English-Spanish word to frame this exchange experience, departing from the idea of an Open Studio. Open Studio experiences were gatherings of artists and academics to share ideas during the art salons of the 17th century. Embracing the openness of these meetings we incorporate this approach in the 21st century by including methodologies of cooperation and teamwork as a strategy for cultural exchange, interdisciplinary work and creativity. The physical exchange of faculty and

students during the intensive course is possible by a prior intensive planning organized through virtual interactions between the coordinators at Purdue University and Universidad de Antioquia. These managing activities must be carefully planned and are crucial steps for the success and improvement of the program, facilitating a dynamic intercultural collaboration that makes the exchange evolve each version. In particular, this course operates as a Maymester Study Abroad program from Purdue and an elective course at Facultad de Artes of Universidad de Antioquia. Professors, instructors, researchers and students from both universities participated at the 2014 and 2015 studio experiences that encompassed two modules. The first module took place during the first week, focusing on the development of technical competency in the areas of animation and programming interactivity. For this content, we used the open source platforms Processing and Blender. The second module, during the second week, focused on intercultural group work through the development of multimedia and interactive projects. These projects were presented as a public art exhibition at the end of the experience. For both modules the instructors emphasized on the concept of “Journey” and invited students to document their experiences through journaling and cartography. For this matter, the course had a third modality that included daylong trips to the city of Medellín and its mountainous and exuberant surroundings.



Figure 1. Purdue University's student analyzing a map of Santa Fe de Antioquia in the 2015 course

Conceptual Frame

Journeys and Cartography in the Digital Age

The topic of the course is inspired on the practice of travel logs, documented through literature, arts and cartography. For centuries, travelers have documented their experiences through guidebooks, sketches, maps and memoirs. However, we asked ourselves about its equivalency in the contemporary world, and in our particular digital age. We encourage participants to find spaces and objects during a series of field trips, to engage with the creative process and encourage critical reflection. Piccolo Careri describes in his book *Walkscapes: Walking as an Aesthetic Practice*, the idea of moving and walking the landscape as primary form of mapping the individual experience symbolically and aesthetically (Careri et al., 2004). Specifically, we encouraged students to document their experiences during the field trips with a perspective that integrated psychological and geographical impressions, in a similar manner that the artist André Breton proposed in 1924 to document emotions and behaviors of the urban landscape (Sánchez, 2015). Thus, we invite students to document their trip by combining traditional media (such as drawing and writing), and including new media tools, such as digital photography, video and sound. These artifacts will not only be used as documentation, but also as materials for creation. This aligns with the scope of reflection that Christiane Paul developed in her book *Digital Art* (2003), in which she proposes the understanding of digital art from two perspectives: as a tool and as a medium. The reflections that emerged after being exposed to new cultural contexts became raw material for the creative projects that were developed during the studio.

In this manner, the studio can be seen as a vital practice that goes beyond the classroom, in a sense that it includes the lived experiences and emotions of the travelers. During the course activities that were conducted in 2014 and 2015, the group went on different field trips within and around the city of Medellín with the goal of locating students in diverse surroundings including both rural and urban perspectives. Some of these trips included visiting places like Cerro Nutibara, Parque Arví and Metrocable. Additionally, the group did two other field trips to the patrimonial small towns of Santa Fe de Antioquia and El Carmen de Viboral. The active character of these outings was reinforced with hikes that provided the opportunity to document the journey and

to reflect on the construction of a personal map, one that combines cognitive, emotional and geographical perspectives. This aspect of documentation and creative reflection is the backbone of the course, and is intended to integrate students in an immersive experience with the visited locations that includes body and mind. Students created analog and digital journals compiled in the form of photos, videos, sounds, drawings and notes. These artifacts constituted the basic materials for the creation of multimedia projects. In some cases, students articulated their own reflections of the trip within the concept of digital cartography by creating interactive maps that departed from their journeys and documentations. Examples of this are two cartographies created in 2014 and 2015: *Diario Cartográfico* (2014) (Cartographic Diary) by Diana Marcela Zuluaga and Sara Echeverri (Colombia), and *Untitled* (2015), by Betzie Yasmin Ajsivinac (Guatemala), Mary Luz Ochoa (Colombia) and Cameron Tyson (USA). Both projects invite the viewer to interact and immerse themselves in a map that creatively recreates their emotional and critical reflections of these trips (see Figure 2).

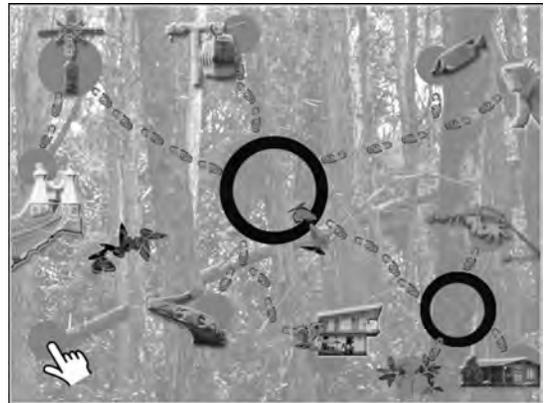


Figure 2. *Untitled*, 2015. An interactive map project created by Betzie Yasmin Ajsivinac, Mary Luz Ochoa and Cameron Tyson

In addition to offering sociocultural experiences for the students to create their projects, the field trips became a space for group bonding. Specifically, the hikes established teamwork and cooperation among intercultural groups and created a sense of friendship. One example of a “bonding moment” was the support that one of the Purdue students in 2015 gave to one of the Colombian students to overcome her fear of heights

by holding her hand until they both crossed the long bridge in Santa Fe de Antioquia. A second example was the karaoke activity that emerged naturally in the bus when returning from the same field trip. In this case, music was the media that integrated professors and students from different cultures to help them have a more horizontal relationship.

These dialogical and horizontal interactions were a complement to the academic objectives that motivated this course. Paulo Freire (1995) explains the nature of a radical, pedagogical experiment in the practice of dialogical theory. In dialogical pedagogy, “dialogue presents itself as an indispensable component of the process of both learning and knowing” (p 379). In the Open Estudio experience, teachers and students embrace dialogue in the liberating acts noticing and learning from one another, disrupting the hierarchies of traditional pedagogy. Another important pedagogical framework was the idea of facilitating learning by focusing on concrete problems as proposed in Problem-based learning (PBL), a teaching-learning methodology that departs from the socio-constructivist perspective of learning (Casals, García, Noguera, Payà & Tey, 2010). In the Open Estudio course, students are actively engaged in:

(a) Identification of personal and common interest, (b) Design of methodologies for team work (establishing role and activities), (c) Selecting materials, means and programs to develop their projects, and (d) Installing and socializing their project with the audience.

Cooperation for Creative Learning Bridging Purdue and Universidad de Antioquia

The beginning of this exchange experienced between Purdue University and Universidad de Antioquia (UdeA) departed from identifying common interests in the relation between art and technology. Specifically, Open Estudio started from the participation of Esteban Garcia Bravo (Purdue University) and Isabel Restrepo (Universidad de Antioquia) in the Latin American Forum at the International Symposium on Electronic Arts, ISEA 2013, in Australia. From that moment, both professors started a leadership process to establish interpersonal and institutional relationships. This process eventually expanded to other professors in both institutions until they created the conditions to perform the courses in 2014 and 2015. The perspective of the required exchange implied

the socializations of ideas, the search for financial support, the construction of the methodology and the content of the class, and a series of physical and online meetings. In the ISEA 2014, we presented the results of our first experience with Open Estudio reflecting on the details of creating a bridge between two educational institutions (Garcia Bravo & Restrepo, 2015). In general, the exchange process can be seen as an organic, interactive and iterative dynamic that includes three components: academic management, realization of the course, and evaluation.

In the Classroom

The course is composed of classroom sessions at the UdeA Cultural Center with scattered field trips in between. The space is also used as one of the university’s off-campus museums and auditoriums. In the classroom, students and faculty get to meet one another and to learn the tools for their work. The first week’s goal is to learn the fundamentals of programming and the fundamentals of 3D modeling. By combining instructor explanations and students creative hands-on work, participants solve problems and applied technical and theoretical concepts for the development of creative projects. We chose open source software tools because of its accessibility. Open source tools facilitate learning and the continuity of the work across diverse spaces and platforms. For the programming module, we used Processing and, for 3D animation, we used Blender. Each learning module had a final assignment that allowed students to demonstrate their learning through the design of digital artifacts (prints, interactive animations, and 3D models). In the case of the programming module students approached the understanding of basic functions of programming and applied them to various multimedia elements such as images, sound and video. For example, in one of the class exercises, students had to create an interactive “Metrocable” (iconic cable car transportation in Medellín) from scratch. They used code to control the graphics and the interactive components of their project. It is important to highlight that the project’s aesthetic departed from participants’ documentation during the fieldtrip to the Metrocable. An example of the cable car designs can be seen in Figure 3.

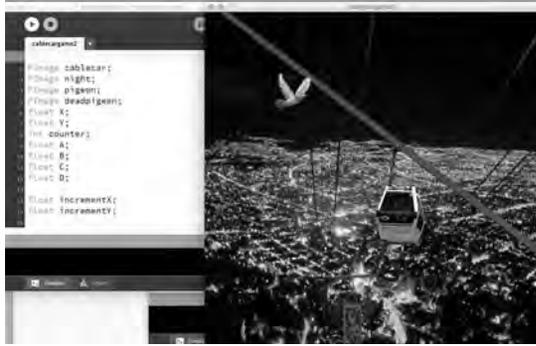


Figure 3. A cable car interactive application by Rachel Louthan

In a similar way, in the 3D module students learned how to model elements of the city to the virtual space of the screen. Specifically, from the experience of the city, students are invited to adopt an object from their journey as the origin for a visualization process in Blender. Students are also invited to create a narrative associated to it. Using basic tools for modeling and texturing, students recreate and resignify their inspirational objects in an activity named “Archive of Urban Objects”. One of the works that was done under this premise expresses the experience of one of the participants, the student Betzie Ajsivinac, who selected a chair (Figure 4) for modeling in Blender and wrote the following narrative: “Every morning on our short road trip to the classroom to Centro Cultural, I always walk past this chair that always catches my eye.



Figure 4. Example of a 3D model made by Betzie Ajsivinac

The design is simple yet interesting and with an antique look. In this image I wanted to capture the attributes of this interesting chair so that I can look back to it as a memory of my everyday morning walk to the classroom where the real fun began for the day. Thus, the chair becomes an important significance in my stay in Medellín, Colombia”. Another example of the Archive of Urban Objects exercise emerged after one of our visit to the Piloto Public Library in Medellín, where students and instructors were inspired by an exhibit of old photographs and artifacts from the city. The designs were printed on paper and displayed at the exhibit. Figure 5 shows the work of Katlen Vergara, who reflected on how trashcans may be overlooked as “dirty” objects, undermining the importance of they role in every city.

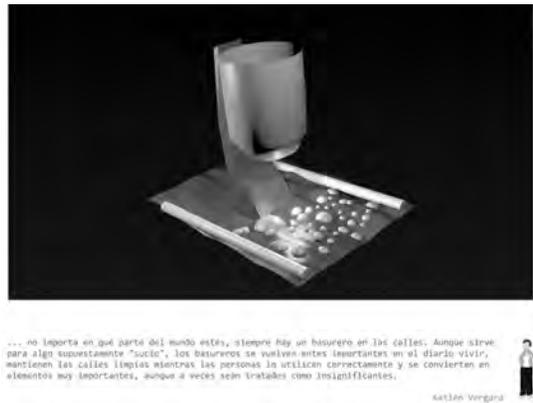


Figure 5. Example of a 3D model made by Katlen Vergara

For the modeling of the objects, instructors started with a tour of Blender’s interface to teach the elements that are needed to build a 3D scene. Among the basic elements that are taught in these sessions are: cube, camera, lights, and positioning in the virtual space. Students learned how to position, move and manipulate the basic geometrical figure of a prism in order to model it in a new form. Methodologically, students start transforming the cube into simple forms, such as chairs, crosses and tables. Eventually they are able to create complex designs like cars, buildings, plants or animals. In parallel to the modeling, students are guided into the program to better use light options, textures and camera positions to improve their compositions.

Both of these assignments (interactive cables and the objects for the Archive of Urban Objects) were a methodological invitation to activate a creative and technical learning process of the programs, in a way that opened possibilities for acquiring a common background for later teamwork.

The second module of the course occurred during the second week; when students are invited to put into practice what they have learned to creative teamwork. The methodology of this second module started with an invitation to share individual ideas with the rest of the group, with the intention of integrating their experiences in the search of common interests. The instructors moderated these experiences and aided in the formation of groups. In particular, instructors motivated participants to find common topics and diverse collaborators from a different culture and area of expertise. This intercultural prompt became more intentional in 2015 and students did in fact form groups with members from both universities. In 2014 there was only one intercultural group, while in 2015 there were three of them. During the project development, students collectively planned the audiovisual and conceptual components of their idea. They determined the tasks and assigned them to different group members. All instructors were available to provide feedback during the ideation process and guidance and support during the development of their projects, solving technical questions. There was no formal lecture and only hands-on work individually and collectively. The questions and difficulties that the students encountered ignited a dialogue with the instructors. The members of the different groups were also able to help one another, figuring out solutions to their problems. This way of teaching and learning allowed a constant feedback among students themselves and instructors, providing multiple views and opinions. Simultaneously, there was dialogue between the instructors to curate a final exhibit of the resulting works.



Figure 6. Project development phase in teamwork

The group dynamics were not limited to academic aspects. For example, the field trips became a space that strengthened interpersonal relations that benefited the development of the group projects. Students recognized that through collaboration, they could achieve a greater quality of work compared to what they could have achieved on their own. One of the greater struggles for both students and instructors was the language barrier because most participants were not bilingual. To minimize the impact of this barrier, the course was taught in both English and Spanish. The instructors also invited the students to not be timid about trying to speak the other language and to find creative strategies to understand their classmates. Students used mobile technologies to facilitate their communication, translating in real time or using gestures and images to make themselves understood. The importance of learning a second language became more apparent to the students, as they identified it as a form of self-improvement that opens doors to new experiences and opportunities.

To facilitate the learning experience of students and the culmination of the projects, all the activities of the course required the collaborative work of additional people who focused on activities relating to administration, logistics and communications. It is important to mention the participation of other personnel that took on tasks that facilitated the experience. More explicitly, these tasks were: Production, administration, companion, graphic design and documentation. For example, student groups had access to a limited materials budget that allowed them to cover the costs of production and installation of the pieces. The production team made possible the implementation of the materials.

The resulting projects were exhibited publicly at the Cultural Center. The double of this space nature (classroom and exhibition) was positive because it allowed participants to get familiar with it and to visualize their projects in relation to that setting. It is important to highlight that the space strengthens the concept of the “Open Studio” referenced before, because the place of the learning experience is opened to the public. The items displayed at the exhibit included images created during the learning process, such as interactive images of the Metro Cable and the Archive of Urban Objects. Foremost, the exhibit displayed the interactive artworks that resulted from the group projects realized during the 0 second week of the experience. The day of the opening seemed more of a happening than a regular class critique.

A retrospective analysis of the final results of individual and team projects allowed us to group the projects into some categories that speak about the aesthetic qualities of works that merge art and technology. In particular, they exemplified some of the principles of New Media proposed by Lev Manovich (2002). For example, the vast majority of projects were the result of numerical representations, either for directly creating the piece by algorithmic operations or by digitizing analogue documentation; secondly, the modularity and variability principles appeared as key elements for the understanding and creation of code for aesthetic purposes. The resulting projects can be grouped in the following categories: printed digital imagery, animation, video, interactive installation, and video games. This experience also allowed some students to use the programming skills to make an approximation to data visualization, an area of study that invites artists to take advantage of the plasticity of the data (Waltz, 2011). This was the case of the application “Vida Nocturna” by Guillermo Blanco and Alex Stamm (2014).

The results from the Processing module in 2015 were displayed in Android tablets to allow the public to observe the interactive graphics that the students designed inspired on their own experience of the “Metrocable” travelling through the mountain. The resulting group projects were also documents of lived experience. For example, the video game “El Paso de Occidente” by Daniel Blandón Cañas and Sebastián Zea Quintero, takes place in a virtual representation of the centennial bridge of Occidente in Santa Fe de Antioquia. In the game, the user must overcome vertigo while crossing the epochal suspension bridge. This project was the reflection of an actual sensation that the students had when visited the place during one of the field trips. In “Evolución Constante”, by María Camila Arenas, Shubham Gulati and Juan Felipe Orozco Posada, reflected on the indiscriminate growth of the city towards the mountains. This generative piece adds repetitive building designs to a mountainous landscape, questioning the idea of progress and commenting on the formulaic International architectural style. These projects exemplify lived experiences and reflections of the city turned into interactive artworks that surpassed the expectations of the instructors. Our initial plan of documenting emotions as a form of reflection became the catalyst for engaging interactive art works.



Figure 7. Video game titled “Paso de Occidente”, by Daniel Blandón Cañas and Sebastián Zea Quintero in 2015

For some participants, the experience of showing their works in a public venue was totally new. Most of them had never shown their work outside an academic setting and this brought an additional sense of value to them. The interaction among work, creator and audience gave a new dimension to the experience. Students were eager to establish a dialogue with the audience about their process creating their final project and to receive feedback. These reflections allowed students to get motivated beyond a grade and transcend to their individual development.

Evaluation

At the end of the course experience, and after the public exhibition, the whole group (instructors and students) ventured to a retreat to the country to facilitate a state of group reflection. We went to the Oriente regional Campus of Universidad de Antioquia near the township

of El Carmen de Viboral. In a classroom, the instructors also assessed the experience through a questionnaire to be filled individually by students. The written evaluation was followed by a group round table. About the evaluation of 2015 one of the participants said: “This is in reality an experience that is built day by day. Maybe, the most emotional moment for me was the closing session, when we shared our opinions about the experience. It is at this moment that you face yourself and other participants and realize what was the experience about. It is like the moment of a confession, or at least, that was for me because at that moment I was disappointed of humanity and with this exchange, in particular, realized that I should not generalize, and that there was a space for me in this world”.

From analyzing the evaluations, students reassured their disposition to learn, investigate and create outside the motivation of a grade, something that was also observed during the entire experience. They identified that learning based on relating to others, was a potent tool for project development. We also learned that although students felt at times tired or overwhelmed with the daily activities, the overall experience was of great value for them. They were thankful to have participated: “I met a friend and we are so alike” one student emphasized. They felt satisfied that they were able to communicate and work in groups despite the language and cultural barriers.

The evaluation of the experience corroborated aspects of our methodology of teaching and learning inspired on Luis Camnitzer pedagogy: “Information is not limited to be a transmittable object, but becomes a group of conclusions resulting from an investigation made in the commons” and “Pedagogical authority is shared and assumed predominantly by the one in the team that can contribute with the best performance” (Camnitzer, 2009, p82).

From these ideas, it is important to say that dialogical model of teaching and learning was an important element for the experience. The non- hierarchical approach diffuses the traditional concepts of teacher and student: the teacher as the source of knowledge and the student as a passive receptor. Open Estudio challenges the traditional proposition of the instructor as a container of all knowledge and the students are passive vessels, and it empowers participants to actively engage in pursuing a common goal through project-based learning. Our pedagogy aligns with a

contemporary approach where the teacher is a guide who departs from sharing experiences and basic content, and moves towards mentoring research and creative processes.

Additionally, to the documentation that each student did during the classes, the entire experience was also documented on photographs and video, in order to develop print catalogues and video clips. In this way, the exchange is transferred via social media to new audiences and help recruit future interested students of both universities. In general, the analysis of the evaluation and the construction of the documentation of each course provided the necessary elements to improve new versions of the exchange in coming years.

Conclusions and Future Work

From this study, we analyzed the Open Estudio experience retrospectively from 2014 and 2015 as a dialogical tool for learning, researching and creating digital artifacts. The methodology proposes a non-hierarchical relationship between instructors and students while immersing in a new cultural context. The Open Estudio course showed its potential as an innovative pedagogical experience to integrate art and technology through real experiences, located in particular geographical and symbolic contexts. First, for its interdisciplinary efforts connecting art and technology, and second, for facilitating vital points of learning: where exchange, cooperation and research evolve into personal growth for all stakeholders. Since the experience is based on continuing more intercultural dialogue, each time we face new information, skills and material to conceptualize and improve future versions of the exchange among universities, programmed to be done every two years. Our next version will be in May 2017.

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Authors' Biographies

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Isabel C. Restrepo holds a PhD from Universidad de Antioquia and a MFA in Art with emphasis in Multimedia from San Diego State University. In 2008, Restrepo founded the interdisciplinary group Hipertrópico to study relationships between art, technology and society. She directed key research within that group, including the project on Augmented Reality and Imaging and Artistic Education: A Pedagogical Model. In her exploration, Restrepo has utilized Open Source as a tool for production, experimentation and teaching digital

media in art. Such work has led to the creation of the pedagogical multimedia Líneas Digitales, based on the use of GIMP. In addition, she has worked as a curator and an educator.

Esteban García Bravo

Esteban García Bravo explores computational arts as a researcher, a practitioner and as an educator. He earned his MFA from Purdue University in 2008, and a PhD in Technology, also from Purdue, in 2013. His research on computer art history and digital media art practices has been featured in the annual meetings of international organizations such as SIGGRAPH, ISEA and Media Art Histories-MAH. His artwork has been displayed internationally in media art festivals, gallery exhibits, museums and artist-in-residence programs. Esteban is an Assistant Professor in the department of Computer Graphics Technology at Purdue University, where he teaches digital imaging, visualization and computational aesthetics.

Carlos Mario Sánchez

Carlos Mario Sánchez Giraldo holds a Master of Arts from Universidad de Antioquia and an undergraduate degree in Arts from the same university. He is a member of the research interdisciplinary group Hipertrópico, convergence between art and technology. He is the coordinator of the research schools (semilleros). He has been co-investigator in the following research projects: Imaging and Artistic Education: A Pedagogical Model (2009) and is actively part of the researchers of The Animation in Colombia (1990 -2010), Medellín, chapter. He participated in the Chataee project with the component FotoVoz for communities Tikuna and Cocamas in Leticia, Amazonas (2011). As a creator he has participated in multiple spaces and artistic local events. He is also a professor at the School of Art at Universidad de Antioquia.

Pablo Andrés Pulgarín

Pablo Andrés Pulgarín holds a BA in communications with an emphasis on multimedia from Universidad de Antioquia. In 2008 Pulgarín became part of Hipertrópico research group, and he participated in several research projects with this group. He is currently a professor in the departments of Art and Communication of the same university.

Vis. [Un]Necessary force A Socially Engaged Creative Practice Research Project. Dr. Luz María Sánchez Cardona

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Abstract

Vis is a long term socially engaged creative practice research project that—using digital technology as a tool—examines the consequences of violence on the daily life of civilians in contemporary Mexico. This project addresses the tensions that take place in the smallest human unit/group possible: family. Specifically, *Vis* focuses on families in both rural and urban areas of Mexico, that have one or more members that, officially, are not kidnapped or killed, but who are not present: absentes [ausentes], that is those taken away by police forces, the military, or by members of drug-cartels. At present the ausentes, their children and/or spouses [not officially orphans or widows yet], are just numbers and statistics in governmental reports. This project reclaims the experiences of these families by attentive listening to them, understanding their stories, and engaging in an active participation about how they would like to be portrayed within the contemporary social ethos. Using the potential of technology through creative practice, *Vis* collaborates with these families in order to regain the lost power of their voice—a voice that has been silenced—within a dialogue that has yet to start in Mexico.

Keywords

Social Justice, Art, Creative Practice Research, Community, Digital Technology, Digital Image, 3D portrait, Sound, Voice.

War and Violence in Mexico

How to explore contemporary violence in a country where the figure of the state has been completely absent or, in the best case scenario, breaking apart? It is a challenge to try to grasp such a complex theme: There is no official data one could relate to there is continuous intimidation of media and journalists; there is lack of trust in the state representatives—from mayors and judges, to street police. Could it be that the state itself—from its edges to its center—is suffering from a process of permanent de-composition, which makes it impossible to navigate reality armed with the lingua of 21st century democracies.

Words like ‘reconstruction’ or ‘peace’ do not have a place in the Mexican chorus, given the fact that we are

far from being in a stage of reconstruction. Scholars, social activists and individuals do not yet have a consensus on what the word ‘peace’ may mean. Are we talking of ‘peace’ as the opposite of ‘war’? War against whom? Why? And who is fighting it?

In Mexico, government and cartels alike avoid calling things by any name. Silence is the rule they would like to impose, at any price: “Different forms of forced silence, of quietening” (Ochoa Gautier, 2003).

The Government has not declared a state of emergency, and actions of Cartels are counted as petty crimes. The Mexican legal system is way behind on what is taking place, and corruption—if not collusion—of police and special law enforcement groups is now at the highest levels of government.



Figure 1 Luz María Sánchez. *Detritus* (2009-2016)

Each community is forced to make its own code to refer to what is happening. The simple act of sharing an experience, by the way of trust—if the wrong listener is on the other side—may bring direct physical violence to the person voicing reality. Entire communities are living in a state of despair, fragility, and even terror.

During the past five decades we have witnessed drug cartels infiltrating every layer of life. But the last ten years [2006-2016] have been the most violent ones. The whole strategy of former President Calderón—even before he took office—was to knock down violence associated with drug trafficking in Mexico and, actually, just a few days after taking his oath of office he declared a war against drug trafficking that endured from 11th December 2006—when Calderón actually started this war by sending 5,000 soldiers and police officers to the state of Michoacán (Agren, 2015)—until the last day he was in Office: 30th November 2012. During the six years that this war took place, former President Calderón appeared in military garments as Mexico's Drug War Commander in Chief.



Figure 2. Luz María Sánchez. *Detritus*. (2009-2016)

The main target of this military strategy was to reclaim control of those states where Mexican cartels were in charge. Mexico's Drug War (Archibold, 2012) began as a decision to recover sovereignty in a context of political and social crisis (Pereyra, 2012). At the end of this period, there were more than 45,000 officers deployed in the states of Mexico, Baja California, Tamaulipas, Michoacán, Sinaloa and Durango (Aguayo, 2008: 174), and more than 60,000 casualties.

The strategy of having military and special forces units deployed all around the country continued under Peña Nieto's Presidency, if not under the tag of Drug

War, but as a way of trying to regain control over certain regions of the country—plazas as they are being called under this parallel code used by the police, the military, the government and the cartels, and that civilians are learning on the go.

This war, however, seems to be against civilians, and every broken boundary makes the problem harder and harder to resolve. Entire communities in the north of Mexico have been abandoning their belongings and their jobs, in extremely fast exodus, in order to save their lives and those of their loved ones. When the story of the 43 missing students surfaced, the independent search for their remains—in the case that there actually are any—resulted in the discovery of several mass graves in which the bodies did not match those of the 43 (Miroff, 2014).



Figure 3. Luz María Sánchez. *Detritus*. (2009-2016)

During these ten years we have witnessed how individuals and entire communities—beaten by violence—are being criminalized by media and the government. The voice of victims of this violence is being completely suppressed, their accounts are under scrutiny, and their lives under siege.

Ausentes

Hundreds of parents are currently looking for their sons and daughters—taken by the police, the military or the cartels—fearing that in the best case scenario they are working either at the drug farms—or ranchos—as slaves, or as prostitutes for the drug capos, or in cartel-controlled brothels. In the worst case scenario, these kidnapped individuals might be resting in the thousands of mass

graves dispersed around the country (Lakhani, 2015).

The term *ausentes*—absentees or missing—was coined by the families of these individuals that do not have any information on their loved ones, there is no trace of them, but there is no ransom asked for—technically is not an abduction—their bodies do not materialize—without a body there is no technical confirmation of a death—but the fact is that they are not present. Families then reject any other term until they do have confirmation of their loved one’s fate.

Since the State is not implementing real social strategies to help these families and their communities, and given the condition of extreme despair that these individuals are in, they started different ways of collaborating in order to get organized and start the search for their loved ones.

This search, through local or national brigadas [brigades], is a community act in which individuals join groups to independently track and find mass graves—some of these are clandestine burials managed by legal authorities (Janowitz, 2016)—where they dig—with or without the help of local or federal authorities—and then exhume the remains found. That is the reason why they call themselves *rastreadores* [trackers], or *rastreadoras*—like the group of the same name of more than two hundred women based in Los Mochis, in the northern state of Sinaloa (Padilla, 2016) that are tracking the whole state in the search for missing citizens.



Figure 4. Luz María Sánchez. *Detritus*. (2009-2016)

Through *Vis* we are looking closely at this social phenomenon, and even if the final creative project will find the shape of sculptural sound installations, the creative research process using technology at each stage will help us answer the question: What is the role of art in defining the use of technology to support—if not

peace and conflict resolution—social reconstruction?

Families are units: the smallest human group possible. And using a metaphor: when an element of this unit is extricated for no apparent reason, it takes time until the unit realizes that this element is not coming back, and therefore that it has no possibilities to repair itself. Reasons are diverse, but all of them deal with the collapse of the structure of the state.

The unit turns, then, to its own community. But the community is unable to help because the exacerbated violence is implemented by organized groups—legitimate and illegitimate. Since these groups have the power to take over the whole community, silence builds up as a barrier: nobody knows anything. What happens then is that the unit collapses—economically and emotionally—: Families break apart, some of them emigrate to safer places, few of them start the search for the missing one, the *ausente*.

For those that are broken, frightened, and threatened, silence and acceptance seem the only options to keep going—a sort of survival mode. In the exceptional occasions when members of the unit start a search for the *ausente*, they also start wandering in circles through state offices, morgues, brothels, any place where they get a hint of information on the whereabouts of their loved ones.

Vis core group is made of these individuals that are already in the process of voicing themselves loudly. The chorus begins with them. *Vis* focuses specifically on two groups: the orphan children and the surrounding family of the *ausentes*. Children and adults that are willing to share their experiences in living with violence—violence that is not just implicit but explicit, symbolic violence, psychological violence, extreme physical violence.

This approach to the described problem requires the construction of trust, the building of connection, common of ground. And since some of these families are under threat, we have to be very sensitive about the information we move around the project—we barely can imagine a scenario where there is no confidence in authorities, neighbors, even other family members—that is why this project has to operate on the basis of ‘trust’.

Interdisciplinarity

Working with such a multifaceted theme requires collaboration and advice from professionals that work in different fields. *Vis* is surrounded by a group of advisors that includes psychologists, social justice specialists, and legal experts that provide counseling on a case by

case basis.

This interdisciplinary group of professionals facilitates the direct contact with specific families and individuals, and enables part of the creation process by providing me with information on previous experiences within the field as reference.



Figure 5. Luz María Sánchez. *Detritus*. (2009-2016)

A parallel—but not less important—group of advisors is made of programmers, engineers, and designers. Programmers assist me on the operation of the Vis online repository. Engineers and designers help on the 3D modeling, scanning and printing, and in the actual operation of the electronic sound devices that will be part of the two sound installations that will be constructed at the end of 2017 and mid 2018.

Repository

Vis—as the projects 2487 and diaspora produced previously—has a strong research component. The Vis archive is being assembled at the same time as the creative research is taking place: interviews, research, graphics or maps all are part of the process and are being stored directly into the Vis repository. Therefore, the repository is the archive.

The repository is open for contributors, colleagues, and advisors who are able to access the research. Once all the installations are completed, the repository will be locked, and no more data will be added. But the general public will be able to access it as it will stay open as the complementary documentation of this socially engaged, creative research project.

On the public part of this repository [front], we are creating a dynamic portfolio to introduce the project online. But on the back of this repository, we are building an intuitive work experience in real-time. This

tool enables Vis team members in different parts of the Americas and Europe to add information and share it in real time.

Social Engagement

Through dialogue and conversation, relatives of ausentes—parents and children—get involved in a dynamic that eventually will help them regain the lost power of their voice and use the voice to talk about their private, inner emotional situation and also discuss the violence they have to endure. “There are two kinds of narrations that should be interlaced to try to give violence a proper place: the private narration that will allow mourning, and the narration of those responsible for the public voice. The condition for getting out of the catastrophe lies in the possibility of intertwining both narratives” (Ochoa Gautier, 2003).

By attentive listening to these individuals, understanding their stories, and engaging them active participation about how they would like to be portrayed within the contemporary social ethos, we are taking a humanistic approach, far away from media—for which these individuals are ‘news’—far away from media and government offices—for which they are data. Vis implies a process of rehumanizing these individuals, taking them out of their positions as mere data and making them real to others.



Figure 6. Luz María Sánchez. *Detritus*. (2009-2016)

Now that we are already three years—and counting—into the creative research of Vis, and have had several conversations with human rights activists and civilians, we have found that there is a need for more information about creative practices and technology as social catalysts. Consequently, conferences and talks on the theme of art and violence were designed, as well as workshops in which participants—children—could voice their current situation, where they could have

the “possibility of gathering together around a creative activity outside of the practices of violence cultivated by the local gangs” (Ochoa Gautier, 2003).



Figure 7. Luz María Sánchez. *Detritus*. (2009-2016).

I see *Vis* as a nod that listens forward, taking those that surround the 24,000—and counting—missing-individuals, outside of the lists of secondary casualties of violence in Contemporary Mexico.

Human Scale

Working with digital technologies [online-repository, 3D images, geo-localization, digital video/audio/photo] but operating on a human scale [one-on-one dialogue, building trust, attentive listening], I am looking forward to finding equilibrium when the reconstruction of these histories take place, both on the net and in the three-dimensional space.

Technology facilitates the final shape of the creative process. The online repository works as a reference tool while the project is developing: it allows team members to build up batches of information gathered during research, visualize them, and understand the numbers and their social implications.

Even if *Vis* is using digital tools to build and communicate, it is important to state that it is being made on a human scale. Building research within the repository is a hand-craft. Analyzing data, organizing data, even if using digital tools to visualize it, has to be done on a one-to-one basis. That is what the project is calling for.

Working hand in hand with social psychologists, social workers, educators, and human-rights advocates, we are approaching these families and providing 3D models of drawings by children in art therapy. These 3D figures modeled after the children’s drawings will give

shape to the 3D printings that will have integrated audio-reproduction systems and that will be integrated as part of the sound installation *V.[u]nf_2*.

Vis explores the possibilities offered by 3D scanning and printing with the aim of developing functional sound devices that depart from commercial design and enable me to adapt sculptural elements to the requirements of the sound installations.

Construction of Aesthetic Objects

As the last stage of this creative research project, there is a commitment to create several sculptural, large-scale, sound installations that closes this investigation on violence as voiced by civilians.

The first sound installation of the three that conforms this *Vis* is already completed: *V.(u)nf_1*—an acronym that stands for *Vis*. [un]necessary force edition 01.

The second iteration will consist on the 3D sculptural sound objects based on the drawings of children, and the third will consist of custom made sound devices in the shape of fragments of human heads, bodies—molded after living family members of ausentes.

Interaction

For the participants it is important to be heard, listened to. Their histories—sometimes hidden as something illegal, since family members of victims deal with a double victimization—are important to be heard, to be known by the general public, inside and outside of their communities.

The more visibility they get, the safer they feel, the more empathy that can be constructed around their situation— our situation.



Figure 8. Luz María Sánchez. 2015. V[u]nf_1. 74 sound clips in mp3 format each playing through 74 sound devices shaped in the form of a Carcal F Pistol. Installation detail. ©Cecilia Hurtado



Figure 9. Luz María Sánchez. *detritus*. (2009-2016)

For the public that eventually will interact with the final work, it is important to know the histories of those

who live in a state of emergency due to the exacerbated violence exercised by distinct groups of power—legitimate and illegitimate—in contemporary Mexico.

Last

Technology is indeed a potential tool to support social process pointed at resolution of conflicts. In the Colombian case, individuals were called to build “new coexistence and ethical practices that counteract the violent death empire, to call for a new civility order, and to transform the heritage of revenge through the construction of mourning.” (Ochoa Gautier, 2004: 23).

In Mexico, where we are still unable to use the word war or the word peace without asking first where are we standing and how we got here, we are embarked in a creative research project that uses technology to register and circulate the fragmented stories of the victims of this war against civilians.

Vis is looking forward to present, through digital means—the archive, the repository, the data, the creative work— one of the possible answers that may help build a new chorus, a chorus that will allow everybody to be heard.



Figure 10. Luz María Sánchez. *Detritus*

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Author Biography

Transdisciplinary art practitioner, scholar, media archaeologist and author, Luz María Sánchez (Mexico) studied music and literature, and through her doctoral studies (Universidad Autónoma de Barcelona) she focused on the role of sound in artistic practices since its mechanical inception in the 19th century.

Sánchez is Artistic Member of the National System of Art Creators in Mexico, and is part of the Program "Science, Art and Complexity" of the Complexity Sciences Center at Universidad Nacional Autónoma de México C3-UNAM. She is the Chair of the Department of Arts and Humanities at Universidad Autónoma Metropolitana, Lerma.

Samuel Beckett electrónico: Samuel Beckett coclear (Mexico City: UAM) and *The Technological Epiphanies of Samuel Beckett: Machines of Inscription and Audiovisual Manipulation* (Mexico City: FONCA) are her most recent publications -both 2016-.

Her artwork has been included in major sound and/or music festivals as well as museums and galleries in the Americas and Europe: Zéppellin Sound Art Festival (Spain), Bourges International Festival of Electronic Music and Sonic Art (France), and Festival Internacional de Arte Sonoro (Mexico); Museo de Contemporary Art (Bogotá), Museo de Arte Carrillo Gil (Mexico City), The Dallas Contemporary (Dallas), The Illinois State Museum (Chicago and Springfield) and Centro de Cultura Contemporanea de Barcelona (CCCB) among others.

SOPRO (The Blow)

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Abstract

This paper talks about “Sopro” (The Blow), an interactive work energized by the public through the force created by their blowing on a propeller. This art proposal is based on the use of a simple technological system, a poetics of the blow and on primordial scientific principles. The system present in the work aligns itself with current energy and sustainability issues, inserting them in the context of art-technology, and post-digital thinking.

Keywords

Art-Technology, Energy, Blow, Sustainability, Post-Digital.

Introduction

This paper talks about “Sopro” (The Blow), a work carried out by the cAt (science/Art/technology) Research Group of the Arts Institute of the Universidade Estadual Paulista (São Paulo State University) - UNESP. We have been working with digital technology in art for long time, and in this work we make use of the thoughts present in the processes of creation with the digital, without employing digital technology. Questions regarding interactivity, collaboration, sustainability, post-digital and also a systemic vision, are present in the discussion process that generated “The Blow”.



Figure 1 The Blow (2014). cAt Research Group

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Energy and Blowing

One of the key issues facing us today pertains to our energy sources. Works in the art-technology field can in a way incorporate this discussion and concern. In this regard, works that require energy can seek alternative energy sources as a more ecological manifestation (proposition). The work, “Sopro”, emerges in this context, searching for poetics in technology itself and its relation with the human being.

In nature, the force of the winds is responsible for several modifications in the environment, such as the act of transforming the shapes of rocks by erosion, the movement of dunes in coastal areas and erosion processes. The processes whose geological agent is wind are called aeolian processes. The climate and its variations are directly related to the movement of the winds, which affect temperature and produce rainfall. These, in turn, transform nature and culture in cycles, like a living system.

Given its strength, man has long sought to turn wind into useful energy, through windmills and sails in boats, and more recently through wind turbines that produce electricity. The so-called wind energy is considered an alternative energy source to fossil fuels and other forms that have an impact on the environment, being a form of “clean energy”.

In common knowledge, the act of blowing is recurrently associated with the genesis of life. Different cultures in their cosmogonies, on explaining the emergence of man, involve a divine breath as an action capable of imparting life to what was formerly inert. In the well-known biblical passage from the book of Genesis, God blew the breath of life into Adam, the first man. We find a similar belief in Tupi-Guarani mythology, an important indigenous culture in South America. In their account, Tupã, the supreme divinity, would have breathed life into the human forms he modelled in clay during a ceremony. In Yoruba mythology from Africa, Obatalá,

the direct son of Olodumare, creator of the universe, was sent to Earth, which was composed of water, and created plants, animals and man: “*It is an undisputed fact that in the end Obatalá was given the task of creating the physical characteristics of the bodies that should house the planet’s human inhabitants. With clay and water, Obatalá made the bodies, waiting for Olodumare to complement the task with the emi - the breath of life that would animate them*” (HASS, 2011).

In the poetic context, we find several references to the act of blowing. Oscar Niemeyer, a Brazilian architect who lived to the age of 105, uttered a famous phrase about the fugacity of life through the metaphor of the breath, “*Life is one breath, one minute. We are born, we die*”. (MURRAY, 2012). The last book by Clarice Lispector, published one year after her death, was “*A breath of life - Pulsations*”. In it several phrases with the word breath can be found, such as: “*I look for the breath of the word that gives life to whispers*” (LISPECTOR, 1978).

Art-Technology

In interactive art the public is asked to participate in the work through a variety of means. The body is present not only by looking, but in its totality, seeing, feeling, thinking, and acting in a simultaneous and continuous process.

The exercise of blowing is a recurrent practice of interaction in interactive works (BORN, 2014). One of the bestknown examples is the installation “*Les Pissenlits*” (2006) by Edmond Couchot and Michel Bret. It is based on a stimulus/response system which invites visitors to blow on a microphone just like they would blow on a dandelion. This action by the public causes the image of a dandelion projected on a wall to behave as if it were real, since it disintegrates and the seeds are carried away by the wind. About the work, the authors comment: “*Our idea was to recreate a gesture, as old as the hills. When we see these works, we want to rediscover the natural gesture of blowing. In this case, blowing on an image for the first time in history*”. (COUCHOT, 2014).

Another work that also involves the gesture of blowing is the work “*Blow 4*” by the group Super Uber:

“*This work basically consists of an end-on projection on a white cube, where several fragments seem to float at random across the plane space of the projection. The particulate system remains in its continuous and random motions until at least one of the interactors blows into the soap bubble ring-shaped device (which is naturally*

associated with blowing), which captures the blow through a microphone” (SUPERUBER, 2011).

There is also “*Breathing*” by Guto Nóbrega, a work created based on the communication between a natural organism (plant) and an artificial system, which also allows blowing to be one of the forms of interaction with the work. This work also involves blowing as one of the forms of interaction. At the centre of this system is a Devil’s Ivy (*Epipremnum pinnatum*) plant whose electrophysiological signals are monitored by an analog-digital device in order to control a robotic interface composed of a mechanical structure, fibre optic and light-emitting diodes (NÓBREGA, 2008). If the interactor blows gently in the plant’s direction, this stimulus can be perceived by the system, possibly generating some response.

The Piece “The Blow”

Based on these samples, in 2014, the cAt group (science/Art/technology) developed the art project titled “*Sopro*” (The Blow). It is a system that involves interactors participating in the work by blowing. Blowing is the “*energy source*” for the activation of the work. Thus, the question of energy in “*The Blow*” is present in several aspects.



Figure 2 Outline of the work The Blow. cAt Research Group

The work takes place in the context of the environmental crisis, especially with regard to the emergence of alternative energies. The blow, in this sense, refers to wind energy. Energy begins by being produced by the human body itself, which through breathing produces

the blow. That action, in turn, provokes a movement in the propeller present in the artwork that, through this kinetics, turns an engine that is transformed into an electric energy generator. The energy activates a vibrating motor that produces a movement in a sphere floating in water, moving it and giving life to the artwork. There is a lamp above, and the projected shadows of the spheres in the water facilitate the visualization of their movement.

From the point of view of its creation, the possibility of showing the technology in the structure was explored and achieved, in order to construct the poetics, allowing the interactor to understand the result of his/her action in the process while at the same time allowing the technological issues to be discussed in an environmental context. Some of the elements involved in the work are:

From the point of view of its creation, the possibility of showing the technology in the structure was explored and achieved, in order to construct the poetics. This process allows the interactor to understand the result of his/her action in the process while at the same time allowing the technological issues to be discussed in an environmental context. Some of the elements involved in the work are:

Water: Water is present in the work because it is an element that is always related to life. The movement of the spheres, caused by the motor's vibration, produces a movement in the water, showing a sign of life. On the other hand, the difficulty encountered when trying to capture the vibrator's subtle movement, found in water both a technical and a poetic solution.

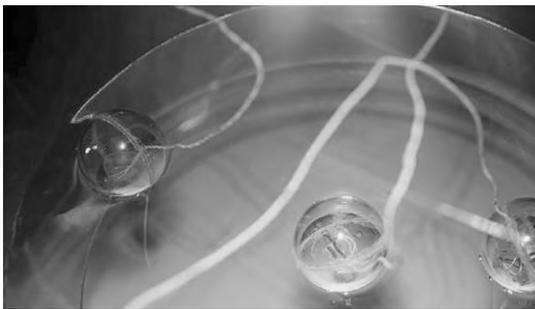


Figure 3 Detail of the piece *The Blow*, with vibrators inside the balls. cAt Research Group

Sphere: In this sense, the sphere is the form adopted in the work as a reference to cells, which also represent life and energy.

The artwork's structure is made up of a system of spheres that are interconnected as in a fractal structure. Energy is present in each sphere, and at the same time it is all of them that produce the work's energy. The main sphere measures 0.5 m in diameter and receives water in one of its hemispheres. On the watery surface are located the three smaller spheres, with a 5 cm diameter. These contain the vibrators, which move when the public interacts.

The visitor, in turn, interacts by blowing on a propeller also placed within an acrylic sphere measuring 15 cm in diameter, and in total there are three propellers in three separate spheres.

Collective: Although it is possible for a single powerful blow to cause the movement of the sphere-cell in the water, it is the simultaneous collective blow on the three propellers that will allow the movement of the water to be perceived more easily. The three spheres with the propellers point to collective participation, in an effort to unite energies to achieve better efficiency.

Technology: The use of a seemingly simple technological system, consisting of propellers, motors taken from CD and DVD players, and a vibrating motor such as those used in reused cell phones, are presented in an intentionally visible manner so that the public realizes the simplicity with which blowing energizes the vibrating motor, causing the sphere that contains it to move. Each propeller is composed of five blades produced in 3D printing (printed at the MemoLab - Digital Fabrication Laboratory of the Memorial of Latin America, in São Paulo), specially designed for the work.



Figure 4 Person blowing on the propeller of the work *The Blow*. cAt Research Group

Conclusion

In this paper, we described and reflected on the work “Sopro” (The Blow), where the relationship between theory, research and artistic creation is present in the academic context. In its production, the work points to some directions. By opting to work with electric energy generated by blowing, a significant part of the artwork’s construction is aimed at dealing with the limited energy produced by this action. In many moments, the aim is to optimize the slightest electric current arising from each interaction. Managing this scarcity is important not only to maintain the poetic essence of a “breath of life,” to categorically vivify the system, but also because it serves as a stimulus to manage necessarily with just the minimum, as a metaphor of the energy concerns of the present times.

The option to make use of recycled and apparently simple technological devices arises from the perception that we can take digital technologies a step further. This is due to the fact that they have already been incorporated and trivialised in our daily life, with the presence of new generations born in digital times and natives to this context. We believe that although the work does not use digital technology directly, all the thinking that surrounds its conception is based on the incorporation of digital processes and on the discussions that are emerging after the boom of this technology, making us pay attention to environmental and sustainability issues.

In Art-Technology, most of the works use electrical energy, and in the current context we would argue that there is a need for these works to include the concern with the energy issue. By dispensing with electrical energy and using wind energy instead through the human blow, the poetics of the work is built with the very technology used and presents this environmental concern. In this process, through research, we discovered that the work “The Blow” fits within the context of discussions about the Post-Digital. The perception that a digital phase in art has passed and that artists are seeking other proposals, but with a way of thinking acquired in this previous stage.

This perception is present in the work “The Blow”, which identifies itself with several other works that seem to converge, materializing the theoretical post-digital assumptions.

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Authors' Biographies

The cAt team – science / Art / technology – Art Institute – São Paulo State University (UNESP) / National Counsel of Technological and Scientific Development (CNPq), created in 2009, has the characteristics of experimentation, reflection and dissemination of research from the connection between science, art and technology.

Structured with interdisciplinary training profile, given the training and experience of its members, striving for the development of common projects and respect for individual projects and research.

The interests surveyed by the group have the following keywords as points for experimentation, production and dissemination of knowledge, which are: Physical Computing, Image, Materiality, Interactivity and Multimedia.

The team consists of Milton Sogabe (doctor), Fernando Fogliano (doctor), Fabio de Oliveira Nunes (doctor), Soraya Bras (master), Carolina Peres (PhD student) and Cleber Gazana (master).

Designing for Bottom-Up Adaptation to Extreme Heat

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Abstract

In the wake of global climate change, our world is projected to heat up and experience more extreme heat waves over the next few decades. Phoenix, Arizona, where this research was conducted, is one of the hottest locations on the planet and presents a testbed for understanding and addressing heat-related challenges. This paper focuses on adaptation as a design strategy that compliments existing approaches to mitigate human impact on the environment. We report on findings from a summer-long diary study that reveals how extreme heat impacts human lives, how participants cope with extreme heat. These findings motivated our critical making work themed around adaption, focusing on artifacts for visualizing, coping with, and utilizing extreme heat. In constructing these artifacts, we critically reflect on both the benefits and drawbacks of designing for adaptation and suggest hybrid approaches that mitigate human impact on and help people adapt to climate change.

Keywords

Extreme Heat, Adaptation, Sustainability, Critical Making

Introduction

In the wake of global climate change, our world is projected to heat up and experience more extreme heat waves over the next few decades [10].

If individuals cannot find successful ways to adjust to warmer temperatures, it could lead to social and structural disruption inside of the community, and, if extreme heat forces mass migration, could cause regional or international conflict.

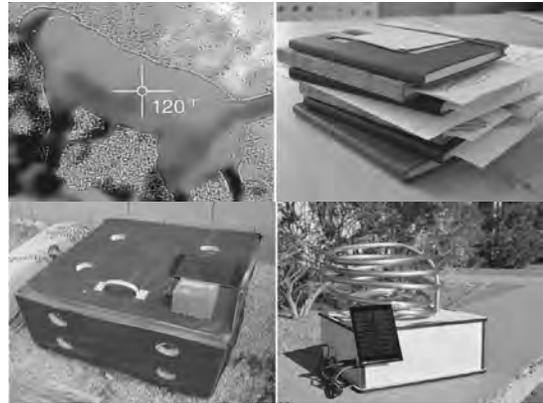


Figure 1. Data from our diary study of extreme heat: thermal camera image captured by a participant and participants' journals; and artifacts speculating on design for adaptation: a sensor-enabled hot compost bin and solar-powered chiller.

Phoenix, Arizona, where this research was conducted, is one of the hottest locations on the planet and serves as a testbed for understanding heat-related challenges. These range from the critical issues of heat vulnerability and heat mortality, to the marginalizing effects heat has on different socio-economic groups (e.g., stakeholders with limited access to cooling appliances or transportation). At the same time, heat also presents new opportunities for harvesting heat as a source of energy or more broadly energizing communities around the topic of climate change.

This paper focuses on a complimentary, albeit equally important set of research questions. How are human lives affected by extreme heat? What are the bottom up workarounds and coping strategies for living in extremely hot climates? And how can design intervene

to address these challenges and harness heat for sustainable outcomes?

To answer these questions, we first conducted a longitudinal diary study asking seven Phoenix residents to document their experiences with heat over the course of the summer. Participants were asked to journal their routines, challenges, and workarounds in regards to heat from mid May through mid September. Themes from this study inspired our critical making activities to create physical artifacts as speculations on how design can support resilience in the face of extreme heat.

Research Contributions

This paper contributes insights into how humans adapt to extreme environments and critically reflects on how or if design should support these coping mechanisms. Our work is an important step towards 1) understanding bottom-up coping strategies and enhancing community resilience in the face of projected climate change; and 2) broadening the scope of research to include adaptation as part of the sustainability discourse. We continue by presenting the background and related work, including an overview of the extreme heat and existing relief efforts in Phoenix, AZ, and prior work across related areas. We then detail the methods and findings from our diary study, including 1) aspects of participants' daily lives affected by heat; 2) participants' coping strategies; and 3) barriers that hinder coping capacity. These insights motivate our critical making of artifacts themed around bottom-up adaptation: Thermochromic visualizations of extreme heat, low-cost solar cookers, a sensor-enabled hot composter, a solar-powered compression cooler, and a zine-style heat survival guide. We conclude by suggesting hybrid design approaches that both mitigate human impact on the environment and help people adapt to extreme conditions.

Background and Related Work

This section draws on multidisciplinary literature to paint a broad picture of extreme heat in Phoenix and the relief efforts on the ground. We position these challenges and workarounds within a broader discourse on global climate change.

Extreme Heat

Phoenix, AZ is arguably the hottest city in the United States and one of the hottest on the planet. As early as mid May, the average daily temperatures exceed 100F

(with lows often staying above 85F) and remain that high through September [10]. On average, it is over 100F for 107 days a year, making Phoenix the hottest large city in the US [ibid]. Even short-term exposure to this type of heat stresses the human body, with effects ranging from mild discomfort, to shock, fatigue, collapse, or even death [9]. Existing on-the-ground relief efforts in Phoenix are aimed at alleviating factors that contribute to heat vulnerability, with initiatives ranging from heat refuge and hydration stations, to wellness checks, factsheets, and awareness campaigns [14, 15].

The extreme heat experienced in Phoenix for nearly a third of the year is relevant within the broader context of global climate change. As the earth's surface temperatures are projected to increase over the next few decades [2], many areas are expected to experience more extreme heat waves [21]. Even if these trends stabilize, heat already affects parts of the world and there is an urgency to consider adaptation as well as mitigation strategies [2, 12]. Heat has marginalizing effects on low income groups and can lead to political and economic tensions around resources. Adaptation is therefore a critical component of addressing climate change peacefully. In this paper, we study bottom-up coping in Phoenix using ethnographically-informed fieldwork, an approach that is different from existing quantitative studies (e.g., mortality statistics or GIS data [1]).

Sustainability and Interaction Design

Eco-feedback research visualizes consumption and aims to nudge human behavior towards reducing impact on the environment. Examples range from low-power energy monitoring platforms [16], to persuasive representations of desirable behaviors [7], adaptive indoor temperature settings [3], and higher-level reflections on eco-feedback design principles [7] to name a few.

In addition to these mitigation approaches, recent work has also examined perceptions of and adaptations to climate change [6, 4]. For example, Knowles, et al. identified barriers for political mobilization towards cutting fossil fuel emissions [13]. Recent research has also considered adaptations to extreme weather patterns, namely the effects of cold weather on youths in Northern Finland [29]. For hot weather, Ryan explored the possibility of using wearable technology to help individuals adapt to the altering weather caused by climate change [19]. Co-design methods have also been applied to develop mobile technologies that support

adaptations to climate change in the Pacific [29]. We contribute to this body of work on adaptation by focusing specifically on the problem of heat.

Methods

We began with a summer-long diary study to gain grounded insights into how human lives are affected by extreme heat. Study insights focused critical making activities and led to the prototyping of artifacts around the theme of adaptation.

Diary study: Drawing on prior sustainability research that examines everyday practices [e.g., 27], our diary study focused on heat-related experiences amongst participants who regularly spend time outdoors. We reached out to a local bicycle advocacy organization and a library to recruit seven participants (3 male, ages mid 20s to late 50s) who rely on biking and walking as a mode of transportation even in the summer months. An initial group meeting introduced participants to the project and invited them to document heat-related experiences in Phoenix from mid May through mid September.

The participants were provided with journals, and instructed to describe their experiences however felt most natural, as per prior work that validated free-form, paper-based data collection [28]. In addition, participants were asked to mail the researchers a weekly postcard detailing one heat-related experience from that week (Fig. 2).

Participants completed semi-structured interviews at the end of the study (about 2 hours), reflecting on their summer experiences. During the interviews, participants read parts of their journals as prompts and discussed the written events in greater detail with the interviewers. In addition, participants were asked to complete a card sorting exercise to reflect on the extent to which aspects of their lives— food, sleep, commute, relationships, etc.—were effected by heat. Participants were also asked to sketch their ideal urban location and speculate on ways that heat could be used

to improve their lives. Participants were compensated \$10 for every two mailed postcards, \$10 for each hour of their time during the interviews, and an additional \$30 for completing the entire study. Audio from the interviews was transcribed and analyzed along with the journal entries, photographs, and postcards.

Prototyping artifacts: The construction of physical artifacts is a longstanding method in design

research, whereby engagement with materials reveals opportunities and constraints for future work [e.g., 8, 22]. Given the grounded account of extreme heat from our diary study, prototyping of artifacts was employed as a method to envision how design might support bottom-up adaptation to extreme heat. Our prototyping focused on three themes: 1) visualizing; 2) coping with; and 3) productively utilizing extreme heat. The resulting artifacts materialize new design opportunities and challenges presented by extreme heat.

Extreme Heat: Impacts and Coping Strategies

This section details key findings from our diary study of participants' experiences with heat in Phoenix. On average, participants wrote 8-12 diary entries over the course of the summer, with most writing more entries at the beginning of the study, and one person making a journal entry every single day. The data falls into one of three high-level themes: 1) Heat's impact on daily lives; 2) participants' coping strategies; and 3) challenges that hinder coping.

Extreme Heat and Participants' Daily Lives

Before detailing how heat affects particular aspects of participants' daily lives, it is worth noting some of the general ways they describe the summer conditions.

You don't walk outside and adjust, you walk outside and essentially get punched in the face. -P5

For all participants, a Phoenix summer involves, as P1 best put it, "*sweating while doing next to nothing outside*". We continue by detailing how the extreme heat impacts specific aspects of participants' daily lives.

Contact with hot materials: In addition to the high daily temperatures, participants routinely come in contact with uncomfortably—and often dangerously—hot materials. Examples include having to "*maneuver around the metal seatbelts and car door handles*" (P4), testing the pavement before taking out pets because "*they'll have possible burns on the concrete*" (P5), or common electronics overheating when left outside even for "*not even five minutes*" (P2).

We have a concrete wall and in the summer, that wall heats up. We don't have a headboard on the bed so right up against the wall. You can feel the heat from the wall in the summer. -P5

Lack of cold water. In addition to these interactions with hot materials and objects, participants also struggled to find cold water. All participants commented

on uncomfortably warm water in pools and faucets: cooling water systems are not common in Phoenix homes, and all participants reported that their “cold” faucets and most pools were never actually cold.

All the plumbing runs overhead. All the piping is in the attic, and the attic is 120 degrees. Getting a cold shower in the summertime is actually a bit of a challenge. -P1

Mid July through August, a lot of the pools are like bathwater and it's just in the sun. -P7

The above comments reflect the challenge of accessing cold water for drinking, showering, or swimming.

Appetite and diet: To varying extents, heat impacts all of the participants' food habits during the summer. Logistically, participants are unable to bike with frozen items (e.g., “ice cream's pretty much a no-go, unless I happen to be driving”, P1), and cold items require insulated bags whether shopping by car or bike (e.g., “if I didn't bring my insulated bag, then I wouldn't buy any cold foods”, P2). Participants also reported a decrease in appetite (e.g., “I would definitely say smaller, and I think it's also because I feel so dehydrated”, P4). Cooking behaviors change as well, with most participants opting for colder foods, not using the oven, or not cooking at all (e.g., “I didn't use the stove or the oven”, P3; “We did cold foods more than not, or went out”, P2).

Exercise: During the peak heat, participants avoid hiking, running, walking, swimming, or biking outdoors, which leads to changes in their exercise routines. Three of the participants switch to working out indoors, while others limit their workouts.

I guess I don't go on long rides over the summer. I don't go on rides over usually about five miles or so just because it's hard to carry enough water to make sure that you're going to be able to get there. -P5

I just end up not running. I tried swimming. I still work out with the trainer. We still do that, but we—usually, when it's nice out we work out outside, which is also very nice. -P7

Social interactions: Participants reported that the weather impacted their social lives. For some, extreme heat led to less social gatherings (e.g., “there were some days where I was like it's too hot to do anything”, P3). For others, travel distance is limited during the hotter months. Participants also noted that social events often have lower attendance:

It's a real trick to make sure that everybody wants to go out. Nobody really wants to go out and ride around in the heat. - P5

Health: All participants reported experiencing various physical symptoms that they directly attributed to heat. These range from mild headaches, nosebleeds, feeling disoriented, and other side effects of dehydration (P1, P3, P5), to allergies from being exposed to circulating air indoors (P2, P6), or full-on heat strokes (P7). In addition, all participants noted that they encounter more people who are sick over the summer than during other seasons.

Mood: Participants reported that heat has psychological effects on their lives. To varying extents, all participants observed feeling more “cranky”, “lethargic”, or “crabby” over the summer (“people are short-tempered, they're lethargic”, P6).

Just having to run outside to the car to take the trash out type thing. It just definitely puts everybody in a cranky mood. -P4

Everybody is crabby the last week of May and then they're crabby the first week of October, 'cause it's still hot and we still have triple digits like next week. -P7

To summarize, this section detailed how extreme heat—both in terms of exposure to high temperatures and hot materials—effected participants' water access, diet, exercise, social lives, health, and mood.

Coping Strategies

Here, we describe participants' coping mechanisms for the presented challenges. These include minimizing exposure, as well as different strategies for adapting to the heat.

Staying indoors: Participants spent significantly more time indoors in the summer months, especially during daylight hours. To save money on air conditioning, participants insulated their homes by closing the window shades (P2, P3, P4); putting wooden doors over the windows (P6); or using fans (P2, P3). Participants also seek out public spaces that are air conditioned, including movie theatres, restaurants, or grocery stores. In addition, they tend to alter bicycle commutes to include indoor stops.

Costco has, in the back of the store, a produce room and a dairy room, and those are colder than the rest of the stores. You can walk in. You learn those. -P1

Changing routine: To maximize time spent indoors during the hottest parts of the day, all participants change their routines. Most notably, when they have the flexibility, they opt to run errands and leave their homes during early mornings or late evenings. For example, participants would grocery shop at night (e.g., “I'd do grocery shopping at night, which I generally don't like

to do”, P3) and batch multiple tasks into a single car trip (e.g., “since it’s hot, we just try to hit all three stores in one day”, P3).

Leaving the city: Finally, all participants escape the heat by leaving Phoenix for at least some part of the summer. Trips range from weekend get-aways to Flagstaff (a cooler city in Northern Arizona), to longer-term vacations in the Pacific Northwest or the East Coast.

It’s just like a great burden’s been lifted off your mind when you get the temps that aren’t destroying you as soon as you walk out every single day. -P6

Adapting to the eat

When staying indoors or traveling is not an option, participants employ various adaptations to the environment: hydration, clothing, shade, and productively utilizing heat.

Hydration: Participants emphasized hydration as the most important strategy for coping with exposure to heat. All participants travel with a water bottle and many rely on different types of reminders to drink water (e.g., “I do have to remind myself, ‘cause I feel like even as much water as I’m drinking it’s still not enough”, P7). Given the predominantly warm tap water, some participants refill their bottles with cold water in restaurants, or refrigerate or freeze their water containers at home.

Clothing: All participants rely on protective clothing to shield from the sun. Examples range from sunglasses and hats (all participants), to long-sleeve shirts purchased at thrift stores (P1), shoes that insulate from the hot cement (P4), sunsleeves (P6, P1), and UPF clothing (P5).

I’ll apply sunscreen but it seems to quickly wear off of me and I have to reapply it, and I never remember, so I’ve decided that physical barrier is probably the best bet. -P5

In addition, participants often apply cold water to various articles of their clothing—bandanas, shirts, helmets—to cool off.

Shade: In addition to clothing, all participants seek shade as a coping strategy. For example, P1 uses an umbrella for longer walks, P7 cools off in a walkway shaded by a bridge, while P3 enjoys shaded patios.

I stood there waiting for the train. That was just one of those hot days, there’s no shade or anything like that so I was just standing in the sun and that was probably one of the most acute heat experiences I think of the entire summer. -P5

Productively utilizing heat: Finally, participants discussed ways to utilize the heat for productive purposes. Air drying clothes outside was the most common practice (P5, P1, P2, P3, P5), followed by gardening desert-tolerant plants (P3, P7). Participants also commented on the longevity of materials and products as afforded by hot, dry climates, including longer-lasting roads, and less rust on cars and bicycles (P1, P6). In addition, participants speculated on ways they could use thermal energy in the future, ranging from thermal cooking (P5), solar-powered electricity in the home (P1), a backyard food dehydrator (P2), buildings that utilize convection cooling (P5), and the use of heat to grow plants to create shade (P3).

In summary, this section described the mechanisms by which participants cope with extreme heat, ranging from ways of minimizing exposure to strategies for adapting to the temperatures.

Barriers for coping

This section details three types of barriers that participants identified as hindering their ability to cope with extreme heat.

Money: All participants noted the financial challenges associated with staying cool over the summer. These range from the cost of air conditioning (e.g., “we basically bleed money trying to keep our house cool”, P2), to the price of protective clothing (“It’s hard to find proper clothing to deal with heat and for it to be cheap”, P5), or the expense of travel to leave the city (“cause you have to have money to do all those things”, P6).

I think that there’s definitely a socio-economic issue with dealing with heat because it’s much—and AC, AC is expensive. There are those kind of aspects that you need to pay to remain cooler. You need to pay something and it’s very tricky. P5



Figure 2. Visualizing extreme heat: screenprinting with thermo-chromic ink and a paint-based heat visualization

In addition to the costs of coping with heat as discussed by P5, summers also hurt the job market, as noted by P7:

Everything shuts down here. She [niece from out of town] would be competing with my 35-, 40-year-old friends for jobs because they lose jobs in the summer. It's very bad for people in the service industry here. P7

Public awareness: In addition to the expenses associated with staying cool, participants also noted lack of public awareness about the environment as a barrier for coping.

I think that a lot of the problems with the environment that we've had here is from people coming in from outside and they want to have what they have in other places. They've got the grass they're watering. They're building lakes and ponds. I think it's completely changed the environment in the past 20 years because of that. -P7

Infrastructure: Finally, participants cited several ways that urban planning could improve coping capacity: more public water fountains (e.g., “*more available water at trailheads*”, P5), better shading at bus stops (e.g., “*a trellis with some vines on it. It's gonna create some shade in the summertime*”, P3), or more desert-appropriate landscaping with native plants that use less water (all participants). Nearly all participants also commented on the growing population and urban development in Phoenix as a contributing factor to the heat:

I definitely think it's more people, more development. I don't know if there's more freeways, but I think it's a combination of the environment and just the buildup of civilization here. -P2

Like most of the other participants, here P2 suggests that the influx of people and the resulting development may have exacerbated the area's trend towards hotter weather. To summarize, this section discussed money, awareness, and infrastructure as factors that potentially hinder participants' (and other residents') ability to cope with extreme heat.

Adaptation as a Theme for Design

While some of the behaviors unearthed in the diary study are not surprising (e.g., staying indoors or leaving the city during summer months), our study also revealed unexpected ways that extreme heat impacted the participants and inspired creative workarounds. We found, for instance, that heat presented unique physical constraints (e.g., anticipating when everyday materials would be too hot to touch; re-routing commute to access cold water or shade); as well as psychological effects that led participants to change their eating habits, schedules, and social interactions. Understanding how people cope with and adapt to extreme heat—from the mundane to the extraordinary behaviors—is a critical first step towards designing for this space.

Above all, our findings present clear opportunities to design for adaptation. Environmental science literature has highlighted adaptation as a viable strategy for addressing climate change [2, 12, 19]. The theme of adaptation seeded our critical making work and the resulting artifacts span three categories: 1) visualizing, 2) coping with, and 3) utilizing extreme heat. Drawing on critical making literature [18, 20], we continue by reflecting on the insights uncovered during our materially-oriented work.

Visualizing Extreme Heat

Our first materially-oriented exploration is inspired by the subset of our diary study findings that reveal many day-to-day challenges presented by extreme heat. The findings reveal that participants face interactions with warm tap water and uncomfortably hot materials (e.g., maneuvering around the black seatbelt and steering wheel of a hot car), and experience adverse effects on their appetites, moods, social lives, and in many cases, personal health. These rich experiences are hard to communicate using quantitative metrics or digital sensors, and in our maker sessions, we wanted to investigate how extreme heat might be visualized beyond numeric data. We focused on screenprinting with thermochromic and UV-sensitive inks to creatively express heat and UV exposure.

Screenprinting is a flexible technique for replicating stencil-based images across a variety of mediums—paper, fabric, plastic, wood, etc. When coupled with inks that change color based on temperature or UV levels, the versatility of screenprinting makes it an ideal method to visualize temperatures of everyday materials

or UV radiation in outdoor spaces. We worked with thermochromic pigments [24]—colored powders that become translucent at particular temperatures (86F in the pigments we worked with), and solar drops [ibid], which conversely change from being translucent to an opaque color in the presence of UV radiation. Our final ratios consist of: 2 teaspoons of transparent extender base [26] and 40-60 solar drops for the UV-sensitive inks; and 1 tablespoon of opaque screenprinting ink with 2.5 teaspoons of thermochromic pigment for the heat-sensitive ink.

Low-cost UV and thermal sensing: Inspired by earlier artistic uses of thermochromic paints [e.g., 11], we developed two concept ideas for our screenprinting inks. The first is a UV exposure indicator, printed on a vinyl sticker and placed outdoors to warn passerbys when sun protection is necessary. This idea is informed by the fact that all of our participants rely on UV-protective clothing, while non-natives to the region have been known to underestimate the effects of the sun. Our second concept is a printed “thermometer” which can be visualize when materials or objects



Figure 3. Coping with extreme heat: Phoenix survival guide cover and Hazards section

become uncomfortably hot (Fig. 2). This idea has a variety of practical applications as inspired by our field data—e.g., showing whether the pavement is safe for pets, or when surfaces such as public benches or playgrounds are too hot to touch.

Reflection: Our engagement with temperature and UV-sensitive screenprinting inks led us to imagine how emergent technologies might draw attention to the problem of extreme heat more broadly. For instance, low-cost, printed indicators might be coupled with image processing on mobile phone cameras to infer and monitor local temperatures on a scale that is not feasible with specialized digital sensors.

Coping with Extreme Heat

Our participants cited a range of coping strategies to stay cool—from wearing protective clothing to altering commute to access shade and cold water. At the same time, they also discussed a general lack of public awareness about the dangers of and coping strategies for extreme heat. Inspired by these findings, our second set of artifacts explores how design might enhance local coping capacity and fill gaps in public knowledge.

Solar powered chiller: We wanted to examine how design might address the lack of portable cooling in extremely hot climates. Using Amontons’ Law of Pressure-Temperature (the pressure of a gas at fixed volume is directly proportional to the gas’s absolute temperature), we developed a prototype consisting of a DC air compressor connected to a copper tube that is sealed with an end valve. The air compressor, which can be powered by a solar battery, pumps air into the copper tube. Once a desired pressure is reached, the end valve is used to rapidly release the air, thereby decreasing the pressure and resulting in a temperature drop. In our initial tests, we submerged the copper tube into 750ml of water, and effectively reduced its temperature by 4F.

Heat survival guide: In parallel, we examined how design can reconcile the gap in public knowledge and share the insights embedded in the native or street-educated culture of Phoenix. “Phoenix, a survivor’s guide” is designed to provide local knowledge and resources to the uninitiated in surviving the extremes of the desert climate (Fig. 3). The survival guide is intended as a low-cost, DIY style, self-printed zine to be distributed amongst vulnerable populations.



Figure 4. Utilizing extreme heat: solar cooker made from repurposed materials and hot composter deployed outside

Structured with minimal text and bold graphics and photos, the design suggests the importance of observing one’s surroundings for the abundance

of resources available to any engaged citizen. The content draws on additional field visits to two homeless shelters, a conversation with a homeless family, and photographs of municipal resources available within the Phoenix metropolitan area. Information is structured in order of importance: Hazards, Water, Food, Shelter, and Transportation.

Reflection: Developing these prototypes led us to more deeply engage with the coping strategies employed by our participants as well as the challenges for disseminating this local knowledge. Constructing the chiller sensitized us to the difficulties of accessing cold water in extremely hot climates. At the same time, the construction of this artifact materializes future possibilities, whereby design can intervene and enhance coping capacity through portable cooling. The survival guide led us to more broadly consider how coping techniques might be annotated and shared. This approach could also scaffold social networks aimed at not only disseminating practical information, but also enhancing community members' social wellbeing. With participants' moods and social lives being negatively affected by extreme heat, these sharing mechanisms might provide psychological support amongst community members.

Utilizing Extreme Heat

Despite the many challenges presented by extreme heat, our participants also identified numerous ways for creatively and productively harnessing thermal energy. Our final set of prototypes more broadly examines how extreme heat can be harnessed to improve people's lives. Inspired by the fact that extreme heat impacts food and cooking habits, especially given participants' reluctance to use the stove over the summer, we constructed artifacts for solar cooking and heat composting.

Low-cost solar cooking: While there is no shortage of available solar cooking designs [e.g., 25], we aimed to 1) use only simple household or repurposed materials; 2) develop easy and fast assembly methods; and 3) cook real food to validate our designs. We experimented with several set-ups, including a modified ten-inch can; a box lined with mirrors; and a cone cooker made from a car windshield insulator. The designs were tested in the winter, with outside temperatures of 62F, and resulted in food temperatures of about 115F. The set-ups were used to heat up a layer of precooked rice, chopped tomatoes, corn, and cheese, which was uniformly

melted in each of the cookers. Working and cooking with these simplistic designs in the winter led us to envision the feasibility of summer-time solar cooking, when outdoor temperatures would be 40F higher.

Hot composting: In parallel, we explored hot or "Berkley" composting, a method that relies on a high temperature and moisture level to rapidly break down organic matter in the course of several weeks [17]. The process is catalyzed by a ratio of 1 part nitrogen to 3 parts carbon in the compost matter, which needs to be "turned" or mixed when the bin's temperature falls below the desired range of 130-150F. We prototyped a sensor-enabled hot compost bin: A wooden box with mesh-covered holes for ventilation, and a thermocouple and a soil moisture sensor routed inside. Data from the sensor is processed by the Arduino micro-controller (Fig. 4). A display mounted on the lid shows current temperature and indicates when the contents should be turned or watered. The system is powered by a solar panel, with all electronics encased in a waterproof acrylic box. Moving forward, our prototype could be coupled with an information guide such that it could be assembled and used by non-experts.

Reflection: Harnessing heat with our artifacts led us to think more broadly about inverting some of the heat-related challenges into opportunities: e.g., utilizing heat to cook meals, compost waste, dry clothes, cultivate plants, dehydrate food, or extend the lifespan of products such as cars or bicycles with less exposure to road salt or humidity. Practically speaking, harnessing thermal energy in these ways could help alleviate some of the financial challenges that were revealed in our study. More importantly, these approaches could build communities around an optimistic and resilient view of extreme heat.

Discussion and Implications

Our diary study of participants' lives in one of the hottest cities on earth reveals extreme heat's broad impact on human lives. To adapt, participants alter their routines and travel to minimize outdoor exposure to extreme heat, and keep track of hydration, switch to protective clothing, seek shade, and find ways to utilize heat for productive purposes. These coping mechanisms, which are sometimes hindered by infrastructure and lack of money or public awareness, suggest adaptation as a viable design strategy to support community resilience.

Supporting Bottom-Up Adaptation Through Design

We see adaptation as a complimentary trajectory for sustainable HCI, much of which tends to focus on mitigating environmental impact [7, 13]. As we noted earlier, there is an urgency to consider adaptation in addition to mitigation to support community resilience in the face of climate change, even if global trends stabilize [2, 12]. The second part of this paper thus set out to concretely identify design opportunities by making and reflecting on artifacts themed around adaptation to extreme heat.

Drawing on insights from our diary study, our artifacts materialize ideas for visualizing, coping with, and utilizing extreme heat. In line with prior literature, whereby researchers' work with physical materials reveals new insights [e.g., 18, 20], making our prototypes enabled us to deeply engage with the heat-related challenges experienced by our participants and imagine solutions rooted in the physical world. For instance: screenprinting with temperature-responsive inks led us to envision how communities might draw attention to thermal infrastructure disparities across neighborhoods; assembling a heat survival guide challenged us to consider broader mechanisms for gathering and sharing local coping knowledge; and our solar cooking and composting applications inspired us to think about productively utilizing heat to improve human lives. While our artifacts are not intended as fully-functional devices per se, the key takeaways could be incorporated into future systems and deployed with stakeholders.

Adapting to What?

While enabling communities to better cope with existing conditions can significantly improve human lives, it is also worth considering what it is that we are trying to adapt to. In our diary study, for instance, the participants understandably adapted to existing infrastructures (e.g., unshaded roads; meals and social interactions scheduled around the corporate 9-5 workday, etc.). Participants' coping strategies, and the artifacts we created, necessitate a reflection on the broader systems that transpired these challenges: the car-centric southwestern culture, or broader yet, the existence of Phoenix, originally a mining town, as a large desert metropolis in the post-industrial era. Notwithstanding the obvious drawbacks of focusing on adaptation alone (e.g., accepting the status quo), there are real dangers in framing adaptation

discourse around "sustaining the unsustainable" [23]. Moving forward, we see adaptation as merely a part of the solution, with future systems taking on hybrid and systemic approaches.

Hybrid mitigation-adaptation approaches: The diary study reveals several grounded examples whereby participants' coping strategies also minimize their impact on the environment. For example, air-drying clothes utilizes heat and reduces electric power consumption; insulating homes (e.g., covering windows) lowers indoor temperatures and improves energy efficiency. Some of our designed artifacts also reflect these ideas: a solar cooker utilizes heat while minimizing fuel and electricity consumption; like-wise, a hot compostster takes advantage of environmental conditions to convert waste into a useful material. Practically speaking, new systems can facilitate other adaptation-mitigation behaviors: e.g., solar dehydrating to preserve food; or harvesting heat-loving plants to create shade and improve efficiency of air-conditioned spaces. On a higher level, hybrid systems could reframe routine household activities to utilize thermal energy while reducing human impact on the environment.

Conclusion

Motivated by climate change projections that suggest increasing temperatures over the next few decades, our work aimed to understand how design could support bottom-up adaptation to extreme heat. Our diary study revealed the human challenges and workarounds for living in an extremely hot environment. These findings served as prompts for critical making and reflection on junctures where design can intervene. Above all, we hope that our work energizes the ISEA research community around design that both mitigates our impact on and helps us adapt to the environment.

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Media Art, Landscape and Heritage
Papers

Curating/Containing: Exhibiting Digital Art about Mental Health

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Abstract

Museums and galleries have always been recognized as creating wellbeing outcomes. This paper builds upon this existing discourse with a study that is specific to the curation of digital art-works addressing the topic of mental health. It documents my own practice based research and audience response to the exhibition: *Group Therapy: Mental Distress in a Digital Age*, held at FACT, UK in 2015. Audience feedback was gathered using a psychosocial research method called the visual matrix, which is designed to capture more affective responses than existing methods of arts evaluation. Presenting this feedback, I focus on a perceived dichotomy between the historical and the digital, where audiences understood the asylum as a place of sanctuary and the digital content as anxiety provoking. I use this tension to propose next steps in my own practice alongside some wider considerations for curatorial approaches to digital art dealing with mental health. Issues of curatorial care are central, as I consider how a curator can support audiences to encounter challenging digital artworks that deal with mental distress. I adapt and test Wilfred Bion's concept of container-contained (also a key theoretical component of the visual matrix method) as a paradigm for this caretaking function.

Keywords

Curating, Evaluation, Audiences, Digital Art, Psychosocial Research, Practice-Based Research.

Introduction

Museums and galleries have always been recognized as creating wellbeing outcomes (Chatterjee & Noble, 2013) and happiness and mental health are burgeoning areas of discussion for many contemporary artists (Watts, 2015). My practice-based research in curating adds to this established discourse with a study that is specific to the curation of digital artworks and objects addressing the topic of mental health in gallery spaces. It is written from a curatorial perspective and is influenced by psychosocial approaches to museums and galleries, specifically the work of Lynn Froggett. Following on from her approach, it borrows selected ideas from object

relations theory to explore the affective and emotive dimensions of audience response to digital artworks that deal with mental health. These approaches are beginning to gain traction in the curatorial field, in the light of increasing interest in capturing the aesthetic and affective work undertaken by audience groups in response to exhibitions¹. These approaches are ideally suited to understanding the impact of aesthetic works addressing mental health, as they employ techniques and theories that are native to the territory of understanding the mind.

The primary research method used here is the visual matrix, a new technique developed by Froggett and her colleagues at the Psychosocial Research Unit at University of Central Lancashire. The method is applied to document audience response to *Group Therapy: Mental Distress in a Digital Age* co-curated by Mike Stubbs and Vanessa Bartlett. This exhibition, held at FACT (Foundation for Art and Creative Technology) in 2015, used media artworks, archival material and digital research to explore the complex relationship between mental health and digital technologies. The arguments presented in this paper pivot around a tension that emerged in the audience feedback generated by one of the visual matrices conducted on *Group Therapy*. Images of the asylum depicted in work by Quintan Ana Wikswo and other objects in the exhibition were juxtaposed against the digital content, creating a perceived dichotomy between the historical and digital. While the group became caught up in the notion of the asylum as a place of stillness and sanctuary, the digital content was interpreted as overwhelming and anxiety provoking. As the group grapples with this tension in the visual matrix

¹ See *Curating Third Space*, an ARC funded research project applying Lynn Froggett's visual matrix method to investigate new knowledge produced by art-science collaborations (Muller, Bennett, Froggett, Bartlett, 2015).

process, it reveals a number of potential insights about the process of curating digital artworks about mental health for the museum or gallery space. In this paper I offer a set of conclusions to be drawn from this material that will inform my own future practice and a second iteration of the *Group Therapy* exhibition due to take place in Sydney in 2017.

As this paper unfolds issues of curatorial care and the institution become a central concern. I evolve ideas from Wilfred Bion, whose ideas also inform the theoretical make-up of the visual matrix, as a means of extrapolating the caretaking function of the curator and gallery. I consider uses for Bion's formulation of container-contained to make sense of the support that audiences require in the process of dealing with exhibitions that address digital mental health. I trace how the original curatorial framing of

the project percolates through audience responses in unexpected ways, creating an opportunity for audiences to do their own 'work' on themes related to mental health care and digital technologies. As I unfold this process it will become clear how the psychosocial research method offered a unique insight into understanding the deep psychological work conducted by audiences when they encounter an exhibition dealing with digital art that addresses mental health.

Background: Curating Digital Art About Mental Health

The first iteration of *Group Therapy* took place at FACT in Liverpool in March 2015. Featuring 13 contemporary artists, alongside digital tools and archival material, the exhibition examined the impact of our digital lives on mental health, selfhood and social relationships, while also exploring increased use of technology for mental health treatment. In several of the works selected for this exhibition, artists integrated technology and artistic inquiry to offer insight into the experience of mental distress or as a tool to elevate symptoms. For example Jennifer Canary Nikolova's *Labyrinth Psychotica* was an immersive installation that used LED lights and directional speakers to simulate the experience of psychosis. The technologies used here helped to create a metaphor for psychosis, of losing and finding oneself, and for how beautiful yet fearful the experience can be. The installation was intended not only to create empathy, but also to highlight the fact that everyone is capable of experiencing the sensations of panic,

anxiety and claustrophobia that characterize a psychotic experience. Other works served to reflect on new paradigms in our mental health created by technological progress. Katriona Beales' *White Matter* explored the seductive and habit forming qualities of mobile digital and online technologies in a work that addressed the emerging diagnostic territory of 'internet addiction'. In this installation viewers were invited to watch moving images projected on the ceiling through the reflection created in a collection of handheld black glass objects. Seductive and mesmerizing in nature, the work recalled the sensation of falling down a rabbit hole of hyperlinks late at night and losing awareness of time and space, an experience that many smartphone users will identify with.

From the outset the curation of *Group Therapy* sought not only to reflect on the relationship between technology and mental health, but to approach mental health systemically, considering social and political factors that impact on awareness and treatment. Issues of care and agency have always been key drivers in debates around how to treat mental distress *and* around the impact of technological progress on individual wellbeing. From antipsychiatry to the service user movement, questions of power and its relation to care have played a fundamental role in projects seeking to modernize mental health treatment over the past 100 years. Meanwhile debates over control and autonomy in online space are a key concern for many users of digital media who value their right to privacy. According to this framework, we selected a number of objects and artworks for the exhibition that referred to asylum histories and the punitive approaches sometimes adopted to mental health care. We hoped this would set a context for a larger debate about neurodiversity and the politics of biomedical approach to mental health.

While the phrase 'digital age' used in the title of the exhibition implies a concern with the present tense and with futurity, the conceptual roots of this exhibition are located very much in longitudinal and historical perspectives. This was intended partially in the spirit of a media archaeology (Parikka, 2013) approach, which understands all 'new' technologies in relation to their historical antecedents. For example, by curating a 1930s ECT machine alongside a set of contemporary mental health apps, the exhibition sought to frame a question about the coercive potential of digital mental health technologies. In doing so, it also sought to suggest some possible ideological synchronicity between punitive

asylum treatments and the current proliferation of commercial mental health technologies that seek to gather data and influence behavior (for more on this see Gardner, 2013).

I collected a large volume of digital artworks, archival objects and research material during the curatorial process. While conscious that presenting a breadth of content including ‘non-art’ objects would be a deviation from traditional curatorial processes, this was embraced as a form of media convergence that reflected the ‘digital age’ of the exhibition title. As technology is increasingly theorized less in terms of its ontological properties and more around the emotional labour it facilitates (Madianou & Miller, 2013; Berardi, 2009), there is scope to move beyond strict definitions of media art to build a curatorial narrative about digital mental health. This approach to curation is not without correlates in the field. Recent biennales and festivals such as DOCUMENTA (13) and the 55th Venice Biennale have adopted a stance that Langill & Muller have termed ‘post-disciplinary curating’, bringing objects and practices from anthropology, science, philosophy and psychology to bear on the exhibition space (Muller & Langill, 2016). At *MONA Museum of Old and New Art* in Tasmania, Muller suggests that gallery displays bringing together historical objects and media art foster an approach that ‘resists the disciplinary object’ (Muller, 2015).

While seeking to position the conceptual foundation of this exhibition I have regularly returned to Berardi’s words on affective labour and cognitive overload as a way of modeling the kind of experience that my curation sought to create. In *The Soul at Work*, Berardi describes new forms of estrangement created by the increasing use of digital technologies for both personal and professional use, in tandem with the increased levels of emotional labour that these technologies demand both at home and at work. This affective work itself is essential to the functioning of post-industrial capitalism and has a tendency to trap users in an endless cycle of affective production. By conflating dense collections of apps, artworks and archival material the exhibition sought to mirror digital space in terms offered by Berardi as ‘cognitive space overloaded with nervous incentives to act’ (Berardi, 2009, p.108). Reflecting digital and online spaces in modes of gallery display has been seen in other recent exhibitions of digital media. In *Electronic Superhighway: From Experiments in Art and Technology to Art After the Internet* (Whitechapel

Gallery, London, 2016) curator Omar Kholief attempted to survey an enormous body of technologically driven artistic production from 1966 to the present day. While earlier works were presented sparingly, areas of the gallery containing works from the ‘post-internet’ period took on a more chaotic aesthetic that one critic described as ‘junk-shop vibe’ (Fuller, 2016). The dense hang of the contemporary period appeared to accommodate the origins of many of the works as online pieces (Jayson Musson’s youtube videos for example) by seeking to mirror the qualities of online space. This exhibition can be understood as part of a wider coming to terms with digital space in the context of the white cube, which Group Therapy is also a part of. In the following sections we will observe how our own decision to work with ideas of media convergence, interdisciplinarity and online space in the curation of the exhibition appears to have influenced audience response to the Group Therapy exhibition.

Research method: The Visual Matrix

As a curator I have an investment in understanding audience experience. This concern comes in part from my interest in curatorial discourses that foreground methodological innovations that give insight into audience experience (Turnbull-Tillman, 2016; Muller, 2011). More crucially though in terms of my own approach to my practice, is a concern with how the impact of visual arts projects are framed in the wider arts and health sector and the problematic assertion of value through mechanisms that derive from clinical rather than artistic discourses (Broderick, 2011). The visual matrix was developed by The Psychosocial Research Unit at University of Central Lancashire to address several major gaps in existing methods of arts evaluation. Most crucial in the context of this research is the capacity of the visual matrix to access preverbal responses to a work of art. The qualities of aesthetic experience are often difficult to verbalise, however most existing arts evaluation models demand that participants do just that. This method works with images to build an impression of the audience’s subjective aesthetic experience. In this way, the visual matrix is highly suited to the task of responding to artworks dealing with mental health, as it provides a supportive environment for processing complex emotions that are hard to articulate.

In a matrix participants sit in a special configuration that is designed to prevent people addressing one

another directly. Participants are invited to ‘free associate’ images, emotions and associations stimulated by the exhibition. The 2-3 facilitators model this process and play an important role in creating the containment required for the process to unfold. If it works well, participants should enter a relaxed state of mind that allows them to create a shared collage of affect and imagery related to their aesthetic experience. The transcript of the matrix is then used as the basis of a series of structured panel discussions conducted over time by the research team. The early panels consider immediate images and their emotional resonance, while panels happening later in time look at broader issues such as social context. The researchers keep the original matrix ‘experience near’ by constantly returning to the transcript and their memory of the matrix itself.

There are three key theories that form an armature for this method; the scenic, the Rhizome and the concept of container-contained. Alfred Lorenzer’s work on the scenic offers a way to understand how participants undertake a group process through the collective unconscious in response to shared cultural material. Lorenzer is essential in defining how the matrix forms a ‘third space’ between the group and the aesthetic stimulus where unconscious processing can take place (Froggett, 2012, p.45; Muller et al, 2015). Additionally, Deleuze and Guattari’s Rhizome is used to describe the collage of imagery produced by the matrix as non-linear traces of meaning revealed through following intuitive, often oblique hermeneutic interpretation processes.

The third theoretical pillar of the matrix and the one that is central to this research is the psychoanalytic school of British Object relations, specifically the work of Wilfred Bion and his concept of containment. Container-contained is originated by Bion and describes both the capacity for processing unconscious thoughts (container) and the unconscious material that is processed (contained). It is a meeting between these two elements that a facilitator desires to create in the visual matrix. To demonstrate how the term functions, Joan and Neville Symington use the example of a distressed client who continually avoids investing effort in finding a job worthy of his intelligence, as doing so would involve admitting he has wasted 33 years on procrastination. The analyst describes this concept of waste as something too painful to acknowledge and asks, could you acknowledge this pain if I was sitting beside you? Here the pain is the material that cannot be contained and the offer of the

analyst to ‘sit beside’ provides the potential beginning for a container (Symington & Symington, 1996, p.55). The relation between container-contained is dynamic, there is always an emotion gravitating towards being processed. In the visual matrix containment is essential as ‘the capacity for moderating anxiety and retaining and processing unconscious affect linked to ideas’. (Froggett, et al 2012, p.12) If the container functions properly participants should enter a state of what Bion would refer to as ‘reverie’, where their pre-conscious, pre-verbal responses to the aesthetic stimulus can come to the fore. However, it is crucial to note here that for Bion, containment enables psychological processing not just of negative experience, but of the full range of human emotions. As Ogden states, the container: ‘with its benign connotations of a stable, sturdy delineating function—becomes a word that denotes the full spectrum of ways of processing experience from the most destructive and deadening to the most creative and growth-promoting’ (Ogden, 2004, p.1349). Containment provides a context or a circumstance in which any affective experience can be held and given expression.

In the next section I will discuss how Bion’s formulation of *container-contained* resonates in my research beyond the practice of collecting evaluative data, to influence the mechanics of my wider curatorial processes. I will describe how my experience of implementing the visual matrix as evaluation, gave rise to a deeper consideration of how containment might be made applicable to the whole curatorial and evaluative process. I will also consider how curators might create containing environments that support audiences in the process of encountering works of art that deal with psychological distress. This concern with creating containing environments is led by my belief that in the field of arts and health it is imperative that practitioners be engaged in making work that deals not with creating ‘feel good’ emotions, but with offering challenging aesthetic encounters (such as works from *Group Therapy* that explored internet addiction and psychosis simulation). Integral to this position is the question of how a curator can offer a supportive environment for this challenging material to be digested and facilitate the personal growth that might emerge as part of this encounter. This research adds to the long-standing museological tradition of creating a suitable backdrop for encounters with objects and experiences, a field in which some psychosocial work has already

been applied. In Froggett and Trustman containment is applied to describe how museums might serve to reduce anxiety in the process of taking in unfamiliar objects:

It is tempting to compare elements of [this account of] human development to the curatorial function of a museum that both holds (looks after) objects and contains them (provides a structure that prevents their loss or decay). Equally important but often unacknowledged functions are to contain the emotional responses of the museum visitor, provide the conditions for attentiveness and, for people who are ill at ease in such environments, assuage the anxiety objects may provide (2014, p.490)

In the context of this research *container-contained* provides a means of considering the enabling function of the curator in both the curatorial and evaluative processes surrounding an exhibition. In the following section we use data from one of the visual matrices to observe how audiences seek containment for their affective responses to the responses to the Group Therapy exhibition.

Audiences Seeking Containment: Responses to Group Therapy

Part of the value of the visual matrix is that it creates a space to observe as audiences test imagery and ideas offered by the artworks and other exhibition content. Images move between participants, transforming and gathering meaning as the process unfolds. The following section tracks the development of the image of the asylum and attendant questions of institutional care as this audience group grapples with its resonance within the *Group Therapy* exhibition using the visual matrix process. The result of this exploration will be a set of assertions about the relationship between the digital and analogue materials in the exhibition and how they led this group to a particular stance on their own anxieties about technology and mental health.

The visual matrix opened with participants expressing a little discomfort with the process and with an absence of the kind of image led and impressionistic responses that should indicate the development of reverie. For example, there were contributions from one or two members of the group who were concerned about their ability to give appropriate feedback as they felt that they had not had enough time to experience the exhibition:

So I rather than try and go in and experience it in a rush I decided I am not going to be able to experience it right now I will come back when it is quiet in the

early morning so that I can experience the whole exhibition, have as much information as I need to so it's a question for you really of just an extra hour to really absorb some of that

While this kind of feedback does reflect a legitimate methodological concern (the time available for participants to view the exhibition was limited) it also reflects the presence in the participants of the kinds of anxiety that containment is intended to ease. This was my first time as a facilitator of this method and my ability to create containment was still developing. This led me to think laterally about my containing role not just in the evaluative process, but also in the making of the entire exhibition. Had the exhibition itself been a containing space that helped audiences to process anxieties arising in response to the more challenging works? Or was the anxious affect that emerged in the matrix symptomatic of emotion that had not been well enough held in the exhibition space as well as the evaluation process? One of the crucial arguments postulated about the visual matrix is its capacity to act as a mirror to its aesthetic stimulus. This isomorphism creates a space that allows participants to some extent to “relieve” the exhibition’ therefore offering researchers the opportunity to glimpse the nature of the ‘perceptual, affective, aesthetic work that is done by the audience within the primary experience’ (Muller et al, 2015). With this in mind I began to reflect on ways that the curation of the exhibition may have served to limit the audience’s capacity for deep engagement. However, as the visual matrix progressed across its one-hour running time, the imagery and emotion that was registered by the group did become more impressionistic, reflecting the increased presence of reverie. The group began to situate their anxiety increasingly within the digital content of the exhibition and as a register of their feeling that the media saturated environment was too much for them to process. The exhibition was later compared to a set of ‘hyperlinks’ or ‘a wikipedia page on group therapy’ in which multiple points of information consumption were presented:

Like you were saying constant consumption on different levels you know you kind of bookmark all these things and never read them it is a bit like that with the exhibition you kind of ‘I want to see all of this’ and then you kind of are paralyzed almost into never seeing anything.

The paralysis highlighted by participants here can be seen as a reflection of forms of fatigue and depression

that are inevitable consequences of overwhelming and affectively loaded digital spaces (Berardi, 2009, p.10). As referred to during my discussion of the curatorial framing of the exhibition, the show sought to reflect Berardi's conception of 'cognitive space overloaded with nervous incentives to act' (Berardi, 2009, p.108). Yet for some audience members this translated so completely to their exhibition experience that it almost started to become a barrier to engagement. While elsewhere the critical and evaluative feedback on the exhibition was positive, the visual matrix gave insight into these feelings of frustration, a fact that serves as testimony to the value of the method.



Figure 1. CARRIE BURIED BENEATH CATALPA BEANS // MOUNTAIN SWEEP, Panorama Detail, Quintan Ana Wikswo, 2014

In response to this sense of paralysis, the group appears to gravitate toward two analogue objects in the exhibition that were singled out as different to the media artworks and multiple screens. These objects opened up the visual matrix to a trajectory of exploration that started as a fascination with 'stillness' and developed as an exploration of the asylum and public institutions more broadly. Coming to terms with the way that the asylum is represented, the group worked through responses of fear and nostalgia to draw a direct comparison between the historical asylum and contemporary new media environments.

Two objects within the exhibition, the ECT machine and New York based artist Quintan Ana Wikswo's photographs of abandoned asylums in West Virginia (Figure 1.) are sited early in the matrix as moments of 'stillness' that are also 'menacing' presences and refer to 'the institution and all the terrible things that go on behind the walls of the institution'. As an artist Wikswo is invested in uncovering alternative narratives

about incarcerated and marginalised people who were admitted into asylums under the cover of moral cleansing by governments that wanted to eradicate non-white, homosexual or other 'undesirable' members of society. Her images for this exhibition show fragments of asylum exteriors and were shot using salvaged government cameras manufactured during the 1930s and 40s using institutional slave labour. At first the group associate this work and the ECT machine with feelings of coercion and are anxious about their own lack of agency in the face of systemic abuse and institutional power. The feeling of being sucked into the centre of something that one is unable to control pairs with a worry about being passively complicit in institutional abuse:

But there's a horrible feeling there of being er coerced into treatment it's like ah you know something really horrible about that isn't there, once you're in this within this boundary its like something that sucks you into its centre and you you've got no power over it

Yeah as an object it kind of has carries a weight of cultural anxiety

So we feel anxious when we see that even though, you know as a society we are complicit in our enabling that to happen when it was happening to a large extent. In the same way we were complicit as a society in allowing people, you know single mothers to be put into asylums

The group works with these objects and their non-digital status and struggles to determine whether they in fact enflame or alleviate their collective anxiety about the way society responds to mental health. The 'weightiness' of these objects and the anxieties they represent reoccurs throughout this section of the text, with much significance being placed on their conspicuous state of belonging to a predigital age. Eventually the group makes a direct comparison between the still and sensorially impoverished atmosphere that they associate with the asylum and the overstimulation of digital environments. The asylum and its firm belonging to the predigital age may be lonely and punitive, but it also has a distinct appeal. In the following passage we can observe the group moving away from their fears around their lack of agency in the face of institutional abuses, toward a stance that this more complicit. This is embodied in the very nostalgic image of the idealized asylum:

Because that's so interesting that that's like kind

of place where you might potentially end up and it's just so isolating and lonely compared to the kind of overstimulation of the with all of the screens and kind of not knowing what to do with all of that information and then not being able to deal with any kind of conditions so it's interesting still that those, the way that the institution is represented was very still, still images and the still object and if you did find yourself in that environment then that kind of stillness is what you would then be in potentially.

I found something really reassuring about this the kind of certainty of an asylum.

You feel like you know what you're getting into You kind of like, that's defined as an object in the space in which all the cultural, all the cultural anxiety or uncertainty is contained, whereas the exhibition represents a much more nebulous erm version of how that anxiety about mental health public secret is distributed now more across different spaces different dialogues and different approaches and different alternative ways of dealing with it

Yes that's like all the apps that were there

Exactly so there is all this technological kind ways of dealing with it and yet the I don't believe it's right but there is a certainty about the physical embodiment of a building which says this is where we contain all that which somehow might perhaps even help society function better

I think there is something quite appealing about being somewhere where your screen time is massively limited and someone tells you what to do

And it's really quiet. Maybe that's just me?

It brought to mind with me the images of the old Victorian mental hospitals that have now been largely demolished with water towers like leper colonies always in beautiful, beautiful countryside.

Associations to the asylum embodying 'certainty' and offering a picturesque outlook in 'beautiful countryside' speak to a moment of idealizing on behalf of the group, as they explore the exhibition for objects that hold and contain their own anxieties. As Foucault has observed, the asylum has throughout history served a source of fear, but also as an image of threat contained (Foucault, 1988, p.65). Creating a site, which embodies the perceived horror of madness permits the rest of society to be separate from it, free from the threat of being 'sucked in' to mental dysfunction and attendant incarceration. As we will see in the following section, observing the

group reach toward this nostalgic image of the asylum has brought about a number of key reflections for the role of digital art about mental health in my research.

Museum, Gallery, Asylum: Implications for Digital Practices

As many curators and specialists in museum studies have noted, there is a degree of symbolic slippage between the spaces of the museum, gallery and asylum. In her essay *Who Cares?* Kate Fowle notes the historical coupling between curating and caregiving when she states that 'from 1362 "curator" was used to signify people who cared for (or were in superintendence of) minors or lunatics' (Fowle, 2007, p.10). From the 16th century the word became more directly applicable to persons in charge of museums and places of exhibition, yet the implications of hierarchy were retained. The museum and the curator's role within it developed into the 18th and 19th centuries as sites for the display of power and as devices for giving order to a complex set of social relations. For sociologist Tony Bennett, author of *The Birth of the Museum* there is an historical link between nineteenth and twentieth century museum practices and the articulation of order and provision of education. He takes a Foucaultian perspective to suggest that visitors were given 'object lessons in power' (Bennett, 1995, p. 62) becoming experts in self-surveillance and self-regulation: 'the exhibitonary complex... perfected a self-monitoring system of looks in which the crowd comes to commune with and regulate itself through interiorizing the ideal and ordered view of itself as seen from the controlling vision of power' (1995, p.69). Not unlike the social function of the asylum, the museum or gallery served as a determinate of moral codes of conduct. In the group's reaching toward the asylum as a site of 'certainty' in the face of the 'nebulous' digital spaces of the exhibition, there appears to be a moment of nostalgia for the social codes presented by museums, galleries and asylums where 'someone tells you what to do'.

While we might see symbolic links between the museum and the asylum as tied explicitly to a more historical vision of museology, we might also consider this proposition in relation to more contemporary perspectives on museums and galleries. For Claire Bishop writing in 2013 the role of the gallery or museum in a post global financial crisis era continues to be controlled by agendas related to wealth and power. She argues in *Radical Museology* that the purpose

of most contemporary museums and galleries is less about preserving a complex research culture around artistic and social issues, than it is about attracting corporate investors, philanthropists and mass audiences (Bishop, 2013, p.11). Moreover she sites the grandiose architecture (or 'starchitecture') of many large contemporary institutions as statements of the power and wealth embodied in these buildings, a strategy of course widely employed in asylum architecture. The populist and civilizing function of the art museum perhaps persists today, and in their search for certainty in the image of the asylum the group perhaps brings forward a latent inclination to cooperate with institutions that perform these didactic and containing functions.

Within this turning towards the 'certainty' of the physical embodiment of a building is also recoil from the 'nebulous' vision of mental health that the group locates within the digital material in the exhibition. While the asylum contains the 'mental health public secret' in a stable way, the digital material in the exhibition distributes it across multiple sites and modes of complexity. In contemporary new media curating there has been significant discourse examining the relationship between media practices and the exhibition spaces that contain them. New media art-works have characteristically been framed as open ended, collaborative and distributed by their creators, a remit that does not fit easily into the image of the classical art museum. For curator Christiane Paul writing in 2006 gallery spaces, with their tendency to create 'a "sacred" space' (Paul, 2006) for the contemplation of objects do not make conducive containers for media artworks that demand to be touched, interacted with, or broadcast over multiple sites and spaces. As discourses in this area have developed in recent years, new media art has increasingly been welcomed into the musicological sphere. Galleries such as FACT have developed specifically to house digital works and curators such as Beryl Graham, Sarah Cook and Steve Dietz have made significant contributions to integrating the presence of media art in large museums and galleries (Graham, 2010, p.190). With this in mind, there are few grounds on which to claim any real ontological schism between digital media and the institutions that contain it, particularly in the case of an exhibition space like FACT. However, the group's act of invoking these more simplistic positions on the complexity of ideas around mental health presented by the digital content and the

relative simplicity of the institution, provide insight into how audiences are inclined to respond to challenging or over-stimulating exhibition environments when appropriate containment is not created.

Returning to the idea of container-contained, we can begin to position the group's initial distinction between digital media as 'nebulous' and overwhelming and the comparative sanctity of an asylum as a set of anxieties seeking containment. What emerges in the audience feedback is nervousness about a perceived complexity of the perspectives on mental health presented in the multiple media and digital forms in the exhibition. Moreover, the group expresses concern about the proximity of some of the technological issues to their own daily experiences and the loss of the historical asylum as a way of making mental illness separate. Later in the matrix, the group's working through the concept of asylum did develop further in the direction of an empathetic relating to the experience of incarceration. Yet this process of testing out the asylum as a desirable space (which is uniquely evidenced by the visual matrix process), speaks volumes about how audiences might process the anxieties brought about by an exhibition of confronting digital artworks that deal with mental health. While our curatorial framing of the exhibition sought to put forward the asylum as a punitive space that represented the darker side of mental health care, it took on significance as a place of refuge for this audience group. Our curation of the exhibition as 'cognitive space overloaded with nervous incentives to act' (Berardi, 2009, p.108) certainly succeeded in recreating many of the universal anxious encounters that define the digital age. Yet for this participant group there is a moment of clear desire for the gallery to be a space that holds and contains their anxiety rather than amplifying it.

It is crucial to remember here that for Bion, when containment is created it enables psychological processing of the full range of human emotions. An exhibition environment that induces containment should therefore afford space to tolerate even the most challenging and overwhelming experiences. Difficult emotions aroused by works such as *Labyrinth Psychotica* and *White Matter* should not be outside of the boundaries of containment or of an engaging curatorial strategy. Yet this research suggests that a desire to hold and contain should be integral to all stages of the curatorial approach in order to facilitate deep audience engagement with the topic of digital mental health. It should be stated here

that the object of this wider body of research is not to arrive upon a universal curatorial formula for facilitating containment in exhibitions of digital art about mental health. Indeed, searching for such a blueprint would run counter to the affect centered and context driven nature of the methods employed here. Rather this approach seeks to build curatorial capacity for sensitive and empathetic exhibition making that is informed by a deep engagement with audience experience.

Conclusions: Curatorial Implications

Overall the critical and evaluative reception of the *Group Therapy* exhibition was positive and it was only in the visual matrix that deeper anxieties emerged, a fact that serves as testimony to the unique value of this method. While the next iteration of the *Group Therapy* exhibition will not abandon its interest in reproducing the overstimulation of digital environments, it will seek to pay greater attention to ways that the exhibition environment may elevate or exacerbate anxiety-making experiences, and to question how valuable these experiences are for audience engagement.

Strategies under consideration include reducing the number of objects/works and collaborating with the exhibition designer to create spaces that support deeper immersion with individual works rather than an imperative to digest lots of material simultaneously.

The significance of the image of the asylum in audience feedback on the *Group Therapy* exhibition suggests that while digital media has integrated into gallery and museum spaces over the past ten years, audiences may still fall back on outdated distinctions between the historical museum and digital media. This is perhaps particularly pertinent in the case of exhibitions dealing with health and wellbeing, where the historical museum has symbolic connections to the asylum and its nostalgic connotations of containing anxiety. Although audiences at FACT are well versed in digital media, they still appear in this case to encounter a degree of difficulty dealing with the way that the exhibition escalates anxiety using digital forms.

My application of container-contained provides an experimental paradigm for a curator who wishes to support audiences to experience challenging digital artworks that deal with mental health. Its usefulness resides in its accommodation of both positive and distressing emotions, therefore pushing beyond the traditional 'feel good' sentiments of some arts and health

practices.

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Eastern Cultural Heritage, Digital Remediation and Global Perspectives

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Abstract

The paper describes findings from a practice-based research project exploring cross-cultural influences between the West and the East by recreating the concept of Shan-Shui-Hua – the traditional Eastern landscape painting within the new genre of “Video-Painting” as wall-mounted flat screen video installation. It uses concepts of Art Appropriation, Remediation and Remix to re-investigate relationships of man and nature in Eastern traditional landscape art and philosophy and transposes the content to con-temporary global environmental issues and digital visualization technology. Using the “other” or the “unfamiliar” allows a fresh access and new interpretation of well-known territory. As such cultural heritage is seen as an opportunity to explore new artistic boundaries and styles of representation within set commodities of contemporary (digital) image creation. Translating and adapting subtle aesthetics, rich metaphor and philosophy of Eastern traditions creates a powerful, subversive tool to address pressing ecological issues differently and allows alternative ways of seeing and thinking thereby detecting Western preoccupations.

Keywords

Eastern Cultural Heritage, Traditional Chinese Landscape Painting, Video Painting, Digital Visualization Practice, Eastern Philosophy, Remediation, Remix, Cross-cultural Art.

Introduction

The paper is a critical reflection on the general use of our current digital visualization practice. It highlights how its technical, aesthetic and expressive conditions are the result of a long continuous cultural, technological and intellectual development within the Western civilization which allows certain ways of visual expression but also puts restraints on others. It investigates Eastern cultural heritage and art traditions as an opportunity to create a different approach to reflect on some parameters of contemporary (visual / digital) culture.

The paper does not suggest alternative modes as a new paradigm, it just invites to engage in alternative, competing and / or opposing cultural perspectives in

the light of a multi -cultural globalized world where the understanding of other (visual) cultures and heritage becomes increasingly important and opens ways for new approaches in the future.

The practice presented in this paper consists of three video paintings that rework each certain aspects and contents of Eastern visual culture and philosophy. The artworks transform the original messages embedded in the source material as well as the source material itself:

1) The video painting *Shan-Shua-Hua* or *mountain-water-painting* adapts visual principles and contents of Chinese Landscape art and the ancient hand and hanging scroll.

2) The video painting *Shizen?natural* adapts the concept and content of the Japanese *Makimono*.

3) The video painting *We myself I and Them* reworks an ancient hand scroll of a cityscape and poses questions about citizenship and the relationship between individual and society.

All three video paintings recontextualize aspects of Eastern art tradition in the following areas:

- The use of time and temporality
- The use of space and perspective: linear perspective versus the Eastern concept of shifting perspective and multiple vanishing points
- Eastern philosophy: Relationship between man and nature, individual and society



Figure 1. *Mountain-water-painting*, digital video painting, 2009, 6,12min. ©Christin Bolewski

Remediation, Remix and other Theories

In the pivotal book *Remediation - Understanding New Media* published in 2000 the newmedia specialists Jay David Bolter and Richard Grusin coined the word "Remediation" to refer to the ways in which any new medium is always both a refashioning of an earlier medium and a novelty understood through previous media. They note that earlier media have also refashioned one another: 'photography remediated painting, film remediated stage production and photography, and television remediated film, vaudeville, and radio.' They come to the conclusion that 'for our culture, mediation without remediation seems to be impossible'. (Bolter and Grusin, 2000) Any new medium develops hereby step by step from the emergence of a novel technology and through the articulation of a specific media language and semiotic system by reworking, remodeling and sampling various elements of differing other media into newly converged forms to successfully establish its own aesthetic vocabulary.

Irvine notes in *Remix and the Dialogic Engine of Culture* that 'today we inhabit a *semiosphere* formed by a hybrid system of old and new media with built-in combinatorial processes for new meanings and media hybridization and that the ongoing, recombinatorial principles of culture have often been noted in general ways, and emphasized by many recent scholars.' (Irvine, 2016) Recent theories, for example, in *Remix culture* define remix as a general method of (cultural critique) using quotation, citation and commentary. Originally made popular in music culture during the late 1970s remix theory today encompasses a large variety of forms in music, film, poetry and the visual arts with *remix video* relating to earlier concepts of *found footage* in *video art* based on reediting mainly television, movies and news media content for critical and political purposes. As both *found footage* video art and *remix video* are mainly linked with appropriating and critically commenting on popular media culture and symbols and to transform them through juxtapositions, repetition and often rhythm the 'older' concept of *art appropriation* seems to be more suitable to describe the approach to reworking concepts and contents of Eastern landscape painting tradition into contemporary moving image practice - mixed with some reflections on recent theories of global and cross-cultural art practice or alternative modernities.

Today there are global themes and global codes of image making which are shared by all of us and certainly are being pushed via digital media technology.

Contemporary art practice is now global and artist from all cultures contribute today in developing it forward. Cross-cultural practice is very common, hence heritage from different cultural settings can act as instigators for new development. Also concepts of *remediation* and *remix* stemming from within Western art theory could now be revisited and extended by including traditions and media from other cultural backgrounds that are being *remediated* or *remixed* into a global culture.

Time and Temporality: Western Film Tradition, Eastern Visual Art and Contemporary Video Painting

An early example of referencing aspects of Eastern culture in relation to film practice is the Russian avant-garde filmmaker Sergej Eisenstein. Beginning of the 20th century he was inspired by the commonality between the medium film and the Eastern art tradition in the development of his theory of film montage. (Eisenstein Leda, 1996) He studied Japanese language and art and concluded that all the various branches of Japanese art were permeated by the same cinematic element, so that it was appropriate that the cinema should learn from other forms of Japanese artistic practice. Besides extracting techniques from Chinese characters and the Kabuki theatre, Eisenstein had also drawn on traditional scroll paintings that fused in his mind a combined image of close-ups and composition in depth.

The link between film and Eastern art has not been very prominent for a long time, so that it is quite challenging - from the perspective of a contemporary digital media artist and film maker - to look closer to this relation and to consider the early observations of Eisenstein specifically in an approach to digital film and visualization practice, nearly 100 years later.

The video painting *Shan-Shui-Hua* (translated from Chinese language into *mountain-water-painting*) that was developed first in this practice based research project follows the idea of Eisenstein and introduces the genre of the *video painting* as a suitable form for development. The video painting is a quite new artefact in contemporary moving image practice. It is a hybrid concept (or *remediation*) between still and moving image using traditional pattern of film and painting practice. It emerges as a supremely pictorial form and due to its ambient and meditative character video painting seems to be privileged to represent the conceptual and philosophical ideas of the traditional *Shan-Shui -Hua*.

‘It creates a visual aesthetic, which relies on high visual impact, the subtle manipulation of image, multiple layers, and the play of gradual, complex transitions. It is a smooth temporal flow, always changing, but never too quickly. The piece is an exploration of concepts of ambience, time, and the liminality of image and of narrative. (Bizzocchi, 2005).

Cross-cultural Art Practice

During the practical process it became obvious that it is impossible to create such a body of work without encountering difficulties of translation between Eastern and Western art tradition and without engaging in a debate on crosscultural art or post-colonial issues. In the past ten to twenty years it has become quite common for Eastern contemporary artists to incorporate aspects of Western art into their practice, and there is evidence of its worldwide success in various exhibitions in major museums and galleries. In the short time contemporary Eastern art has had to establish itself - sometimes accused by Western and Eastern critics of continuing to mimic Western art historical movements.

Meanwhile a more complex relationship of influences has developed and Eastern artists are reworking their traditional concepts combined with Western ideas in a more independent way, which the Chinese art critic and curator Fei Dawei describes as ‘gradually placing issues brought from Chinese context into the larger cultural background of the world, in a lively and creative way, so that it can set in motion a process of becoming “common” and “extensive”.’ (Dawei in Lu, 2009)

The quite new technical genre of the high-resolution flat screen display wall-mounted as video painting inspires also a number of Eastern artist to set their traditions into motion. The Korean artist Lee Lee Nam is internationally very successful and transcends traditional Eastern forms into digital sculptures and video paintings. A very prominent example was presented at the Opening Ceremony of Beijing 2008 Olympics. Here a mega scroll was displayed and set in motion on probably one of the world’s biggest LED screen: 22 meters wide and 147 meters long. As usual, the painting was a still image. It was not temporal art, but the scroll’s dynamic display set the painting in motion and was able to show both the still image and dynamic one.

The adventure of mixing aspects of both cultures is rarely been undertaken in the other direction from the West to the East. Although the incorporation of Eastern

aesthetics into Western art has long precedent in modern art, it is today sometimes still regarded as “esoteric” or can be criticized as a “post-colonial attitude”. So there is a crucial question: Is it possible today in the age of globalization to create new modes of cross -cultural art based on a comprehensive understanding of the other culture and without being accused of mimicking or exploiting the other?

There are many different (and often contradictive) conceptual frameworks available to answer such a question. Elkins concludes in *Is Art History Global?* that ‘it can be argued that there is no non-Western tradition of art history, if by that is meant a tradition with its own interpretive strategies and forms of argument.’ He finally comes to the conclusion that ‘globalism means the use of Western forms, ideas, and institutions.’ (Elkins, 2007) More positive approaches such as theories of *Alternative Modernities* or *Altermodernity* coined by French art critic Nicolas Baurriand conclude that (*altermodern*) culture is based on increased communication, travel and migration. Multiculturalism and identity is being overtaken by creolisation and artists are now starting from a globalized state of culture. This new universalism is based on translations, subtitling and generalized dubbing. ‘*Altermodern* art is thus read as a hypertext; artists translate and transpose information from one format to another, and wander in geography as well as in history.’ (Baurriand, 2009)

Detour via China – A Philosophical Approach

East Asian aesthetic and philosophy is difficult to understand for the Western mind with its emphasis on openness and suggestiveness. There is a difficulty involved in bridging the gaps of understanding when viewing Eastern art. The reception of the art is passed through filters of language and culture and we in the West often realize that we cannot always grasp the full meaning. In her essay *Another kind of global thinking* published in *Is art history global?*

Barbara Maria Stafford points out that translation and interpretation always involve transformation. ‘The pristine distinctiveness of other cultures cannot be maintained through the process of interpretation. It involves assimilation to the conceptual vocabulary and values of the other culture and does not overcome the basic fact that they are still being removed from the specific cultural context to which they belong, translated into an alien context and idiom - Anglo-American

art history - and set into a net-work of concepts and comparisons which transform their significance.’ (Stafford, 2007)

There are some contemporary writers such as the French philosopher and sinologist Francois Jullien, South Korean cultural theorist Byung-Chul Han or the Chinese French writer Francois Cheng who translate Eastern culture and aesthetics for Western understanding offering some insights and interesting alternatives to compare and rethink Western traditions. In his book *The Detour via China* (free translation of the German title *Umweg ueber China*) Francois Jullien attempts to create a new approach to Western culture: A “local change of thinking”, a process of distancing from Western thinking as an effective strategy where Eastern philosophy functions as an “outside” from which to see more clearly the values and preoccupation of Western culture. His detours about China always emanate from European philosophy with its Greek origins and lead back there to reveal the contingencies of their principles and conditions. Jullien talks about the impossibility to compare the two separate cultures. Eastern and Western ideas are often not in opposition; instead they are based on different categories and different pattern of thought, which makes a direct comparison impossible, and he suggests distancing and reflecting each others preoccupations.

Detour via China Applied to Practice

The three video paintings confronted with this problem of understanding and translating contents of a foreign culture apply this philosophical concept as a methodology for art making: In the sense of Francois Jullien the art work is a *detour via China*: Emphasizing to some extent philosophical as well as pictorial concepts and practical aspects of the Chinese painting process enables to distance and to take a fresh approach to Western thinking, film and digital visualization practice, but at the same time using software tools that generally have been devised to create 2D and 3D artefacts from a Western cultural perspective avoids the pitfalls of echoing and imitating Chinese landscape painting too closely.

Space and Perspective

Erwin Panofsky argues in *Perspective as Symbolic Form* that the perceptual schema of each historical culture or epoch is different, and each gives rise to a different but equally full vision of the world. Panofsky articulates

these different spatial systems, demonstrating their particular coherence and compatibility with the modes of knowledge, belief, and exchange that characterized the cultures in which they arose. For the Western vision of the world he identifies linear perspective as the dominant perceptual schema: the disregard of the blurred human vision in favor of the precise concept of a finite mathematical spatial system where every point is defined. Not only through the use in Western painting, but also through the existence of that system in every image that is taken from our reality through photography or film the “geometrical sharp vision” has influenced our perception of the world, so that the understanding of our reality is illustrated and equated with a precise defined sharp form of visualization (Panofsky, 1991).

Western Principles: Linear Perspective and Transparent Immediacy

In *Remediation - Understanding New Media* Bolter and Grusin define *Transparent Immediacy* as one of the most important aspect of the Western visual culture. It is a concept, which is based on geometrical perspective and in accordance with the thoughts of Panofsky. *Transparent immediacy* longs for a medium whose purpose is to disappear, a visual experience without mediation. ‘Virtual reality, three-dimensional graphics and graphical interface design are all seeking to make digital technology “transparent”. The user moves through the space interacting with the objects “naturally” as (s)he does in the physical world. In this sense, a transparent interface would be one that erases itself, so that the user is no longer aware of confronting a medium, but instead stands in an immediate relationship to the contents of that medium. The desire for immediacy itself has a history that is not easily overcome.’ (Bolter and Grusin, 2000)

Bolter and Grusin also note that at least since the Renaissance it has been a defining feature of Western visual representation. ‘To understand immediacy in computer graphics, it is important to keep in mind the ways in which painting, photography, film, and television have sought to satisfy this same desire. These earlier media sought immediacy through the interplay of the aesthetic value of transparency with techniques of linear perspective, erasure, and automaticity, all of which are strategies also at work in digital technology.’ (Bolter and Grusin, 2000)

Eastern Principles: Multiple and Shifting Perspective

In Chinese culture the (landscape) painting is not a representational image of reality, a specific place or landscape. It is called *Shan-Shui-Hua*; the three characters standing for respectively mountain, water and painting and is a metaphorical or “spiritual” vision attached to a landscape - free of that “sharp precise vision” mentioned by Panofsky. Chinese art is based on philosophical and spiritual ideas and the depiction and creation of realistic space is not one of its aims. So unlike the Western painting tradition, which under the strong influence of science emphasized proportion, perspective and realistic depiction of form, the Chinese artists never felt compelled to restrict themselves to this limited view. Eastern art has a concept of using no or multiple vanishing points called *San-e-ho*. Because a painting is not a window, there is no need to imitate the mechanics of vision and view a scene from only one spot. Instead, they developed a more abstract and free spirited attitude towards art. ‘The Chinese artist inspects the world from unrestricted, shifting points of view, this is also known as the “shifting perspective” method *San Dian Tou Shi* and is essentially different from the strict and realistic western “single perspective”. This unique feature enabled Chinese painters to free themselves from the limitations of human vision and permitted more freedom to improvise using ones imagination.’ (Art Realisation TM, 2005)



Figure 2. *Shizen?natural*, digital video painting, 2013, 7,15min.
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Shan-Shui-Hua Reinterpreted: The digital Video Scroll

The three video paintings explore the Eastern concept of shifting and multi-perspective and the endless scroll through digital filmmaking, video compositing and virtual camera, depths and particle systems. They are a

combination of a traditional Eastern hanging and hand scroll. The vertical hanging scroll is given through the format of a vertical mounted flat screen and gives space to apply the concept of *San-e-ho* (multi-perspective) combining different perspectives within one image. The horizontal scroll of the video unrolls in time and space, but only in the moment of projection and is composed and animated from right to left in analogy to the East Asian principle. The video presents a permanent virtual camera movement gliding through an indefinite landscape. This imitates the conception of spatial representation of an original hand scroll where multiple points of view are spread horizontally, parallel to the scene; or to say within the concept of Chinese axonometry: it has no clear vanishing point.

The landscape of the video scrolls contains original 2D video recordings as well as 2D / 3D computer generated images and animations of landscapes. Whereas in the original paintings the journey within the third dimension of space is simulated through a careful arrangement of *San-e-ho* and the repeated appearance of the figure of a solitary traveler (for the viewer to identify with being on a journey) the video scroll additionally uses virtual camera movements along the z-axis as an extra layer to push and question the perspective composition of the traditional Chinese painting.

The video scroll uses templates of mountain models, especially wire frame models and particle systems for snow, mist and clouds. As the Chinese landscape traditionally does not represent a single landscape rather than an ideal and symbolic form of it, the different elements become a set of “metaphorical templates” similar as the templates in 3D construction.

Man and Nature in Chinese Art and Philosophy

The theme of the “journey” is an enduring theme in Chinese landscape paintings. This means yearning for the spiritual, the remote, or the unattainable. The artist frequently portrays himself as a lone figure, a romantic fugitive, wandering into the uninhabited parts of nature where he can linger forever. Chinese landscapes usually include small human figures that blend harmoniously into the vast world around them. Man and nature interact and complement each other to reach a state of balance and harmony. The animated video scrolls reframe the original narrative and transpose this traditional relation into a different, more contemporary Western manner reflecting current environmental issues:



Figure 3. Mountain-water-painting, digital video painting, 2009, 6,12min. ©Christin Bolewski

1) Mountain-water-painting

In *mountain-water-painting* the ancient pilgrim is replaced by the figure of the Western mountaineer equipped with special tools and protective clothing to vanquish the highest peaks in order to conquer nature, thus counterpointing Eastern and Western ideals. The ambient video scroll presents a poem of the famous Chinese poet Han Shan. He was a hermit and poet of the T'ang Dynasty and most of his poems were written when he lived alone in caves and primitive shelters in the far Eastern mountains of China.

Chinese is a symbol language, ambiguous and open for multiple interpretations. Therefore, also the poetry is open to varying interpretations and within the video scroll it is presented as a reflection on the Western mountaineers fight against nature ascending and descending the highest peaks counterpointing the Chinese attempt of spiritual harmony.

In the Chinese landscape as well as in the video scroll different parts of the image sit separately designed within a large empty space. Water, mist, or clouds divide the scene naturally through the interplay of mass and void. Mass and void is an important principle of composition. 'The mist is also empty space, and empty space contains the possibility for transformation. Transformation is central to Taoist thought. It is like being in meditation, when the entire cosmos looks like a white mist, and one finds oneself in a world of white light. Here, time and space seem to be annihilated.' (Wong, 1991)

The video paintings play with absence and presence, totality and emptiness, materiality and transcendence. 3D computer generated forms and wire frame grids of mountain models mix with 2D video recordings; illusionism meets reality. The principle of transformation

so central to Taoist thought becomes the transformation of an imaginary digital landscape.

2) Shizen?natural

Shizen is the Japanese word for nature and the second video scroll reflects our relationship to nature by citing and transposing form and content of the *Makimono* - a traditional Japanese horizontal scroll painting- into a contemporary manner: Throughout the year seasonal motifs are changed - accordingly spring, summer, autumn and winter progress as well as the destruction of our environment. The work is a comment about the huge contrast between ancient traditional Japanese culture and the modern extremely technology based and artificial life which exists there today. It shows traditional temples and gardens now filled up with modern tourists and overcrowded street scenes in Tokyo as the modern replace for the ancient pilgrim. It refers to the nuclear meltdown after the Earthquake and Tsunami in Japan in 2011 and a global question and challenge arise for mankind: to coexist in harmony or to control, master and exploit nature? This ambient video scroll presents a poem of the famous Japanese poet Yamabe no Akahito celebrating iconic Mount Fuji as a reflection on the conflicting relationship struggling between tradition and technological and cultural progress.

Challenging the Western preoccupation with narrative and distinct meaning the ambient video scrolls contain no complex narration and attempt to be meditative open artwork combining and contrasting Western and Eastern culture by reflecting our current disturbed relationship to nature in contrast to original Eastern poetry which celebrates harmonious existence.



Figure 4. *Shizen?natural*, digital video painting, 2013, 7,15min. ©Christin Bolewski.

3) We Myself I and Them

The third video painting is an investigation of the city-scape. It makes references to an old Chinese hand scroll titled *Along the River During the Qingming Festival* by the Song dynasty artist Zhang Zeduan. It captures the daily life of people and the landscape of an old Chinese capital. The painting is considered to be one of the most renowned works among all Chinese paintings and has been reinterpreted by a number of court artists of subsequent dynasties each following the overall composition and the theme of the original but differing in details and technique. Citing and reworking of art tradition seems to be therefore also a well-established concept of Eastern and not only Western art tradition and for the World Expo 2010 presented at the China Pavilion the original painting was again remade into a 3D animated digital painting titled *River of Wisdom*.

We myself I and Them adopts this old master piece again into a contemporary manner by using contemporary and historical video footage recorded at *Tianamen Square* in Beijing. The work particularly makes reference to tourists who are today mostly populating the square and to military parades and the *Tianamen Square* protests in 1989. So the work investigates public space and provides some comments about citizenship and the relationship between individual and society in the traditional Eastern society now affected by Western and global influences.

Conclusions

The digital artwork presented in this paper can act as an example and point of controversial discussion as to how cultural heritage from a foreign culture can act as an unfamiliar access to own (Western) culture and digital visual practice. The “other”, the unfamiliar acts as a fresh input or way of seeing things. Reframing of the original narrative produces a fresh perspective on both the source material and the context in which it first existed and in which it exists now - in the Eastern, Western or globalized world.



Figure 5. *We myself I and Them*, digital video painting, 2017, 7,15 min.
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Eastern aesthetics seem to be particularly suited to create subtle and poetic approaches – rich in metaphor – providing a meditative (and subversive) contemplative situation that puts the audience into a state of flow, to calm down and take time to reflect on those conflicting issues that the artwork presents: There is destruction of nature presented as poetic beauty. Working with those contrasting effects can create very powerful experiences for the viewer and invites engaging in alternative, competing and opposing cultural perspectives in the light of a multi-cultural globalized world where the understanding of other (visual) cultures becomes increasingly important or as Irvine concludes in his essay in *Remix and the Dialogic Engine of Culture* ‘any work produced and received in a culture is, necessarily, a materialized symbolic structure encoding an interpretive dialogic pattern of combinatorial units, meanings, values, and ideas that came from somewhere and are on their way to somewhere else.’ (Irvine, 2016)

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Author Biography

Christin Bolewski is a digital media artist and experimental film-maker from Germany. She exhibits regularly at international media art and film festivals and has taught media art and design in Universities in Europe and America. She is currently a Senior Lecturer and researcher at School of the Arts, English and Drama, Loughborough University UK. Her artwork and research is a critical investigation of the potential of digital media to expand the aesthetic possibilities of audiovisual / film art. It includes video installation, genre mix, alternation and remediation of traditional art concepts / film structures, nonlinear storytelling, combination of still / moving image, video / photography. She has had regular exhibitions at international digital media art events in Europe, Asia, North and South America, including SIGGRAPH Asia, ISEA 2011, Worldwide Video Festival Den Haag, FILE Brazil, Transmediale Berlin, 'Manifestation on video-art and video making of the last 15 Years' Rialto Filmtheatre Amsterdam, Electronic Undercurrents, Art & Video in Europe Statens Museum for Kunst Copenhagen, part of group exhibitions at Kunstmuseum Bonn, Dt. Kinemathek Berlin, and awarded with UNESCO Web Prize, etc.

Decomposing Landscape: Hearing the Troubled Site

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Abstract

Site-specific sound artworks are developed through location based listening and recordings made at specific places with a particular cultural heritage. The compositional strategy in these works relies on artistic intervention by intricate processes of field recording and processing of recognizable environmental sounds using multi-channel spatialization techniques. The artistic transformation renders these sounds into a blurry area between compositional abstraction and portrayal of their site-based narrative. The question is: how much spatial information is retained and how much abstraction is deployed in these works? In this proposed paper presentation, I discuss my recent multi-channel sound work: *Decomposing Landscape* (2015) to shed light on the specific approaches and the methodology of handling site-specific evidence in sound art production dealing with environmentally troubled heritage sites in India.

Keywords

Sound Art, Media Production, Landscape, Heritage, Ambience, Sitespecificity, ambient sound, Artistic Transformation, Mediation.”

Introduction

As a practitioner of sound art I am involved with “field recording,” a practice that embraces the methodology of recording site-specific ambient sounds outside of the studio. The practice is also known as “phonography” – a term used to signify its similarity to photography. Field recording was originally developed as part of a documentary approach in anthropological field research; it also stands analogous to location recording in filmmaking, albeit being largely controlled by the predominant narrative strategies of cinema. With the introduction of high-quality portable recording technologies after the digital revolution in the nineties, it has subsequently become an independent and evocative art form in itself within the realm of sound art and new music. The current avatar of field recording often involves capturing environmental sounds, which might range from animal sounds from the remote corners of

the wilderness to everyday urban sounds, subliminal in apprehension and low frequency in content; therefore, the sonic material tends to be complex in texture, tone and characteristics. In response, artists have often pushed the technical capabilities of sound recording, demanding low noise and extended frequency response in portable, easy-to-use recording equipment, ranging from high-resolution multitrack recording kits to the DIY technologies of contact microphones, for example. The arrival of digital technology actually made such recording techniques and methods possible. Hence, we can observe that the digital era has turned out to be an ideal situation for the emergence of field recording-based sound art, enabling diverse approaches to documenting sound from a site. Parallel developments also occurred within sound production practices in the context of fiction films; however, in the scope of this paper I will focus on examining non-fiction field recording-based sound artworks due to their unique contribution to the issues of spatial evidence and presence. Drawing on a few more recent scholarly works on field recording (Demers, 2010; Gallagher, 2015), I intend to discuss one of my recent multi-channel sound compositions: *Decomposing Landscape* (Chattopadhyay, 2015), in order to underscore the complex and evolving relationship between sound and site that is thoroughly challenged in the practice of field recording or phonography-based sound artworks and digital music compositions created with site-specific recordings of ambient sound from endangered sites.

The Discourse

In a recent essay, Australian sound artist Lawrence English enquired into the current flux of field recording practice: “Why has it become a substantial presence in the contemporary sound ecologies? Merely two decades ago it was a somewhat uncharted realm lacking vigorous and pluralistic investigations” (English, 2014). To answer this question, I draw attention to the condition of

contemporary media art since the dust of the digital era has settled. I argue that, following the advent of digital technology in the late 90s, widely available and easy-to-handle digital sound recording devices, applications and facilities made various options and formats available to contemporary sound practitioners. Field recording based sound technologies, as a sprawling field in the realm of contemporary art practices, facilitate the recording of sound on location with greater detail, deeper depth of field, and wider dynamic range of frequency, resulting in more precise, controlled and accurate documentary evidence of the site. These recording capabilities allow for a closer listening to and more accurate sonic documentation of uncharted territories, including underwater and underground locations, in the Amazonian forests, arctic landscapes, and even in outer space. Contemporary sound practice is marked by conditions where the digital saturates itself to give birth to a new context of “post-digital” (Cascone, 2002; Chattopadhyay, 2014; Cramer, 2014 et al.) practices, intensifying technological convergence, aesthetic inclusivity, a sense of democratization, and artistic freedom. In this post-digital era, field recording is amply supported by the development of kits with multitrack recording options, offering greater flexibility, access to the farthest corners of the location, and applications with precise control over each recorded audio clip. Multiple options for saving numerous tracks open up possibilities for recording a larger number of sound elements and working with multiple layers of sound captured from a location. In the studio scenario, there are ample choices for processing sounds (digitally or with retro-aesthetic means, e.g. analogue synthesizers) for spatialization and multichannel composition. But it is not the availability of the tools of music technologies and the way in which this has impacted the proliferation of field recording in sound-based artistic production that I focus on in this article. My interest in this paper presentation lies in examining the nature of the site -specific sound contents that are recorded and used in field recording based sound artworks and the ramifications of the post-digital approach on the handling of audible evidence derived from culturally rich sites or landscapes that are environmentally and climatically endangered within rapidly emerging economies, such as that of India, landscapes that are underrepresented in popular mainstream film and media productions.

The Context

We have arguably entered the Anthropocene epoch, a new geologic era defined by unprecedented manmade disturbances over earth’s ecologies (Morton, 2013). In this era, the ecological integrity of natural, pastoral landscapes in emerging economies like India are endangered due to governmental pressure for rapid growth. Under the specter of the contemporary conditions of anthropogenic climate change in these developing economies, the actual environments of the various rural sites and pastoral landscapes are undergoing massive environmental transformation. Contemporary India is going through an intensifying process of land development to facilitate rapid urbanization (McKinsey, 2010). As a result of this speedy manmade growth, many of the greener pastures in the rural hinterlands are developing into post-industrial zones, deeply impacting the integrity of the environmental as well as socio-cultural climate. Consequently, these scenic landscapes are transmuting to become homogenized wastelands, with complex transitions unfolding within their traditionally rich culture and history. In India there are numerous such sites that are going through an intense cross-fertilization between multi-layered development processes within traditionally integrated rural areas, impacting the natural landscapes suffused with their own unique site -specific heritage. Some of these transitory landscapes are exposed to phonographic fieldwork as sites for investigation through the development of diegetic narratives in sound art and compositions.

The Work

In this context, multi-channel sound composition *Decomposing Landscape* (Chattopadhyay, 2015) developed through extensive field recordings made at specific sites situated at the eastern part of India, close to the city of Kolkata. The work creates a discursive auditory setting to facilitate a contemplative and indepth observation of transitive landscapes. The final outcome of the project includes an Ambisonics sound composition – site-specific field recordings arranged and diffused through multi-channel spatialization – as well as a multi-channel sound/video installation. The works have been developed through a meticulous collection of materials from various locations of India during extensive phonographic fieldworks. This collection formed a digital archive used to realize the work. The project aims to share an aesthetic interpretation of the

gradual transfiguration of the developing societies to the wider public, employing post-digital music technology with a hybrid methodology, marked by a technological convergence between old and new applications; aesthetic inclusivity, combining retro and current techniques of sound processing; and artistic freedom in arranging sound through the wider spatial environment of an Ambisonics system. The multi-channel sound composition was developed during an artist residency at ICST, Zurich University of the Arts and, upon completion, received first prize in the Computer and Electronic Music category of Computer Space festival, Sofia, Bulgaria in 2014¹ and was subsequently released by Touch, London, in 2015.² In this work the sonic representation of the specific sites tends to aestheticize the actual environment of the landscape in the creative process of spatial composition developed while listening and gathering field recordings of site-specific ambient sounds. The compositional strategy consists of artistic interventions: taking intricate location-based multi-track digital field recordings and transforming these recognizable environmental sounds through studio processing. These artistic mediations diffuse these sounds spatially into a blurry area between musical abstraction and recognizable sonic evidence of the site. The question is, how much spatial information, in terms of the recorded ambient sounds, is retained and how much artistic abstraction is deployed during production practice? This artistic process needs to be examined in order to better understand the nature of representation in field recording-based sound artworks that intend to diegetically narrate the traditionally ingrained heritage sites endangered by anthropogenic interferences.

The Analysis

As it develops, the 35-minute long piece deliberately turns from the recognizable textures and tones of ambient sounds in the first 15 minutes to become steadily more abstract.³ As I have mentioned, the work draws on field recordings collected from a specific environmentally troubled site in eastern India as its primary material.

¹ See: http://www.seas.acad.bg/cs2014/index.php?option=com_content&view=article&id=146%3Acomputer-space-2014-awarded-projects&catid=1%3Alatest-news&Itemid=67&lang=en

² See: http://touchshop.org/product_info.php?cPath=113&products_id=693

³ Excerpts from the composition: <https://soundcloud.com/budhadiya/decomposing-landscape-excerpts>

The field recordings are already “composed” on site, as Sound Studies scholar Joanna Demers has shown. Phonography-based sound works are developed from documentary field recordings, which are collected from certain sites and landscapes, employing the act of recording as the primary compositional process (Demers, 2010). Sound artist Yan Jun addresses this purer approach of field recording in the phonography-based sound art production by stating that: “There is no divide between documenting and creating. The point is that, I do not build dreams, neither by field recording nor by playing my electronic instruments or digital audio workstation at the laptop computer. To choose the right equipment, to choose the right recording position and to push the record button are the acts of composing. A recording of tiny meaningless noises can be a beautiful composition” (Jun quoted in English, 2014). However, there are works that use digital mediation as their primary compositional strategy: using musical techniques such as signal synthesis, looping, and so on. This strategy relies heavily on the processing of recognizable environmental sounds recorded from the sites, using effects like delay and modulation, a methodology that follows the example of composer Barry Truax (1996). When analyzing the methodology employed, “Decomposing Landscape” falls into the latter category of sound artworks, however, at places I choose to reproduce recurring motifs in the form of unprocessed, site-based field recordings. My intent with this deliberate interplay between audible site-specific evidence that is recognizable or made abstract should be justified, since the ecologically-disturbed and polluted sites, as the subject of the work, might be viewed as asking for a more truthful (i.e. less manipulated) documentation of the anthropogenic interference in the landscape, as demanded by the notions of acoustic ecology and soundscape (Novak and Sakakeeny, 2015), marked by an environmental concern.

Earlier scholars writing on sound recording have discussed the process of recording in terms of dislocating sounds from their respective sources and the sites of their origin. Both Rick Altman and R. Murray Schafer have spoken about the ways in which recording displaces sounds in time (Schafer, 1994; Altman, 2012). Field recording of site-specific ambient sound, therefore, can be considered as a process that develops a repository of sonic events recorded from the site that can be brought into the realm of composition as sound objects (Demers,

2010; Metz, 1980). Following this, it can be argued that phonography-based composition stems from both site-specific sound recording – “field recording” – and the subsequent studio processing of the gathered artistic material: recorded and disembodied ambient sounds. It remains to be seen as to what degree sound becomes disembodied during the recording process as well as how much abstraction is further imposed on this sound due to the compositional method applied during the production of the sound art. Does the strategy of musical and artistic mediation that is applied distort the audible evidence of the field recordings collected from ecologically disturbed sites with deeply held cultural heritage?

The work begins with unprocessed ambient sounds of birds, insects and traffic from a distant landscape within a spatial perspective of a wide expanse.⁴ This shorter passage is invaded by the unedited sounds of flying bees in spatial diffusion with intensifying proximity and volume, creating a dramatic auditory setting. A slow intrusion of the sounds of cattle bells follows, bringing in subtle musical textures that gradually grow incessantly rhythmic and spatially enveloping. Unprocessed sounds of machineries appear from distant corners and take over the environment. The sound of machineries is intercepted by the rhythms of the ritual drums played at this tribal-dominated site perhaps contributing to the notion of “sounded anthropology” (Feld & Basso, 1996; Samuels, Meintjes, Ochoa and Porcello, 2010). The machineries dissolve into a ritual chant, which gradually morphs into an “echoing chamber where all is erased and [...] left (with) dark brushes of sound enveloping the landscape.”⁵ This last part of the composition becomes heavily processed as time passes, employing tools such as delay, compression, time-stretching and spatialization with multiple audio applications, simulating varied sonic textures using styles from the most recent digital to earlier analogue eras. The piece continues with increasingly modulated abstract textures and ends with the climactic sound of an actual blast occurring at the center of the landscape, opening up the earth and extensively destroying the nature, as suggested through the development of the piece.

⁴ Excerpts: <https://soundcloud.com/budhaditya/decomposing-landscape-excerpts>

⁵ Review of the piece by sound artist and writer Maria Papado-manolaki in a personal email (2015).

The work’s compositional strategy of presenting the unprocessed ambient sounds in the beginning and then gradually turning them into processed sonic textures of ambient electronic music (Demers, 2010) essentially blurs the boundaries between the documentary actualities of the site and the subsequent artistic mediation, turning this process into a musical composition. The strategy of this deliberate but gradual transformation problematizes the nature of representation in a field recording-based sound art production, underscoring the work’s precarious relationship to the site. Particularly when the site in question is environmentally endangered, and thus perhaps seeming to demand an accurate documentation, the question arises: why would such a compositional strategy be undertaken?

Many field recording-based sound artworks such as “soundscape compositions” are, according to sound art historian Alan Licht, “a variant of musique concrète in which field recordings were electronically processed to some degree but fundamentally left recognisable” (Licht, 2009, p. 8). These works therefore tend not to obscure site-specific information “through a superimposition of sound that interpenetrates preexisting spaces, effecting a layering or doubling, which can produce hybrid spaces” (Gallagher, 2015, p. 574). In such artistic processes, the auditory evidence is kept in an ambivalent state, leaving questions concerning the degree of abstraction that the production of sound art generates. Based on the chosen compositional methods in sound artworks developed from field recordings, it can be contended that, in general, the work exists in a state of tension between the abstract and the evidential, subsequently suggesting a manipulation of recorded sonic “facts” within its speculative form of composition. The ways in which this distinction is maintained traces the nebulous line between abstraction and recognition. The processes of abstraction achieved through musical mediation (manipulations achieved digitally or with retro-aesthetic means, e.g. analogue processing of sound) and multi-channel composition collide with the evidential accounts of the field recording.

The diegetic world within the composition appears by means of the sites and their respective actual environments as represented within the sonically augmented environment of the piece. From the production end, if I link my art practice to the reception of the work through speculating on the expectations of the audience or, more precisely, by placing myself as the

first audience member of my artwork, I can contend that the audience members might involve themselves with the work by recognizing a sort of presence of the site within the contested diegetic narrative captured within this constructed world. The embodied experience of presence may vary in degree, depending on the intention of the artist in terms of which ambient sonic details of the sites are recorded and represented during the compositional process. The audience members would believe in and associate with the diegetic world (Percheron, 1980; Burch, 1982) when a resonance of the sites reverberates while experiencing the works. The representation of the site within the composed environments of phonography-based sound artworks are of significance when it comes to convincingly conveying the narratives of the actual sites and the landscapes to the audience: “Truax has noted that soundscape composition simulates a journey, or motion, through a landscape” (Licht, 2009, p. 8). The spatial organization of field recordings of ambient sounds in higher order Ambisonics format intends to create a spatially augmented environment realized through the narrative progression of the composition. The aesthetic experience of perceiving a culturally rich landscape in this sound work is crafted by recorded materials assembled with a narrative musical structure in mind. The strategic combination of recognizable unedited ambient sounds and processed phonographic materials is designed to suggest the development of a fertile interaction between the relative presence and absence of documentary evidence of this troubled site, which, within this constructed interplay, engages the audience’s interest and attention over time. Perhaps a mere factual representation of the site in unedited field recordings would not appeal to the audience’s contemplative associations. The extent to which audiences associate with the sites and how engaged they become while following the artistic transformation of field recordings, both in terms of compositional techniques as well as the Ambisonics spatialization of the ambient sounds, depends on the framing of this constructive interplay between absence and presence or between abstraction and recognition of the site-specific evidence during the temporal development of the composition. In the work *Decomposing Landscape* I have aimed at amplifying the imaginary outlines of the landscape by shifting attention between the concrete and the abstract.

Conclusion

The process of artistic transformation using multi-channel compositional techniques reproduces the field recordings from the culturally rich heritage sites troubled by man-made interference, within an augmented environment, formulating its narrative diegesis by operating between an abstraction from and reproduction of their sited source. The degree of artistic transformation depends on the amount of spatial information retained from the unedited field recordings as well as the processing that is deployed. The resulting tension, as explained above, may help engage the audience members, who might not otherwise lend their ears to a purely documentary representation of the site. In this paper I underscore such tension between offering an evidential account, through the use of unedited and relatively unprocessed field recordings, and an abstraction of ambient sounds, brought in through technology-based artistic interventions and transformation. In my assessment as a sound artist and researcher, this inherent tension makes the work more engaging.

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Author Biography

Budhaditya Chattopadhyay is an Indian-born media artist, researcher, writer and theorist. Chattopadhyay’s work questions the materiality, site-specificity and objecthood of sound, and addresses the aspects of contingency, contemplation, mindfulness and transcendence inherent in listening. His artistic practice intends to shift the emphasis from “object” to “situation” in the realm of sound. His soundworks are published by Gruenrekorder (Germany) and Touch (UK). Chattopadhyay is a Charles Wallace scholar, Prince Claus grantee and Falling Walls fellow, and has received several residencies and international awards, notably a First Prize in Computer and Electronic Music category of Computer Space festival 2014, Sofia, and an Honorary Mention at PRIX Ars Electronica 2011, Linz. Chattopadhyay graduated from the national film school of India specializing in sound, completed a Master of Arts degree in new media/sound art at Aarhus University, Denmark, and obtained a PhD degree in sound studies, involving artistic research from Leiden University, Netherlands.

Imagined Geographies, Interstitial Futures, *Guatemex*

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Abstract

This paper examines *Guatemex* (2006), an intervention at the borer of Mexico and Guatemala by three Mexican artists, Rene Hayashi, Eder Castillo, and Antonio O'Connel. I discuss the project's significance in relation to its conception as a concrete response to local needs, as it was designed to provide internet access and information to undocumented migrants crossing the interstitial space of Usumacinta River, the fluid border between Mexico and Guatemala. In this light, I also consider how *Guatemex* builds on, speaks to, and expand on notions about architecture, "border art", "imagined geography", utopian community, and "securitization". The focus of discussion is on the project's negotiation of these terms, and on its relevance as an intervention that suggests connecting and thinking with the margins as one of today's most ur-gent projects.

Keywords

Architecture, Art, Border, Media Art, Utopia, Intervention, Mexico, Guatemala, Immigration, South.

Introduction

"If they are not meant for children, they are not meant for citizens either. If they are not meant for citizens – ourselves, they are not cities."- Aldo van Eyck, 1962.

Guatemex (2006) [figures 1, 2], a collaborative project by three Mexican practitioners, two artists, Rene Hayashi and Eder Castillo and the architect Antonio O'Connel was conceived as a water-worthy structure designed to function as an internet access point between Mexico and Guatemala. Initially, the construction was assembled on the waters of the Suchiate river at Ciudad Hidalgo, sited at the southern-most point of Mexico in the state of Chiapas, at the main crossing of the international border with Guatemala. As part of a two-year curatorial project realized in the town of Frontera Corozal, entitled *Frontera: Un esbozo para la creación de una sociedad del futuro/Frontier: A Sketch for The Creation of a Society for the Future, Guatemex* was subsequently re-assembled at the Usumacinta

river between Frontera Corazal, a Ch'ol community in Chiapas, Mexico, and Bethel, Guatemala, two border settlements separated by the river and surrounded by the Lacandon jungle. Built with locally found materials, the construction can be seen as a combination of site-specific installation, and environment that is outwardly evocative of vernacular buildings and structures found throughout Latin America, as well as traces to native American constructions like the chinampas (the floating gardens of the Aztecs), and European notions of structuralist architecture.¹



Figure 1. *Guatemex*, Usumacinta River, 2006. Courtesy of Antonio O'Connel

¹ The project's website references *Guatemex* as a chinampa, but in effect, these gardens used for intensive agricultural purposes in the Aztec period in the valley of Mexico, were artificially raised beds, which surrounded by water, created the impression of floating



Figure 2. *Guatemex*, Usumacinta River, 2006. Courtesy of Antonio O'Connel

According to O'Connel, *Guatemex* was designed to be an extension of his ongoing practice that focuses on vernacular architecture in Mexico and Latin America in response to the narrative of “creativity” and “progress” driving Mexico City’s building boom of skyscrapers and museums by famous architects, or “starchitects,” as they have come to be called. Like his structures usually built within the privileged urban environment of Mexico City, O'Connel’s understands.

Guatemex as an architectural form both meant to prompt reflection about Mexican society’s stark social inequalities, and the role of architecture in their propagation.² Working with similar interests, Castillo creates and deploys inflatable structures, which he calls “museums,” in public spaces. Intended to be playfully interacted with by residents of marginalized areas in Mexico City, satellite, and remote towns that he has called “invisible cities,” these constructions are reminiscent of the inflatable playgrounds common in poorer neighborhoods like the one that he grew up in. Castillo’s humorous nomadic museums speak to his experiences growing up with limited access to cultural institutions, as they are typically built and located in more affluent and central parts of the city³ Similarly, Hayashi focuses on playful architectural

² Personal communication.

³ Julio Urizar, “Habitat Processor Esteticos Colectivos, Eder Castillo”, in *Gimnasia: Ejercicios Contemporaneos*, November 7, 2014, accessed August 1, 2016, <https://revistagimnasia.com/2014/11/07/habitat-procesos-esticos-colectivos-eder-castillo/>.

interventions in urban spaces, which include collaboratively-created playgrounds for street children in various cities internationally, such as Jakarta, Indonesia, and Rosario, Argentina. These projects constitute appropriations of abandoned and neglected spaces in cities and are developed after observing how children play in these sites, an approach that is reminiscent of the Structuralist architecture by Aldo van Eyck, the mentor and collaborator of the one-time Situationist Constant Nieuwenhuys. Indeed, van Eyck’s quote, cited above, frames the online documentation of Hayashi’s collaboration with Ruangrupa, a group of Jakarta-based artists, with whom he created a temporary playground in a derelict area of the city.

O'Connel’s, Hayashi’s, and Castillo’s architectural interventions share a critique of the monolithic forms of today’s famous international architects and the latter’s complicity as the handmaids of globalization based on a totalizing economization of culture. Their projects point jointly to the prominent role of architecture and architects in buttressing the ongoing economic exploitation of creativity as the world’s cities scramble to transition from a dying manufacturing economy to a culture-based economy (the so-called “Bilbao effect”).⁴ Under this guise, the spectacle of “art”, and in particular so called relational performances, and brand-name, globalized architecture lends itself as participant, and by extension effacer of the enormity of economic, social, and cultural inequalities and injustices integral to global capitalism. The choice of marginal spaces, and ephemeral and adaptive forms typical of O'Connel’s, Hayashi’s, and Castillo’s constructions works in contrast to the global architecture of starchitects. Their projects’ roots in vernacular building, at its core an architecture characterized by a focus on interstitial spaces, non-hierarchical construction, and participative planning, reflects their politicized vision of architecture itself. In their hands, architecture and designed public spaces are foremost conceived to connect, make visible, and amplifications of marginalized people, indeed, populations that are either dislocated by, excluded, or otherwise ignored by the starchitects of globalization. This focus is similarly reflected in their conception of *Guatemex* as a project that aims at both linking undocumented migrants and communities in the Southern border of Mexico, as

⁴ The Bilbao effect or Guggenheim effect refers in popular press to the culture-driven revitalization of post-industrial cities following on Bilbao, a decaying industrial city in Northern Spain, which

well as disrupting the “imagined geographies” of the border, which are currently shaping political discourse in Mexico and the United States along the lines of security and control.⁵ In this sense, emerged as a cultural hub of sorts by means of the city’s investment in the building of the Guggenheim Museum Bilbao by Frank Gehry in 1997.

Guatemex represents yet another articulation of the utopian vision of architecture as a medium to empower communities’ struggles for social change, all the more poignant for its location, on the outmost southern, rural, “invisible” border of Mexico.

Interstitial Futures

As one of twenty-one works selected for *Frontera: Un esbozo para la creación de una sociedad del futuro/ Frontier: A Sketch for The Creation of a Society for the Future, Guatemex* reflects the conception and goals set out by the organizers of the event, the collective curatorial group, Mexico City-based Laboratorio 060.⁶ Conceived as a relational event, *Frontera* was structured as a collaborative network of curators, Human Rights consultants from Mexico and South Africa, invited artists from Mexico, the United States, and other countries in Latin America and Europe, as well as Frontera Corazal’s residents, including a local artist and members of the town council. After a year of research, *Frontera* transformed Frontera Corazal into a “creative city” for its duration, as the actual exhibition used the town’s public spaces by way of a multitude of public and collaborative projects. Altogether *Frontera* was intended to highlight the lived condition of Mexico’s southern border, a space that in comparison to the northern border, is largely absent in discourses about immigration in Mexico and the United States. Though resembling relational aesthetics, the project stands in contrast to the uncritical tone of much of relational art, instead using this handle to tap into the current enthu-

siasm for this type of art on the part of institutions, and corresponding funding of it. Similarly, a long tradition of border art addresses the dynamics and realities of the northern border, but largely bypasses the southern border. Against this background, the projects of *Frontera, including Guatemex*, show that today, the Southern border is much like the country’s Northern border, both an area of dynamic cultural exchange and a heavily militarized zone.

Alongside the curation of artistic projects and the production of a film about the event, Laboratorio 060 (the curators) also published a catalogue that provides insight into the historical dynamics that shape the current militarization of the Southern border. Gisele Lisa Bonnici, one of the Human Rights consultants involved in the project, writes that the region’s present framing in the language of national security is historically rooted in the Mexican government’s response to various and distinctively different events, including Central American armed conflicts from the 1980s to mid-1990s, which eventually subsided with the collapse of Eastern bloc in Europe; the 1994 Zapatista uprising, which prompted a move toward a strategic isolation of the southern region and a restructuring of Mexico’s military into an internal counterinsurgency force; and international drug trafficking, as U.S. Intelligence reported on smuggling routes through the Caribbean and Southeastern Mexico. As Bonnici explains, together these histories contributed to the perception of the region in Mexico (and the United States) as sites of “vulnerability,” “threat,” and “risk to national security,” which ultimately set the stage for the current militarized approach to immigration in the Southern border.

This course of “securitization” is likely to continue and even intensify, since in the context of the so-called war on terror the area has been deemed a regional security zone under bilateral accords between Mexico and the United States (the “smart borders” agreement of 2003). Because this politicized climate further encourages and consolidates the perception of migrants as potential threats to national integrity, the Mexican government’s silence about its actions to control the flow of transit migration along its Southern border is even more disquieting. Human Rights organizations in Mexico have reported on the regular violation of migrants’ rights in the region, including

⁵ The notion of “imagined” or “imaginative geography” is Edward Said’s concept for the ideological impulses driving representations of particular spaces and places for purposes of control. Edward Said, “Imaginative Geography and Its Representations: Orientalizing the Oriental”, *Orientalism* (New York: Vintage, 1979).

⁶ Laboratorio 060 consists of the art historian Lourdes Morales, landscape architect Daniela Wolf, and artist Javier Toscano. *Frontier: A Sketch for The Creation of a Society for the Future* was awarded an international prize in 2008 (Best Art Practices, Bolzano Province, Italy).

detention of undocumented migrants without due process, their exposure to corrupt and unaccountable state officials, racial profiling, and the harassment of temporary migrant workers unable to obtain required documentation.⁷

As an extension of *Frontera*, *Guatemex* foregrounds the dynamics of a space in which cultural interstitiality rubs against the rigidity of control, thereby highlighting the unforeseen impact of the current international obsession with security on migrant and local populations. As its title indicates, the project playfully resonates with the ambiguous identity of Mexican-Guatemalan border residents (the name of the project melds the names of both countries), while also providing a practical response to their specific communication needs. Historically, the region's migration patterns follow a South-North trajectory, from Guatemala to Mexico. The community of Frontera Corozal has itself both a long history as a source of migration and as a point of transition for several groups. It has been a source of migrants to the North, a passageway, and a final destination to temporary migrant workers. As such, Frontera Corozal is a quintessential interstitial space. Much like its river's ebbs and flows, its population is in constant flux. In addition to more sedentary residents, many of whom make a living as transporters of tourists and visitors, the community's size and makeup reflects the nomadic patterns of temporary workers from Guatemala working in Mexico's coffee and sugar cane industries, as well as construction and domestic work; visitors from Bethel, for whom making a living necessitates frequent river crossing from Guatemala; refugees who settled in the town after the Central American wars; and most recently, migrants and refugees fleeing the escalating violence and poverty of their post-conflict societies who are on their way to the United States, including Central Americans, South Americans, Caribbean islanders, Africans and Asians.

Guatemex was in particular designed with this latest influx of migrants in mind. Inside the vessel, migrants crossing to Mexico on their journey to the Northern border, were able to access the internet and a custom designed Web page with addresses of hospitals and

consulates, advice on road access, details on regional flora, and information on human rights [figure 3]. Additionally, a chat service was created with the intent to connect transitory migrants with the residents of the town of Frontera Corozal. For this purpose, a local guide, Ezequiel Lopez Velasco, was hired and instructed in its management. For the two months of the project, Lopez acted as a facilitator, welcoming migrants, trading experiences and information about the area, as well as providing instruction on accessing the internet. Online chat was not only novel for many of the migrants at the time (2006), but also for the residents of Frontera Corozal, an indigenous town characteristic of many marginalized communities existing without adequate communication infrastructure.



Figure 3. *Guatemex*, Usumacinta River, 2006. Courtesy of Antonio O'Connell

The conception of *Guatemex* as a node of a vast global network (the internet) parallels and supports the interstitiality of Frontera Corozal's geography and community, in practice it also highlights the alienating effects of militarization. During an interview with the author, O'Connell recounted that the creation of the structure was a relatively congenial endeavor, with locals donating and helping procure materials (a trunk from a jungle tree was donated by a farmer and the rubber buoys holding up the structure belonged to the hired guide, Lopez). Yet, with the structure completed, the artists realized that migrants were reluctant to approach it. Not until the artists began providing magazines and other amenities on the vessel did people

⁷ Gisele Lisa Bonnici, "Cartography North of Corozal (-1, 1)", in *Frontera: Un esbozo para la creación de una sociedad del futuro/Frontera: A Sketch for The Creation of a Society for the Future*, eds. Laboratorio 060 (Berlin: Revolver Publishing, 2015), 257.

began to congregate. More disquietingly, during the first week, the group was approached by a Mara member, who left the vessel after meeting in private with the guide, Lopez (the Mara Salvatrucha, whose members are recognizable through extensive tattooing, is a feared youth gang with origins in Los Angeles and now operating throughout Central America).⁸

Taken together, O'Connel's observations drive home the vulnerability experienced by Frontera Corazal's residents and migrants alike in face of transnational networks of organized crime operating in the region (it is well-known that the Mara Salvatrucha is involved in human smuggling and drug trafficking, arms smuggling, kidnapping, and extortion). The incident with a Mara member in particular testifies to the impacts of a strategy of "securitization," which according to Bonnici, does not end violence and vulnerability, but simply displaces it, creating "a situation of vulnerability for someone else," in this case, the Frontera Corazal's sedentary community and its migrants. In all, *Guatemex* shows in practice how the labeling of non-Mexicans, (including transit migrants, local economic migrants, and others), becomes a threat under new policies of national security. These policies offer no recourse to establish options for regular entry and have created a situation in which migrants and refugees are completely vulnerable to the violence of both criminal elements and corrupt immigration officials.⁹

⁸ The Mara Salvatrucha's spread to Central American countries is due to the deportation of Mara members from the United States, where the group originated among U.S. born youth of Central American descent in Los Angeles. This policy created a feedback loop, as it displaced gang activity and led the group to recreate itself into a transnational network spanning the United States, Canada, and Central America. Many of the migrants, in particular children and adolescents, passing through Frontera Corazal are leaving Guatemala because of forcible recruitment by the group.

⁹ "Cartography North of Corozal (-1, 1)", 259, 265. As Bonnici points out, the focus on security as the goal of immigration policies leads to the "security dilemma," or spiral model, a term in international relations that refers to actions undertaken by a state, intended to heighten its security, such as increasing its military strength or making alliances, which leads other states to respond in kind, thus creating a feedback loop of tensions and conflicts even if no side desires them. To date, the focus on punitive methods has meant that Mexico has taken part in binational and regional securitization processes, including security training of Mexican officials by U.S. agencies. Legislative and policy changes, including an integral migration policy for the Southern border region, while promised, have yet to appear.

Pirate Utopias

In contrast to the rhetoric of public safety and national security, *Guatemex*'s, and *Frontera*'s relational approach suggests an alternative model that is based on engaging the community and migrants and building on their interdependence and shared histories of migration. In this sense, *Guatemex* reflects the proposal by *Frontera*'s curators to leverage creative exchange toward imagining a heterotopia, literally an "other" space, here invested in the creation of "a possible intercultural community... in a future yet to come."¹⁰ O'Connel's reflections on *Guatemex* resonate with this sentiment, as he describes the project as "an act of faith," a utopic gesture, which as he explained, is inspired by the (Modernist) belief in the possibilities of architecture as a tool of social change. Conceived as such, *Guatemex*'s ephemeral construction and inclusion of networked technology simultaneously reflect and adapt to Frontera Corazal's fluid geography and mobile populations.

In practice, migrants mostly used the vessel as a shelter, a refuge from the hot sun during the day, and at night, a safe place to sleep. Then in the second week, a young migrant woman from Guatemala who was separated from her brother in Frontera Corazal, came to the vessel looking for information about him. A web search yielded his picture in a Los Angeles's McDonalds, where he was depicted as the employee of the month. As word spread about this, and with the event coming to a close, residents asked the artists to make the structure permanent. The Suchiate River's everchanging flood patterns, lately exacerbated by global climate change, however, made the permanence of *Guatemex* impractical. In face of the devastation caused by a season of unprecedented strong hurricanes, its pieces were instead returned to their owners or scavenged by migrants to build their own shelters. *Guatemex* came thus full circle, from a construction inspired on the non-hierarchical principles of vernacular architecture, to a source of materials for the community. Similarly, the chat page along with the record of conversations is now an archive, part of the communal global memory, which is the World Wide Web.¹¹

Like *Frontera*, the curatorial event in which the project is encased, *Guatemex* points to the possibilities

¹⁰ Laboratorio 060, *Frontera: Un esbozo para la creación de una sociedad del futuro/Frontera: A Sketch for The Creation of a Society for the Future* (Berlin: Revolver Publishing, 2015).

¹¹ <http://www.pixelkraft.com.mx/guatemex/>.

that arise when people attempt to reimagine a space, in this case a border that is itself both imaginary and all too real. Among the many projects included in *Frontera, Guatemala*, most poignantly calls to mind Michel Foucault's image of heterotopia.

par excellence, the boat. Foucault's notion of heterotopia as an interstitial space, resonates with *Guatemala's* shape. It is a vessel located in the space of a frontier community, a moving border, a river, the virtual—in which, the rub of freedom and control is felt most viscerally, and daily.

Finally, *Guatemala's* conception as an intervention into the charged politics of the border, likewise resonates with Foucault's conception of heterotopia as a space fecund with the possibilities of resistance: "In civilizations without boats, dreams dry up, espionage takes the place of adventure, and the police takes the place of the pirates."¹² In this sense, *Frontera* and its projects, including *Guatemala*, leverage the desire on the part of the Mexican state to project a progressive image, a desire that is itself encased in a broader profiling of Mexico as a space of "creativity."¹³ In the last decade, this focus has seen an unprecedented funding of numerous art and creative projects in the country by state, private, and international patrons. Similarly sponsored by governmental and private institutions, *Frontera* situates itself in the interstitial spaces between art, and technology, politics, the institutional, and the commercial, to energize the hopes and dreams of individuals and groups, which, located on geographical margins, in rural areas, are neglected or otherwise outside of the scope of cultural representation and political discourse of the centers.

Thought, at time of writing, *Guatemala* is already an eleven years old project, its subject, and in particular, its focus on questioning the politics of architecture has taken renewed urgency in today's political context.

¹² Foucault cited in Laboratorio 060, *Frontera: Un esbozo para la creación de una sociedad del futuro/Fronter: A Sketch for The Creation of a Society for the Future*, 33

¹³ *Frontera* was funded by FONCA, CONACULTA, two governmental funding agencies, and Fundación Bancomer, and Fundación Jumex, two private foundations connected with banking and commerce, as well as by international funding sources, including the Prins Claus Foundation for Culture and Development in the Netherlands. This type of hybrid funding of the arts in Mexico is relatively new, as prior to the neo-liberal turn of the country in the 1990s, the Mexican arts were funded and controlled by the government in legacy of the Mexican revolution.

Since 2006, when the project was realized, the flows of refugees have swelled globally. Given the continuation of standing wars "on terror", it is likely that this situation will remain unchanged, or intensify in the future. Meanwhile, in face of this, political forces increasingly veer to side of isolationist policies. Thus, the building of a "bigger", "better" border wall on the northern border of the United States is front and center on the discourse of the recently elected U.S. president. Even if the funds for this wall have not yet been identified, nonetheless, the U.S.'s Department of Homeland Security recently opened the competition for proposals. On this background, both the presidents of the U.S. and Mexico harness the controversial project to further their respective political positions, through similar appeals on nationalist sentiment within their respective countries. To this end, it is worth to note that the scenarios sketched by the current U.S. president, are in the image of the fraught experiences with criminal elements preying on the residents, immigrants, and refugees of *Frontera Corozal*. In this light, the focus of *Guatemala*, on the southern border of Mexico, takes on an even more acute relevance, as its erasure from political discourse indicates the complicity of both governments in using immigration as a means of furthering control. By extension, the underlying question to architects, which underscores *Guatemala*, redoubles its creators' prescience: will your architecture endorse walls, or take to the interstices?

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Place-making With Telepresence: A Navigation Guide to *A Journey into Time Immemorial's* Seven Exhibition Spaces

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Abstract

A Journey into Time Immemorial is an interactive website that historically represents the everyday way of life of Stó:lō-Coast Salish peoples in a computer-generated naturalistic setting. This paper closely examines aspects of its seven exhibition spaces to investigate the relationship between the poetics of new media and contemporary curatorial practices in Indigenous culture. By doing so, it seeks to showcase an award-winning example of how an Indigenous community made use of digital technologies and online platforms to reclaim the right to curate, design, and display its own living history, to extend place-making into cyberspace, and to establish a direct relationship with the general public.

Keywords

Indigenous Media, Place-Making, Landscape and Living History, Cyber Museum, Digitization of Tangible and Intangible Heritage, Collaborative Museum Practices, Telepresence, Aura.

Introduction

In his canonical book, *Imagined Communities: Reflections on the Origin and Spread of Nationalism*, Anderson (1991) argues that censuses, maps, and museums are the elements of grammar that have been deployed by colonial states to construct and reinforce nationalist ideologies since the nineteenth century (p. 163). Anderson's thesis belongs to a media studies corpus known as the "paradigm of imagination", an approach that places the emphasis on recognizing:

...the importance of the cognitive instruments that allow us to conceive the society in which we live, to build images of this society. Such images are crucial to political action, historical projects, and the very experience of belonging. (Dayan, 2005, p. 172)

Anderson's argument in relation to institutional exhibitions closely echoes Malraux's (1967) suggestion that a museum is not only a real, physical place, but also an imaginary one, an environment in which visitors must interpretatively (re)construct the meaning of objects placed in collections (pp. 11-12).

It is in this sense that such spaces are said to have a rhetorical function, which Anderson (1991) claims are designed to appeal to the *museumizing imagination*—one's ability to fantasize that an exhibition transports them deep into the secrets of an exotic culture that might otherwise remain little-known and out-of-reach (p. 182).

However, as Said (1995) remarks, it is those who organize, disseminate, and claim ownership of a collection of artifacts and specialized knowledges that effectively have the power to shape and reify narrative "accounts" of a nation's past (pp. 165-166). This historical materialistic outlook highlights *the importance of having the means and space to take stock of, design, and exhibit one's own national archive*. In post-colonial societies, nowhere does this seem more overdue than in regards to the curation and display of Indigenous intangible and tangible heritage.

For decades now, digital technologies have offered new opportunities for self-expressions of identity: Accessible and powerful design-software, interactive affordances, and unprecedented exhibition platforms. This shift has opened up promising directions for the preservation and transmission of First Nations heritage and traditional knowledge.

Based on the story of Xá:ytem longhouse in the small town of Mission, in Western Canada, the interactive cyber museum, *A Journey into Time Immemorial*, provides a UNESCO award-winning example of how First Nations are using new media based curatorial approaches to represent their own history. Funded by the Department of Canadian Heritage through its Virtual Museum of Canada initiative, this website renders an artistic interpretation of the way of life of the Stó:lō Nation's Coast Salish peoples in the Fraser Valley located east of Vancouver, in British Columbia ("A Journey", welcome screen message, 2008-09).

This paper examines the exhibition spaces of *A Journey into Time Immemorial* to lay bare its

navigation architecture. By doing so, it seeks to show how Indigenous peoples are making use of digital technologies and online platforms to extend their place-making rituals into cyberspace through telepresence. This claim is supported by the fact that *A Journey into Time Immemorial* was imagined and designed by members of different Indigenous communities drawing from a body of knowledge primarily sourced from oral history interviews with Stó:lō-Coast Salish elders.

The first part of this paper examines the navigation architecture and spatio-temporal structures of this interactive cyber museum by showing screen captures and diagrams supported by textual descriptions. The second part follows with a discussion on how digital technologies make it possible for First Nations to autonomously engage in placemaking practices by allowing them to curate their own stories of the people and of the land, shaping them through design, and then sharing them on an open global platform.

Experiencing *A Journey into Time Immemorial*

Before reflecting on how telepresence can be used to support place-making in regards to Indigenous cultures and the representation of their intangible and tangible heritage, it is useful to explain the architecture and spatio-temporal logic of the cyber museum under study. This first section and its four subsections aim to provide a sense of what visitors see when they navigate through the seven exhibition spaces.

By recording observations made inside this interactive cyber museum, this paper proposes to introduce readers to some of its key design elements. Figures 1 to 7 are screen-shots captured while the author was navigating through the website to conduct her phenomenological investigation. Each figure is meant to give a quick snapshot impression of one of the seven exhibition spaces, selected because it is representative of the exhibition space it was taken in.

Navigating through the Seven Exhibition Spaces

The opening sequence of *A Journey into Time Immemorial* takes place in exhibition space #1 (**Beach**). It initially shows an exterior scene of a village as seen in Figure 1. For the first seven seconds, the following message is displayed in white font over a black box above the canoes:

Welcome to Xá:ytem, an ancient Aboriginal village

and sacred transformation site on the north bank of the Fraser River, near Mission, in British Columbia's Lower Mainland, east of Vancouver. Come with us to share and explore the life ways of the Stó:lō First Nations people hundreds of years ago. (“A Journey”, welcome screen message, 2008-09)

Moving the cursor sideways to either edge of the screen triggers a panning mechanism that slowly reveals the full circular, cycloramic canvas of the scene shown in Figure 1. The six other exhibition spaces in this cyber museum can be accessed by clicking a strategically located trigger point that appears only upon a rollover event: a white icon in the shape of a hand under a red label inciting the visitor to “JUMP TO” another exhibition space.



Figure 1. Screen capture taken in exhibition space #1 (**Beach**) of *A Journey into Time Immemorial* showing welcome screen when cyber museum is entered in “window” mode. Photography/artwork: Creative Studio, SFU. ©SFU Museum of Archaeology and Ethnology 2008-09



Figure 2. Screen capture taken in exhibition space #2 (**Longhouse-Front**) of *A Journey into Time Immemorial* in “full screen” mode. Photography/artwork: Creative Studio, SFU. ©SFU Museum of Archaeology and Ethnology 2008-09

For instance, when a visitor pans around exhibition space #1 (**Beach**) shown in Figure 1, and moves the cursor on or around the door of the Longhouse structure in its upper-left quadrant, the white hand icon appears

underneath a small red caption that reads “JUMP TO Longhouse-Front” (not shown in Figure 1). Clicking on this icon causes the image to quickly cross-dissolve into the closer, foreshortened image of the Longhouse shown in Figure 2. Moving the cursor in this exhibition space #2 (**Longhouse-Front**) triggers a panning motion, which reveals a distinctly different view of the landscape, as well as different characters and artifacts than the ones seen in exhibition space #1 (**Beach**).

A rollover on the door to the Longhouse makes the white hand icon appear, this time underneath a small red caption that reads “JUMP TO Longhouse-Center” as seen in Figure 2. Clicking on this white hand icon triggers a cross-dissolve that brings the visitor into exhibition space #3 (**Longhouse-Center**), located inside the Longhouse as seen in Figure 3. As was the case in exhibition space #2 (**Longhouse-Front**), here, the visitor has a choice to either backtrack or continue forward, except that in exhibition space #3 (**Longhouse-Center**), there are three different possibilities associated with moving forward. A first option is to click the white hand icon in front of the doorway in Figure 3 under the label that reads, “JUMP TO-Longhouse Cooking Area” to discover what is behind the bark panels.



Figure 3. Screen capture taken in exhibition space #3 (**Longhouse-Center**) of *A Journey into Time Immemorial* in “full screen” mode. Photography/artwork: Creative Studio, SFU. ©SFU Museum of Archaeology and Ethnology 2008-09



Figure 4. Screen capture taken in exhibition space #4 (**Longhouse-Cooking Area**) of *A Journey into Time Immemorial* in “full screen” mode. Photography/artwork: Creative Studio, SFU. ©SFU Museum of Archaeology and Ethnology 2008-09

Option one thus enables the visitor to enter inside exhibition space #4 (**Longhouse-Cooking Area**) shown in Figure 4. However, a second option would have been to continue panning inside exhibition space #3 until a similar partition would appear under the caption “JUMP TO Longhouse-Work Area”. Clicking on this second point of access affords the visitor a view of the next cyclorama, exhibition space #5 (**Longhouse-Work Area**), in which women use hand tools to make artifacts as seen in Figure 5.

The exhibition spaces shown in Figures 4 and 5 also have, at a certain angle of view, a narrow door marked with the caption “JUMP TO Longhouse-Center”, from which visitors can backtrack into the previous exhibition space, that is, back inside the Longhouse-Center. From there is a third option for moving forward, which is one of two points of exit from inside the Longhouse: when the cursor rolls over the back door, again the white icon of a hand appears underneath a small red caption that reads “JUMP TO Longhouse-Back”. Clicking on this trigger point activates a cross-dissolve that brings the visitor into the exterior landscape of exhibition space #6 (**Longhouse-Back**), where trees, bushes, and plants become the objects of discovery of this naturalistic setting as seen in Figure 6, which shows trees haloed as a result of cursor rollover.



Figure 5. Screen capture taken in exhibition space #5 (**Longhouse-Work Area**) of *A Journey into Time Immemorial* in “full screen” mode. Photography/artwork: Creative Studio, SFU. ©SFU Museum of Archaeology and Ethnology 2008-09



Figure 6. Screen capture taken in exhibition space #6 (**Longhouse-Back**) of *A Journey into Time Immemorial* in “full screen” mode. Photography/artwork: Creative Studio, SFU. ©SFU Museum of Archaeology and Ethnology 2008-09

Moving the cursor to survey the forest area depicted in Figure 6 makes another white hand icon appear, this time under the red label “JUMP TO Pithouse”, which can be clicked on to enter the last cyclorama of the cyber museum. Figure 7 is a snapshot of exhibition space #7 (**Pithouse**) taken while the cursor was rolling over objects in the Pithouse that glow with the same white halo effect. From the Pithouse, the visitor can either backtrack to explore any of the other cycloramas once again or else exit *A Journey into Time Immemorial*. The itinerary in this cyber museum simulates that of a visit in its institutional counterpart where one would physically enter different rooms one after another, but also be able to turn around and retreat back in any of them while still inside the building’s exhibition halls. Advantages of an interactive cyber museum include access at any time from any place that supports online connectivity, and the fact that visitors can discover Stó:lō-Coast Salish peoples’ living history in an immersive environment that

simulates everyday life.



Figure 7. Screen capture taken in exhibition space #7 (**Pithouse**) of *A Journey into Time Immemorial* in “full screen” mode. Photography/artwork: Creative Studio, SFU. ©SFU Museum of Archaeology and Ethnology 2008-09

Navigation Architecture

Crawford (2003) has shown how computer science diagrams can be adapted into structures that help researchers analyze and visualize the interactive character of any software application; he refers to these as “interactivity diagram” or “architectural diagrams of interaction”, which essentially look like flowcharts mapping out major information spaces as individuals nodes, and the relationship between them as one or two-sided arrows that indicate the links made possible by their connection (pp. 75-79).

By applying Crawford’s analytical tool to *A Journey into Time Immemorial*, one can produce a visualization of the interactive aspects of the *navigation architecture* -that is, all potential individuating pathways between the seven exhibition spaces. And indeed, Figure 8 schematizes at a glance the itineraries that visitors can take to navigate through the cyber museum, including all possible pathway permutations. In this diagram, the seven circles are each a “node” that represent an exhibition space, and while one-sided arrows indicate a pathway that allows visitors to move only in one direction, double-sided arrows show the reciprocal two-way connections that exist between certain nodes. Crawford (2003) uses the terms *branchpoint* to describe a node that offers more than one option forward or backward, and *storytree* for the overall structure (p.77).

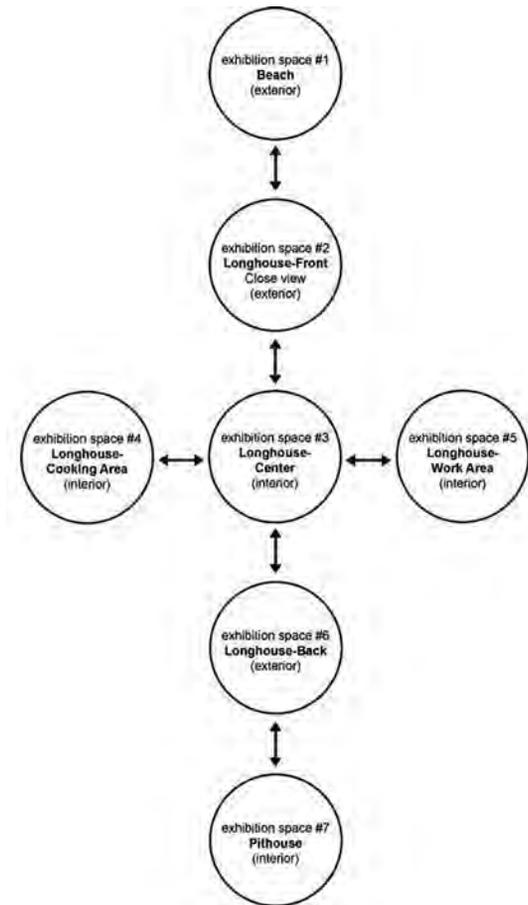


Figure 8. *A Journey into Time Immemorial*'s seven cycloramas presented as interactive nodes that connect in sequence. Image credit: Claude Fortin ©SFU Museum of Archaeology and Ethnology 2008-09.

As Figure 8 illustrates, the interactivity diagram for *A Journey into Time Immemorial* looks more like a cross, than like a tree. And indeed, the information architecture in this cyber museum is spatially organized more like the exhibition halls of an art gallery than an interactive story.

Figure 8 also suggests that the structure of the navigation architecture is almost linear, with the exception of a branchpoint node at exhibition space #3 (**Longhouse-Center**), from which the visitor can choose to proceed in four different directions: backward to the **Longhouse-Front**, forward to the **Longhouse-**

Cooking Area, forward to the **Longhouse-Work Area** or forward to the **Longhouse-Back**. This architecture highlights the fact that the Longhouse is the central, symbolic hearth of this village.

The diagram also shows how the architecture of this cyber museum includes three end nodes from which one must backtrack because they are dead-ends: exhibition space #4 (**Longhouse-Cooking Area**), exhibition space #5 (**Longhouse-Work Area**), and exhibition space #7 (**Pithouse**). As the entry point into *A Journey into Time Immemorial*, exhibition space #1 (**Beach**) is also an end node, but one from which visitors cannot backtrack. Just as the Longhouse situates the center of the village, these four end nodes circumscribe its limits: the imagined and symbolic periphery within which the axial hearth radiates.

Spatial Structure

Taking a different analytical approach, Figure 9 shows how the cyber museum, *A Journey into Time Immemorial*, comprises a total of seven cycloramic exhibition spaces interconnected in a structure that aims to present itself as a naturalistic succession of exterior and interior scenes. As shown in this topological view, four out of these seven sites of knowledge-exhibition space #1 (**Beach**), exhibition space #3 (**Longhouse-Center**), exhibition space #6 (**Longhouse-Back**), and exhibition space #7 (**Pithouse**)-are adjacent to one another: the **Beach** (an exterior) is contiguous to the **Longhouse-Center** (an interior), which is itself contiguous to the **Longhouse-Back** (an exterior), which is in turn contiguous to the **Pithouse** (an interior). In Figures 8 and 9, **Beach** is the first cyclorama of the cyber museum and the **Pithouse** marks the end of the linear succession formed by four alternating exteriors and interiors.

As seen in Figure 9, the two separate interior rooms in-side the Longhouse-exhibition space #4 (**Longhouse-Cooking Area**) and exhibition space #5 (**Longhouse-Work Area**)-are embedded within exhibition space #3 (**Longhouse-Center**). Indeed, the **Longhouse-Cooking Area** (an interior) and the **Longhouse-Work Area** (an interior), each provide distinct cycloramas of interior areas located *behind* the bark-covered partitions seen in the background in Figure 3's **Longhouse-Center** interior.

As for exhibition space #2 (**Longhouse-Front**), it is unique in its visual treatment in that it is the only cyclorama that simply offers a magnified view of a single visual element first displayed in another cyclorama-namely, the front of the Longhouse that appears much smaller in the

background of exhibition space #1 (**Beach**).

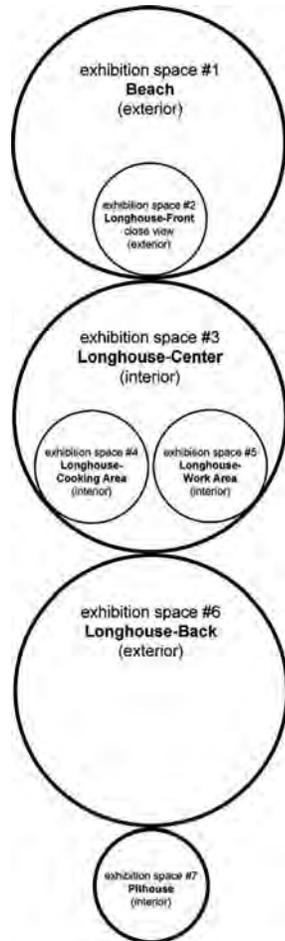


Figure 9. Topology of the seven exhibition spaces of *A Journey into Time Immemorial* showing the spatial relationship between cycloramas: how they adjoin with or are embedded into one another. Image credit: Claude Fortin ©SFU Museum of Archaeology and Ethnology 2008-09.

Here, it is noteworthy that exhibition space #2 (**Longhouse-Front**) shown in Figure 2 offers what seems like a foreshortened cycloramic reinterpretation of the exterior landscape around the Longhouse doorway in the upper-left quadrant of Figure 1's exhibition space #1 (**Beach**), *with modifications of its spatial and temporal parameters*.

In fact, except for the appearance of the Longhouse structure, it is difficult to match up the overlap. In the

Longhouse-Front cyclorama, many visual elements, such as the beach, have become barely visible, while others are foregrounded more expressively as is the case with the multiple drying racks on which are suspended a number of big fish. The presence of these fish as well as new animated characters moving around the drying racks suggests that the **Beach** and **Longhouse-Front** scenes are not meant to be synchronous—*they are taking place at different times*.

Temporal Structure

This design conceit supports the sense *that time passes* when one travels from the first exhibition space (the **Beach** in Figure 1) to the second one (the **Longhouse-Front** in Figure 2). Further, as Figures 8 and 9 suggest, *A Journey into Time Immemorial's* logic of navigation is characterized by linearity and continuity—two defining temporal attributes of history—which are made spatial *through the act of navigating* from one exhibition space to another.

Inside the exhibition spaces, each cyclorama has its own vignettes and live-action videos depicting Stó:lō-Coast Salish living history. And here, computer-generated design is used to suggest different experiences of time. At first, one has the sense that time unfolds chronologically when watching animated figures played by real actors perform everyday chores outdoors and indoors. But then, this sense of time is disrupted once the visitor notices that animated figures and objects are placed next to still ones. This contrast was intentional according to the production manager:

We began this project with a vision of presenting an experience of a living history, where the static objects in the SFU and Xá:ytem museums could be seen in use, as part of a living community...using actors and inserting them into landscapes allowed us to show cultural continuity and the strength of tradition. (Dr. Barbara Winter qtd in Meadahl, 2008, paras. 4 and 8)

Such a graphic design strategy also makes the visitor more aware that the cycloramic scenes are visibly made up of asynchronous elements that have different relationships to the passage of time. This, in turn, suggests that each exhibition space presents a simulation of living history, which offers a composite portrait of tangible and intangible heritage drawn from distinct time periods. Hence, while the experience of navigation drives the visitor forward through a narrative journey of discovery, the stylized use of digital compositing in the scenes can evoke different

clusters of bygone times long past (Manovich, 2001, pp. 245, 264).

This sense that many pasts are brought forth into the present is further emphasized by the long oral history interviews embedded in each exhibition space. These video clips can be made to appear and played at any time in a few clicks when a visitor chooses to forage deeper into the layers of information architecture. The live interviews refer to both past and present, but they also offer the possibility of carrying the traditions of “living history” into the future, thereby keeping it alive in the present and for posterity.

Finally, by navigating within *cycloramas that are circuitous*, exploring the exhibition spaces also works toward producing a sense of temporality in which time is experienced as repetitive, an effect reinforced by the sound loops playing naturalistic ambient noises and the animation loops showing actors performing the same movements over and over again. This design strategy further immerses the visitor into a reconstruction stretching all the way back in time to an immemorial past that has the circularity of myths.

Eliade (2005) has extensively written on how the ritualistic repetition of archetypal gestures “reveals an ontology uncontaminated by time and becoming” that traditional, premodern cultures deliberately practiced to reconnect with the cyclical structure of time that exists in nature (p. 89).

Like the perennial return, each year, of Spring-Summer-Fall-Winter, the repeated performance of a ritual evokes the circular movement of time that is manifest macrocosmically (the motion of the planets) and microcosmically (the perpetual regeneration of nature). While a linear understanding of time suggests historical changes and human evolution, a circular structure of time enacts a constant return to what has already happened and what will always be, that is, a call to what is immutable and eternal:

For the cosmos and man are regenerated ceaselessly and by all kinds of means, the past is destroyed, evils and sins are eliminated, etc. Differing in their formulas, all these instruments of regeneration tend toward the same end: to annul past time, to abolish history by a continuous return in illo tempore, by the repetition of the cosmogonic act [underlined emphasis added]. (p. 81)

In illo tempore --- a Latin expression that means “in that time”—refers to that undetermined time in the past that symbolically stands for the origin of

time. The hypnotic circularity of *A Journey into Time Immemorial's* seven exhibition spaces symbolically summons the Stó:lō-Coast Salish peoples' connection to these sacred origins, to the power of nature, and to the restoration of life through ritual. As well, while the Longhouse acts as a spatial representation of the hearth of this village, the cycloramas actualize its temporal hearth, wherein visitors can partake in the repetition of rituals calling forth the mythical “center of time”.

In a similar train of thought, the very essence of mythological thinking is present here in that a dialectical tension between nature and culture prevails throughout the exhibition spaces (Levi-Strauss, 1976, p.225). The simulated reconstruction of a Stó:lō-Coast Salish village seems to exist in a liminal zone which balances, on the one hand, naturalistic representations of indoor/outdoor spaces, and, on the other hand, cultural artifacts and living knowledge. The cyber museum is the place where they meet, and as such, is the site of transmutation of oral history into myth.

It is also a space used by designers as a live-action painting canvas to produce different impressions of time. The coexistence of such vastly different temporal structures in *A Journey into Time Immemorial* supports Anderson's (1991) argument that the “museumizing imagination” typically creates temporal boundaries where there were often none (pp. 178-179). In addition, it works towards creating a sense of place in an immersive naturalistic simulation that *proposes alternative understandings of sitedness*.

Place-making in the Cyber Museum

According to Basso (1996), the notion of *place-making* describes how people create symbolic and embodied associations to a physical site by remembering and then reimagining events that took place there in the past; this mental process aims to foreground understandings of what happened *here*, in *this* place (p. 5). Might it be possible for online environments to support place-making practices?

Place-making in Indigenous Traditions

This paper first reflects on this question by drawing on an ethnography based on fieldwork conducted among the Western Apache peoples, an American Indian tribe:

Even in societies where writing and other devices for “*preserving the past*” are absent or devalued, *historical knowledge is produced and reproduced...*

it is well to keep in mind that interpreting the past can be readily accomplished-and is every day-without recourse to documentary archives, photographic files, and early sound recordings. It cannot be accomplished, readily or otherwise, without recourse to places and the place-worlds they engender...a widespread form of imaginative activity, place-making is also a form of cultural activity [underlined emphasis added]. (Basso, 1996, p. 7)

While *A Journey into Time Immemorial* is a cyber museum that does include elements such as documentary archives, photographic files, video recordings, computer sound bites, animations, and digital graphic compositions, it is noteworthy that the design of these elements is mostly based on the testimony of elders that were interviewed for the project; in other words, the main method of knowledge transmission here is *oral history* (Fortin, Hennessy & Bizzocchi, 2019).

Yet, as Basso (1996) remarks, beyond the question of what method is used to preserve and transmit traditional knowledge, a historical world view needs a “place” to become a “place-world”; it cannot exist without a physical site. For this reason, it is most interesting to consider the issue of *sitedness* in *A Journey into Time Immemorial*, a living history exhibition project that lies at the intersection of museums, new media, and First Nations cultures.

A Journey into Time Immemorial represents a digital reconstruction of a Stó:lō-Coast Salish pithouse and long-house village that is only accessible to visitors online. Now, while it does include a rich array of media elements used as visual and aural evidence to represent a place-world sourced from oral history, *the sense of place is one that necessarily appeals to the imagination*, for visitors must enter and navigate this cyber museum *from physically remote locations*. In fact, it would be difficult to determine what the exact location of the cyber museum is. Is it where the hard drives are stored? Is it at the service point where the server processes the program? Is it located at the end node (host) from where it runs? Or at the end node where it the visitor accesses it? Or is it in the visitor’s imagination?

Telepresence and Museums without Walls

Such is the conundrum posed by the manifestations of electronic *telepresence*, which go as far back as the early nineteenth century with the invention of the telegraph (Sconce, 2004, p. 51). Significantly, telepresence

has been developed to appeal mainly to two sensory modalities: vision and hearing (technologies such as the telegraph or vibrating devices are rare examples of its haptic expressions). In *A Journey into Time Immemorial*, presence is largely invoked by structuring the gaze: images, as spatial phenomena, render this place-world a conceivable site.

This is not without implications since the generation of images is also what prefigures the act of imagining, a mental process contingent on visual impressions (Enns, 2004, p. 13). And this, indeed, is the crux of both Anderson’s (1991) and Malraux’s (1967) canonical theses about museums: the museum is a site that claims a space in the visitor’s imagination. This process is in turn strongly supported by the museum practice referred to as *musealisation*:

From a strictly museological point of view, musealisation is the operation of trying to extract, physically or conceptually, something from its natural or cultural environment and giving it a museal status, transforming it into a musealium or ‘museum object’, that is to say, bringing it into the museal field. (Desvallés & Mairesse, 2009, p. 50)

Differently put, the process of musealisation transforms artifacts by separating them from their original contexts, by providing them with a new status as works of art, by changing their functions within the museum, and by thus exposing them to other interpretations. This opens up the possibility of rewriting the symbolic significations of artifacts and the contexts they are exhibited in. By extension, it also implies that the exhibition context can be, as Malraux (1967) so famously called it: “a museum without walls” (*le musée imaginaire*), which uses technologies of reproduction to replicate and disseminate *en masse*, in print or digital media, ubiquitous representations of artifacts and the new *tableaux* they are embedded in for public display.

This strategy has indeed always been part and parcel of the musealisation process: artifacts are first taken out of their original settings and then recontextualized in a new physical setting. Concomitantly, images of these artifacts appear in catalogues, newspaper articles, collectible prints or postcards, and now also on digital screens. (Anderson, 1991, pp. 182-183). The infinite capacity of digital technologies to disseminate culture widely and rapidly is perhaps one of the reasons why they have been so amenable to contemporary museum practices. But how do they support place-making in *A Journey into Time Immemorial*?

Place-making in a Global Museum

Whereas in a physical, institutional museum or in a historical longhouse village, visitors would have to physically enter different rooms to see the full exhibition, this cyber museum removes the constraints of physical distance and opening hours: exhibition spaces, available at any time, can come to the visitors on demand. Some authors purport that such instantiations of “global” cyber museums give visitors more freedom to experience and interpret exhibitions:

With hypermedia, telematics and the interactivity, all traditional limitations must fall, making possible museums without walls, curators outside museums, museum action and museum objects in situ and in use. The museum should be the way of appreciating the environment not only in its time-space but also its spiritual dimension...the total museum is thus created in cyber-space and in its counterpart of the human mind. (Šola 2010, pp. 425-426)

This is not the only way in which *A Journey into Time Immemorial* overcomes the limitations of physical space. As Figure 9 shows, the cyber museum also supports the link-age of indoor and outdoor settings that might otherwise be problematic or costly in art galleries. This, in turn, makes it possible to contextualize the artifacts in what computer-generated design makes it appear to be their “natural historic setting”, an important motivation in the curating process according to the production manager of this project (B. Winter, personal communication, 16 November 2011).

This design draws on a walkthrough historical reconstruction, except that instead of being physically present in an authentic site at a specific moment, the experience takes place online by way of jump cuts through a succession of 360-degree computer-generated cycloramas. As a result, here, navigation operates as a process of discovery of the Stó:lō-Coast Salish peoples’ everyday way of life, including hunting-gathering work and the preparation of food.

True, some of the combined aura of the physical objects and spatial environment has been lost, but much has been maintained. And more importantly, as Benjamin (2010) proposed, the loss of the direct aura of physical artifacts can be compensated by an increase in accessibility (p. 14).

Another significant advantage in using a digital toolbox and online environment to recreate Indigenous living history is that First Nations can thus maintain

control over the representation of their heritage. Museal institutions and artifacts are not merely means to disseminate culture, they are also active discursive agents that control, legitimate, and reify historical narratives. In projects such as these, digital technology allowed Indigenous peoples to reclaim those narratives: the team who controlled the development of content, and of its design, was of First Nations ancestry.

This is significant for, as Basso (1996) reminds us, while place-making requires a site to project stories, it is in effect “a way of constructing history itself, of inventing it, of fashioning novel versions of ‘what happened here?’” (p. 6).

In Support of Collaborative Museum Practices

The making of *A Journey into Time Immemorial* provides an inspiring example of how agency might play itself out when First Nations peoples use digital technology to independently and collaboratively design their own exhibit, as explained in this interview with the production manager:

The project was designed as a collaboration between the Director and staff of the Fraser Valley’s Xá:ytem Longhouse Interpretive Centre in Mission and the Simon Fraser University Museum of Archaeology & Ethnology in Burnaby, two municipalities located in British Columbia, Canada. It developed over time, out of conversations between myself, as Curator of the SFU Museum, [Dr. Barbara Winter, the production manager of A Journey into Time Immemorial] and Dr. Linnea Battell, the Director of the Xá:ytem Longhouse.

Content was written and designed by a team comprised of Stó:lō and other First Nations researchers and SFU students and alumni, many of whom have First Nations ancestry. The visual design of the project was created by the Media Design team, which was made up of Xá:ytem staff and SFU graphic artists and videographers. The process was collaborative, with the SFU members of the team providing the programming expertise, and the Xá:ytem members setting criteria for look and feel. The site was vetted by Dr. Battell at several stages during construction.

In terms of the information architecture, the information categories and content were defined by the Xá:ytem staff, with writing done by First Nations SFU students. The written text was edited, vetted, and approved by both Dr. Battell and project research staff.

Xá:ytem organized interviewees with the elders and did the interviewing, creating the video content. The relationships between the data sets and the pathway links through the site were defined by Dr. Battell and carried out by the programming staff. (B. Winter, personal communication, 16 November 2011)

Conclusion

To conclude, the project writ large demonstrates that the rollout of new media technologies of representation can be effectively applied to support tangible and intangible heritage exhibitions that prioritize and enable self-expressions of identity. Easy access to digital tools and to what Castells (2010) has called the “space of flows” (i.e. information networks) allowed First Nations partners to create a direct relationship between the general public and themselves, and thus become their own “cultural connectors” (p. 434), leaving behind older models of museum practices and experiences catering only to the voice of the elite. This essay has analyzed aspects of the online exhibition, *A Journey into Time Immemorial*, to explore the ways in which emerging technologies might offer new ontological paradigms that support place-making in the Digital Age. The analysis is based on the assumption that online environments are distinct settings that offer alternative ways of curating exhibitions and presenting collections of cultural artifacts. As this paper demonstrated, this cyber museum also accommodated the sharing of traditional knowledge: it is exciting to think that new possibilities still lie ahead.

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Emergence of (Experimental) Computer Art in Brazil: Pioneers and Events

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Abstract

This article introduces the emergence of (Experimental) Computer Art in Brazil, nominating pioneer artists and events, its historic contextualization and some of its developments. This art form, immanently connected to computers, emphasizes sensory, poetic and aesthetic experiences intermediated by computational/electronic devices with the capability to process and answer requests, being also the artworks support/media. It is an art focused on the trilogy: artists, computers and public. Taking as reference the Art Institute at the University of Brasilia, Brazil, which promoted Computer Art courses and exhibitions, since 1987, we here describe and illustrate different exhibition spaces for innovative artworks. These experiments originated a series of meetings and exhibitions culminating at the $\geq 4D$ (Either greater or equal to 4D) exhibition in 2004, giving birth to the EmMeio exhibitions that followed until today.

Keywords

Computer Art, $\geq 4D$ (Either Greater or Equal to 4D), Experimental Art, University of Brasilia (Brazil)

Introduction: Historical Contextualization

In Brazil, around the year 1987, a small group of artists and scientists named Infoesthetica Group began to explore an art form that was emerging at the time, in which sensory, poetic and aesthetic experiences would be intermediated by computers. This group was formed by Aloisio Arcela, Bia Medeiros, Homero Picollo (software creator), Paulo Fogaça, Suzete Venturelli and Tania Fraga (Figure 01). These computers act as devices with the capability to respond to procedures, such as processing and answering interactors requests, and, at the same time, being the art-works support/media. Such procedures characterized the artworks proposed at this time in very specific ways, and required from the artists programming knowledge to break the codes (Diamond, 2008). Their main goal was not the development and research on computer science algorithms but to acquire this type of knowledge in order to create meaningful

sensory, poetic and aesthetic environments with it. Such art was referred to, at that time, as Numeric Computer Art or Cybernetic Art.

The Brazilian group did not come up with those terms or definitions. It was already in use promoted by artists such as Bernard Caillaud (France), Waldemar Cordeiro (Brazil), Yoshiro Kawaguchi (Japan) Paul Brown (UK), Hebert Franke (Germany), Nicholas Schoeffer (Hungary), John Whitney (USA), Lilian Schwartz (USA), Frieder Nake (Germany), to quote just a few. Theoreticians such as Arlindo Machado (Brazil), Lúcia Santaella (Brazil), Vilém Flusser (Czechoslovakia-Brazil), Philippe Queau (France), Edmond Couchot (France), Roy Ascott (UK), among others, also had already written about this emergent art form.



Figure 1 Images by Aloisio Arcela, Bia Medeiros, Paulo Fogaça, Suzete Venturelli and Tania Fraga

It is also important to point to, that Brazilian computer artists have suffered strong influence of the Brazilian theoreticians quoted above – mainly the art critique and curator Arlindo Machado, the semiotician Lúcia Santaella, and the Czecho-Brazilian media philosopher Vilém Flusser—who have been instigating artists about the experimental potential of computer technologies. Flusser lived in Sao Paulo for 30 years. His articles inquired about the role of artists and philosophers in post industrial age in contemporary society pointing to the possibilities for technical objects (he used the expression technical images) to become “carriers of meaning” and the transformation of “people into designers of meaning in a particular process” (Flusser, 2002).

In this paper we assume the term **Computer Art** to determine the specific artistic production in discussion. We consider such art as immanently connected to computers. It is also important to state that “experimental art has had a

The pioneer artist Waldemar Cordeiro began to use computers in visual arts in Brazil by the end of the 60’s (Cordeiro, 1986b). He was part of the Ruptura and the Concrete Art Poetry Groups in Sao Paulo (Cordeiro, 2016). In 1971, he showed his computer artworks at the exhibition *Arteônica* (Cordeiro, 1986c) and presented a manifest with the same name influencing many Brazilian artists since then. He said on that occasion that “in Brazil Computer Art found methodological background in Concrete Art” (Cordeiro, 1986a). In 1972, he created the *Arteônica Center* at the Art Institute of the University of Campinas, UNICAMP, which has had a pioneer role for the development of algorithmic art research for image generation in Brazil (Amaral, Pignatari and Restany, 1986).

In 1994, after much struggle, these ideas begun to be more generally accepted by the Brazilian art community and the first Brazilian art graduation program, focusing these issues, was created at the Art Institute of the University of Brasilia, in Brasilia. Other artists such as Gilberto Prado, André Parente, Milton Sogabe and Diana Domingues also accepted the challenge and a few years later were also coordinating Computer Art projects at Sao Paulo, Rio de Janeiro and Rio Grande do Sul.

In 1995 Domingues curated the exhibition *Art of XXI Century* at the Museum of Contemporary Art of the University of Sao Paulo and, in 1999, a Mercosul Biennial section, in Rio Grande do Sul. In 1996, Fraga organized the first online Internet exhibition for the International Visual Semiotics Congress held at Sao Paulo Catholic

University, PUC-SP. In 1997 Bousso curated the exhibition *Mediações* at Itau Cultural Institute aiming to “take out art from its conceptual towers and from the ascetic modern domain in order to allow it to dialogue with the public” (Bousso, 1997). Latter on, as director of the Museum of Image and Sound she created the first Brazilian media lab and instituted, for the first time in Brazil, an artist-in-Residence program for young artists.

Since 1997, the Brazilian Itau Cultural Institute has had a leading role in the field of art and technology. It has been showing and awarding artists and has promoted very important international art and technology biennial strong role in Brazil maybe because the art market did not offer significant possibilities for artists that did not follow the current paradigms. Some of these experimental artists were so radical that they were, during their life, strongly reject by the mainstream Western art. For example, the today incensed artist Lygia Clark was almost expunged from Sorbonne, in France, in the 70’s, because she dared to experiment with visceral body sensations and feelings using ordinary materials such as onions skins, pebbles, plastic bags, among others, having the participants bodies as supports for her work” (Fraga, 2012a).

exhibitions named *Artificial Emotion*. Many artists quoted in this article have won awards and commissions from this institute.

A second generation of artists, working with art and technology, was rising around the years 1996-2008: Anna Barros (in memorial), Carlos Praude, Cleomar Rocha, Carlota Brito, Daniela Kutschat, Douglas de Paula, Dulcimira Capissani (in memorial), Edgar Franco, Eufrasio Prates, Flávia Amadeu, Francisco Marinho, Guto Nóbrega, Gisele Beilgman, Ivani Santana, Kátia Maciel, Lucas Bambozzi, Lúcia Leão, Luisa Paraguai, Luiz Duva, Lygia Saboia (in memorial), Marcos Bastos, Maria Luiza (Malu) Fragoso, Martha Gabriel, Milton Sogabe, Raquel Kogan, Raquel Zuanon, Rejane Cantoni, Rosangela Leote, Sandro Canavezzi, Sílvia Laurentis, Simone Michelin, Valseli Sampaio, Wilton Azevedo, among many others. Many of them are not code breakers (Diamond, 2008). They explore computer systems hiring programmers to set up their concepts in Computer Art.

Theoreticians Priscila Arantes and Monica Tavares, Art Historian Nara Cristina Santos, curators Francielle Filipini, Wagner Barja, Paula Perissinoto, dance curator Maira Spangero, following Machado, Bousso and

Santaella leadership, have begun to investigate this specific type of art. Consequently, at the University of Brasilia, what used to be a small biannual meeting was transformed in an annual International Congress always held with a Computer Art exhibition (Fraga, 2012).

2004: A Turning Point

In 2004, during one of the annual congresses quoted above, the exhibition $\geq 4D$ (*Greater or Equal to 4D*) was held at Bank of Brazil's Cultural Center in Brasilia. For that occasion Tania Fraga and Wagner Barja curated the show and Fraga introduced the concept of metainstallation. The focus of almost of all works was interactivity. The idea was to create space-time dialogues among these artworks, and not a set of separated independent installations. The meta-installation project for $\geq 4D$ not only gave an organic coherence to the exhibition's space but integrated the art pieces exploring their poetic proposal. The architecture of the $\geq 4D$ exhibition was conceived mirroring virtual reality technology navigation's models. "The meta-installation consisted of works by artists and researchers working mostly with this type of art. These works breach the architectural space-time structure, creating tunnels of events that allow the public to dive into their content; they ensure the non-linear nature of the routes through the meta-installation, reconfiguring the architectural space of the galleries, redirecting the gaze and the modes of perception of those moving through it. Lightness and fluidity create conditions for apprehending ineffable, imponderable and transitory feelings prompted by time fluctuations in the various works" (Barja and Fraga, 2004).

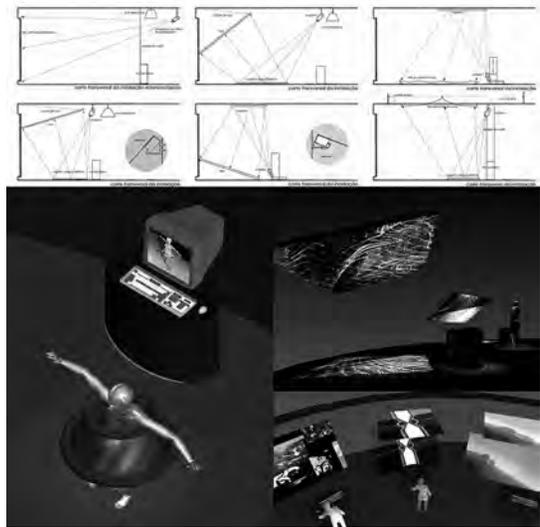


Figure 2 Exhibition $\geq 4D$, Simulation of exhibition and the schematic distribution of six different artworks

Therefore, the structural organization of the exhibition environment was designed to stretch the concept of installation, generally used for contemporary works of art, where each artist produces and organizes his or her micro space individually. This organization aimed to unveil the significant aspects that were being transcodified into sensations, which could be felt and shared. "In general, the works on display cluster images, sounds, tactile sensations and movements, as the outcome of collaborative processes among the artist, the public, the machines and the many minds whose intelligence is embedded in them", Figure 02. Human and artificial intelligence were united to create within the exhibition spaces a symbiotic communion among interactors' mind, the artists and the machines that run the software. The exhibition was held in two galleries.

The "tunnels of events in the upper gallery wander through fields of possibilities contained within the synthesis of images, sounds, abstract concepts, tactile sensations and possible isomorphisms among these categories. The works use computer languages to turn numerical codes into feelings and sensations. The lower gallery offers a hybrid field where images of synthesis and material culture blend, breaking through the barriers of what is normally called the real" (Barja and Fraga, 2004).

The setting of virtual objects and the 'existence' of virtual worlds emerge from the sense impressions they produce as subjective sensations since the perceptions result from illusions. These subjective sensations are nothing more than mental connections. Maybe these connections are the bond that entwines mathematics and art. The sense experience the interactor experiments and its subjective sensations are facts leaving one generally in awe. The comprehension of this emerging sensory order, as the result of numeric relations and functions, is a mystery we may never understand.



Figure 3 Exhibition $\geq 4D$ different artworks

The artists at this exhibition were: Bia Medeiros, Chico Marinho, Daniela Kutschat and Rejane Cantoni, Diana Domingues, Gilberto Prado, Luisa Paraguai (who created *Vestis* the first wearable computer created in Brazil), Lygia Sabóia (in memorial), Margarita Schultz (curator presenting the work of a collaborative Latin America art group, The Colaborarte Group), Maria Luiza (Malu) Fragoso, Silvio Zamboni, Suzete Venturelli and Tania Fraga. These artists stand out for their excitingly innovative and original proposals, mainly in terms of exploring the potential of computer languages, extracting and deploying new poetics from them. By showcasing this type of production this exhibition showed appreciation for the pioneers who faced unimaginable difficulties in developing their output, placing Brazil and Brasilia in a leading position

within the international stage. In Figures 03 and 04, a sequence of images of the $\geq 4D$ artworks.

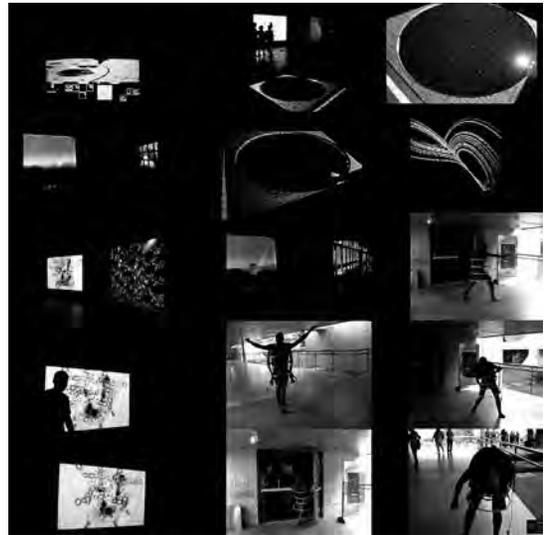


Figure 4 Exhibition $\geq 4D$ different artworks

Obviously, the skill resulting from manipulating computer languages transcoded into feelings and sensations is still very limited (Picard, 2000). Brazil may play a leading role in this field due to the rapidity with which Brazilian society has been absorbing the changes prompted by the development of computer technologies. Brazilian artists have been challenged by theoreticians to develop new identities for a society which desires development and access to technologies and the benefits they bring to contemporary life. Computer Art may become one of the answers for these quests.

Conclusion

As it was said before, the University of Brasilia was a pioneer in developing research projects in Computer Art. Its Master of Arts degree was one of the first art courses in Brazil to discuss and focus on these issues and an undergraduate bachelor degree in Computer Art is in discussion. This type of research answers to the commitment that guided the establishment of Brasilia as a hub of contemporary values, appreciating the blend of Brazilian culture with the arts, while fostering an integrated development. Summing up, we mention the paper under the title '21st Century Brazilian Computer

(Experimental) Art' that gives sequence to this historical review from 2004 until the present days referring to the *EmMeio* exhibitions (Figure 05) held at the National Museum of the Republic, promoted by the University of Brasília

Acknowledgments

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Figure 5 Exhibitions EmMeio and EmMeio#2

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Tania Fraga is a Brazilian architect and artist with a PhD. in Communication and Semiotics at the Catholic University of Sao Paulo. She is vice-president of the

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Maria Luiza P. G. Fragoso, multimedia artist with PHD In Arts and Multimedia by the University of Campinas (UNICAMP) In São Paulo (2003) and develops research on artistic experimentation in telematic environments focused on trans disciplinary aspects between art, science, technology and traditional cultures. Currently professor at the Visual Communication Design Department at the Federal University of Rio de Janeiro, thesis supervisor since 2005. Elected member of the National Association of Researcher in Fine Arts's directory for the period 2010-2012. Coordinator of the research group REDE-Art and Technology, trans cultural nets in multimedia and telematics, and coordinator of NANO Lab – Nucleus of Art and New Organisms.

Warfare Outcome as a Ground for Destruction of Heritage and Real Estate Development

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Abstract

There is a major construction program, being undertaken in the past decade, named “urban transformation” by the ruling government. As the transformation moved forward, it turned out this building activity was intended for profit and not for better urban environments. The construction was also a social engineering construct, causing people lose their native homes during the demolition process (dispossession) to make ground for new costlier housing to be bought by the rich.

While this is one dimension of the story; the more severe dimension is the fact that there is an unending clash in between the Turkish Military and the Kurdish PKK in the past 40 years. Combat previously took place in the mountains; this last confrontation was unfortunately conducted within the city, leaving civilians in extreme danger. The destructive battle fought with heavy weapons including tanks, cannons led to rigorous destruction in the solely residential areas. The area, where residential urban habitat and historical heritage were significantly damaged after the clashes, is at the moment sealed off and clearance of post-war debris has started. The demolition, regularly carried out by heavy construction equipment, was indirectly accomplished through war. The locals will be displaced towards the outskirts of the city where they can only afford a much cheaper flat in an inhumane gigantic high-rise compound.

Keywords

War, Conflict, Restoration, Preservation, Conservation, Destruction, Gentrification, Urban planning, Transformation, construction, Dis-Possession, Dislocation, Forced Removal, Heritage.

Introduction

There is a major construction program, being undertaken in the past decade, named “urban transformation” by the ruling government. As the transformation moved forward, it turned out this building activity was intended for profit and not for better urban environments. The construction was also a social engineering construct, causing people lose their native homes during the demolition process (dispossession) to make ground for new costlier housing to be bought by the rich. People

who have left (or have been forced to leave) suffer from cultural deconstruction, intense feelings of longing for home due to compulsory exile.

“The AKP government seems to view construction as a tool that can spur broader economic growth. Much has been written about president Recep Tayyip Erdogan’s \$100 billion worth of megaprojects for Istanbul, the bid -free contracts of government-friendly developers, and the \$400bn government plan to restore or rebuild a third of Turkey’s housing – some 6.5 million homes.” (Lepeska, 2016)

While this is one dimension of the story; the more severe dimension is the fact that there is an unending clash in between the Turkish Military and the militants of the Kurdish PKK in the past 40 years, that caused the death of tens of thousands of people. Though there were sporadic short temporary ceasefires, the war has recently started again, following Turkish general election, 7th of June 2015, when The Justice and Development Party (AKP), which had governed Turkey since 2002, lost its parliamentary majority. Combat previously took place in the mountains; this last confrontation was unfortunately conducted within the city of Diyarbakir, leaving civilians in extreme danger. “Including Diyarbakir Sur district (registered as buffer area), Governor’s Office declared curfew in this zone for 6 times in 6 neighborhoods; the last one still continues as of today. During the curfew process, due to armed clashes and the use of heavy weaponry in the above- mentioned neighborhoods, we diagnosed serious level of devastation in genuine urban texture of Sur district and in registered historical buildings located in the urban archaeological site. Armed clashes which emerged after curfews and blockades have caused serious damages in Surici Urban Archaeological Site in all respects. Besides the damage on architecturally valuable structures, it has also caused rupture of social and authentic life cycle in this district. Curfews causing forced migration of people living

in the area also resulted in disruption of handicraft production and related commercial activities, which is a tradition that has survived for thousands of years. Collective memory of Sur formed within thousands of years will face a rupture due to changes in property ownership and demographic structure if expropriation decision taken after the end of armed conflicts will be implemented.” (Diyarbakir Metropolitan Municipality, 2016, pp. 4-6)

The destructive battle fought with heavy weapons including tanks, cannons and that seems to be paused at the moment, led to rigorous destruction in the solely residential areas. Tens or hundreds (according to some unofficial local sources) of innocent civilians died, in addition to numerous fighters from each side. The area, where residential urban habitat and historical heritage were significantly damaged after the clashes, is at the moment sealed off and clearance of post-war debris has almost finished. The demolition, regularly carried out by heavy construction equipment in other cities like Istanbul, was indirectly accomplished through war machines.

Historical Significance of the Sur District of Diyarbakir

Diyarbakir has quite a substantial past and is the biggest city in the southeast of Turkey, where the majority of Kurdish population lives. According to United Nations Educational, Scientific and Cultural Organization World Heritage Committee, “The Diyarbakir Fortress and Hevsel Gardens Cultural Landscape is located on an escarpment in the Upper Tigris River Basin. The fortified city with its associated landscape has been an important center and regional capital during the Hellenistic, Roman, Sassanid and Byzantine periods, through the Islamic and Ottoman periods to the present.” (United Nations, 2015)

Diyarbakir Metropolitan Municipality’s ‘Cultural Heritage Damage Assessment Report on Sur, Diyarbakir: Aftermath of the Armed Conflict’ states that “Since its geopolitical significance, the city that has been considered by various civilizations and states as a regional capital as it is evident in the history of Persian, Roman, Sassanid, Byzantine and Islamic empires. Thus, the city is a world heritage with its multi-lingual, multi-cultural and multi-layered characteristics. Within the archaeological site, genuine examples of civilian architecture, mosques, churches as well as inns,

hammams (public baths) can be seen all together as cultural assets of Sur. In total, there are 595 registered historical buildings of which 147 can be categorized as memorial and 448 civil architecture examples. Surici district as a whole, including Ickale was registered as “Di-yarbakir Urban Archeological Site” in 1988.” (Diyarbakir Metropolitan Municipality, 2016, p. 2)

On Preservation of Cultural Heritage during the Times of Conflict

Different cultures, nations, folks have diverse opinions on what cultural heritage is, as they have different traditions, habits, likes, preferences, walk of life. This diversification can be further experienced within a single nation, where various folks forming a society have distinctive ethnic, religious, folkloric backgrounds. Regardless of this fact, “All disasters, whether they are natural disasters like floods, earthquake and volcanic explosion, or man-made disasters like war, armed conflict, terrorist acts and arson, threaten the existence of cultural heritage and people living in the vicinity, and at the same time cause irreplaceable physical and economic loss, and lead to loss of cultural and social memory that coexists with the cultural heritage. The stream of history has not changed in man-made disasters

like war, terrorist acts, and armed conflict during the same period. Selective destruction; conscious targeting and destruction of cultural heritage, as opposed to the general destruction in natural heritage, have continued at full speed. Demolition of Mostar Bridge (Stari Most - English: Old Bridge) in 1993 during the Bosnian War, and demolition of Bamiyan Valley Buddha Statues in Afghanistan in 2001, were only some of the great losses that cultural heritage suffered during the last 25 years.

Number of examples of the damage that man-made disasters cause for the cultural heritage increasingly continues in 21st century as well. Looting of Iraq National Museum in Bagdad during invasion of the USA of Northern Iraq in 2003, civil unrest that absorbed many countries in the Middle East which is named as the ‘Arab Spring’, which caused destruction of many heritage, including Museum of Cairo, were the uppermost examples. Even as these words are written, many historic structures in Syria are continued to be damaged. Africa has become the setting of one of the bitterest examples of selective destruction directed to cultural heritage. In Mali-Timbuktu, World Heritage buildings (1988) Sidi Mahmoud, Sidi Moctar and Alpha

Moya Mausoleums have been completely destroyed under attacks during June and July 2012.” (Ünal, 2012, p. 1)

While the above instances of cultural heritage refer only to physical buildings and/or objects, “the term ‘cultural heritage’ has changed its content considerably in recent decades. 2003 UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage developed normative instruments. According to that cultural heritage does not end at monuments and collections of objects, it also includes traditions or living expressions inherited from our ancestors and passed on to our descendants, such as oral traditions, performing arts, social practices, rituals, festive events, knowledge and practices concerning nature and the universe of the knowledge and skill crafts so called intangible heritage.” (Ünal and Vatan, 2016, p. 1)

Be it tangible (monuments, museums, libraries, archives, buildings, landmarks, objects, relics, artifacts, remains, ruins, etc.) or intangible (creativity, rituals, habits, knowledge, culture, experience, tradition, manners, propriety, decency, ethics, politesse etc.); heritage needs to be protected. There are instances when the loss happens suddenly and drastically. “When armed conflict is not international, but breaks out within the territory of one of the signatories to the treaty, every party involved in the conflict is bound to adhere at least to those articles of The Hague Convention which refer to the respect of cultural heritage. Putting planned measures for the protection of cultural heritage into effect was hindered by the specific circumstances of an undeclared and sudden war.” (Layton, Stone and Thomas, p. 159) The devastation of sites and land-marks of ethnic, traditional, intellectual, historical and spiritual significance is a warfare maneuver that has a long past. Despite the fact most of these detrimental incidents have been declared as unintended or as collateral damage in assaults to other neighboring positions, there are cases of premeditated strikes on heritage.

If some of the heritage cannot be preserved, conserved due to unforeseen, unavoidable, unfortunate reasons like wars and disasters; documentation of damages, under the form of photographic and filmed evidence, gains major importance for the sustainability of the heritage. This documentation should be done prior and subsequent to the wreckage. While the preceding documentation serves as a reference to be able to reconstruct the “original”, ensuing documentation serves as a precedent to convince people not to commit the same crime again.

Gentrification as a Tool of Post-conflict (Commercial) Recovery

Gentrification, as it sounds, may have positive connotations at first sight. As it involves the renovation of an already existing physical entity, it necessitates more costs than building from scratch. This fact manifestly puts the course of gentrification right in the middle of the capital-based economical systems. “The process of gentrification, which initially emerged as a sporadic, quaint, and local anomaly in the housing markets of some command-center cities, is now thoroughly generalized as an urban strategy that takes over from liberal urban policy. No longer isolated or restricted to Europe, North America, or Oceania, the impulse behind gentrification is now generalized; its incidence is global, and it is densely connected into the circuits of global capital and cultural circulation.” (Smith, 2002, p. 80)

Transformation of old dilapidated urban neighborhoods into more sanitized urban corners does not necessarily / thoroughly aim the betterment of citizens’ lives. “Gentrification, cultural innovation, and physical upgrading of the urban environment (including the turn to postmodernist styles of architecture and urban design), consumer attractions (sports stadia, convention and shopping centers, marinas, exotic eating places) and entertainment (the organization of urban spectacles on a temporary or permanent basis), have all become much more prominent facets of strategies for urban regeneration. Above all, the city has to appear as an innovative, exciting, creative, and safe place to live or to visit, to lay and consume.” (Harvey, 2001, p. 355) The rather “manicured” heritage sites need the expensive and globally proliferated prestigious brands in order to recruit occupants that can either lease or purchase the re-conditioned buildings in the hyped-up / hipstered neighborhoods. “Large -scale urban development projects have increasingly been used as a vehicle to establish exceptionality measures in planning and policy procedures. This is part of a neoliberal ‘New Urban Policy’ approach and its selective ‘middle- and upper-class’ democracy. It is associated with new forms of ‘governing’ urban interventions, characterized by less democratic and more elite- driven priorities.” (Swyngedouw, Moulaert and Rodriguez, 2002, 195)

Planning is frequently (ab)used as a tool of social engineering. Zoning various urban components like residential, commercial, industrial, transportational sectors into divisionary juxtapositions may enable

administrations to gain

control of social dynamics. “Conflict, ethno-national and social alike, has spatial expression. Conversely, spatial transformations can also affect conflict resolution processes, testifying to the important role of urban planning as a tool.” (Stanley-Price, 2005). “The new revanchist urbanism that replaces liberal urban policy in cities of the advanced capitalist world increasingly expresses the impulses of capitalist production rather than social reproduction.” (Smith, 2002, p. 80)

Inhabitants of gentrified neighborhoods ended up being losers in the game, losing their properties, neighborhoods and memories. In addition to such individual losses; communal green areas, small-scale humane streets are uncompromisingly sacrificed. Though the typical alliance of state and real estate developers claims to be conservative, not much is conserved at the end; cities as we remember, integral values, traditional urban corners, natural resources are mostly gone. This fracture between past-present and deconstruction by construction can be shortly described as “erasing memory”! “Top-down planning is not a remedy for all problems. It is necessary to have publics informed and sensitized enough to demand, reclaim and even fight for their right over space. In other words, civic awareness is a key factor that can and should be mobilized in participatory planning processes.” (Foka, 2015)

Conclusion

The new urbanism we can observe in developing countries is centered on an excessive construction abused to boost economy. The construction practice is not necessarily meant for good quality housing accessible for all levels of income; there is a surplus of luxury housing for the rich, to the point of ending up with relatively large vacancy percentages: Construction based economy is doomed to failure and recent economic developments in Turkey is a perfect example to this assertion.

Departing from this assertion and focusing back on the devastated Sur district of Diyarbakir, it is viable to ask: “The destruction of Sur: is this historic district a target for gentrification? More than 30,000 residents have fled the Kurdish -dominated World Heritage Site in Turkey. With the PM promising to ‘rebuild Sur like Toledo’, some see links between the government’s military operations and its regeneration plan. The

government has been pushing to remake Sur – much of which is run-down and poor – for years. ‘With the projects we are planning to implement in Diyarbakir, employment will increase in the province and we will make Diyarbakir an international tourism destination,’ president Recep Tayyip Erdogan said in 2011, shortly after the state housing body, known as TOKI, had begun demolition work in Sur.” (Lepeska, 2016)

In the presence of precarity, lack of trust and land speculation “there are two crucial questions: Who will make decisions for the city? The central government, the local town authorities, or private individuals? And how will priorities be determined vis-a-vis urban needs? All of the queries listed above inform the debate sparked by the Sur Renewal Project (Sur Ihya Projesi) initiated by the AK Party

government. The Council of Ministers took the decision of ‘urgent expropriation’ of 6,300 parcels scattered along 15 neighborhoods of Sur.” (Yildiz, 2016) “The rebuilding plans for Sur have yet to be released. But in a recent statement, the office of the Diyarbakir governor, who is an appointee of the ruling AKP, said historical structures would be restored, while slums, shops and various other commercial and residential buildings would be demolished. TOKI would then build ‘luxurious’ housing, along with retail and tourist facilities.” (Lepeska, 2016) A further question is: “Will the inner city of Diyarbakir become a 21st century project town, a ‘new Toledo’, or will it be just another listed UNESCO world heritage site destroyed in the conflict that has flared across the Middle East – like Palmyra?” (Assénat, 2016).

Dragging the combat that previously took place in the mountains to the urban environment, leaving civilians in extreme danger, was surely a very harmful strategy. “The prominent Diyarbakir businessman Shahismail Bedir-hanoglu met with young PKK militants and urged them not to go down this path to defend Sur. ‘I told them it’s as if you’re mad at someone, yet you burn down your own house,’ he said to me in a recent interview. ‘It’s like giving the state an invitation for these operations. We told the people there will be death and destruction.’” (Lepeska, 2016)

The war-damaged area in the Sur district is a remarkably large urban zone covering many blocks. The new residences to be built instead will most probably be too expensive for originally local population to buy, as there will have to be height

regulations banning high-rises within the old city. The locals will consequently be displaced towards the outskirts of the city, where they can only afford a much cheaper flat in an inhumane gigantic high-rise housing compound. “The various forms of exclusion and dispossession the residents have experienced appear to generate intense feelings of belonging and of the rightness of their cause, as well as their conviction of possessing a distinct identity” (Bender and Winer, 2001, p. 31) and this is why all local citizens I was in touch with have no intentions of leaving Diyarbakir for good, though some of them are pushed towards the outskirts of the city.

The new urbanism has changed the manner people interacted with one another: High-rise and / or high-cost luxury construction detaches people from each other introducing a physically / socially hierarchic living format, as opposed to the previously low-rise format that provides horizontal (and rhizomatic) format that fosters audial-visual communication between people and more natural green / public space in between for better placemaking. The strategies consisting of prevention of independence at different levels, individualization of people and less cooperation / collectivity, competition in urban societies for success, zoning principles aiming for separation of various neighborhoods with income levels; result in new cities that divide people, instead of equally uniting them! The result is: Perishing concept of “heritage” and imposed introduction of profit to be gained by the injection of population with higher economic means and consequent dispossession forced relocation of the local/original residents...

Instead of the above results post-war reconstruction should rather focus on the concept of placemaking. Place-making is a collective act and it reinforces relations between community members, consolidates the foundations of a culture. In other words, “the iterative actions and collaborations inherent in the making of places nourish communities and empower people. Creative placemaking animates public and private spaces, rejuvenates structures and streetscapes, and brings diverse people together to celebrate, inspire, and be inspired.” (Markusen and Nicodemus, 2010)

Illustrations & Captions



Figure 1. Construction workers are having a break amidst the demolishing process of some residential neighborhoods damaged seriously during the recent fight in between the Turkish Special Action armed forces and Kurdish PKK militants. ©Murat Germen, 2016.



Figure 2. Both residential quarters and historical monuments and heritage were significantly damaged during the battle that was carried on for months within the urban context. ©Murat Germen, 2016.



Figure 3. Outside the historical Sur district of Diyarbakir province, it is possible to see many new housing development projects, either under construction or already built, within the “urban transformation” movement initiated by the ruling government and that led to excessive urbanization. This particular group of buildings has many vacancies. ©Murat Germen, 2016.



Figure 4. The new housing development is not constructed in a way compatible with the relatively harsh climatic conditions, which get very hot during the summers and cold in winters. The old Sur district has narrow streets, adjacent houses, thicker stone walls in older buildings and internal courtyards that provide comfortable living environments in all seasons. The new buildings are energy-inefficient and are devoid of regional character since they look the same as buildings anywhere else in Turkey. ©Murat Germen, 2016.



Figure 5. The supposedly conservatist (but rather narrow minded) government does not really do much in decently conserving the historical, cultural, architectural, ethnic heritage and they instead construct revivalist mimeries in order to bring Ottoman Empire’s legacy back in a shallow way. These fake public buildings built in the theme-park-aesthetics are usually of very poor taste and built weakly with veneered material; consequently, there is no way they can have sound reference to the historical architectural heritage. ©Murat Germen, 2016.



Figure 6. The various entrances, gates through the old city wall that were previously accessible to public, are all sealed off now with huge concrete blocks for security purposes. ©Murat Germen, 2016.



Figure 7. Even sacred, holy, blessed places like mosques and monuments that constitute the legacy of the Diyarbakir's historical heritage were relentlessly sacrificed during the many combats between the two sides. ©Murat Germen, 2016.



Figure 8. Waste collectors that are called “eskici” (scrap men) are still around in Turkey and they constitute a remarkable percentage of the waste management and recycling in Turkey. When I saw this guy, I thought maybe he salvaged the items on his cart from houses that were damaged during the battle and urgently abandoned as was in order to stay alive. ©Murat Germen, 2016.



Figure 9. This was the saddest moment I personally experienced, which was surely not sadder and more brutal than what some civilian residents of Sur district suffered; loss of homes, injuries, even death... The large hole on the wall in the right-hand side is a puncture caused by a loose artillery shell, that instantly killed an old woman having a meal at her home, away from the conflict area. The place was left as was and nobody has cleared the scene, including the relatives of the old woman. ©Murat Germen, 2016.



Figure 10. The ones who un/consciously suffer the most from the hostilities certainly are the many kids you encounter on the streets of Sur district. The never disappearing warm smiles on their faces was my only source of hope. I sincerely hope this clash will be over very soon and kids will enjoy their innocent infancy. ©Murat Germen, 2016.

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Author Biography

Born 1965, Germen has a MArch degree from MIT, where he went as a Fulbright scholar and received AIA Henry Adams Gold Medal for academic excellence. Works as a professor of art, photography and new media at Sabanci University in Istanbul. Having many papers, photo series published on architecture / photography / art / new media in various publications; he has lectured at tens of conferences internationally.

His oeuvre focuses on impacts of urbanization and gentrification, civic rights and participatory citizenship, documentary sustainability of local cultures, human devastation of nature. Has two monographies, one published by Skira (Italy) and the other by MASA (Turkey). Has opened/joined over eighty international solo+group exhibitions. More than 300 editions of the artist's several artworks are in personal collections of eminent art collectors internationally, in addition to several that are in Istanbul Modern, Proje4L Elgiz Museum of Contemporary Art, Centre of Contemporary Art in Toruń (Poland), Benetton Foundation's Imago Mundi collectionE

The Exhibition Space through the Presence of Digital Games

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Abstract

The purpose of this work is to think about the exhibition room (gallery) based on the presence of digital games. This proposal is a specific development of a research project that studies the exhibition space towards the presence of digital technology. In order to achieve the goal, we will focus here on the Interactive Space of Life Sciences (EICV), which is part of the Museum of Natural History and Botanical Garden of UFMG, in Belo Horizonte/MG. Specifically, this article discusses the exhibition space and its curation when digital games are shown in it. Considering that, we debate about the configuration of the contemporary exhibition space, bringing up the relation among art, digital games, technology and science.

Keywords

Digital Games; Digital Art; Exhibition Room; Arcade.

Introduction

This work aims to study the exhibition room based on the presence of digital games. In order to achieve the goal, we will focus on the Interactive Space of Life Sciences (EICV), which is part of the Museum of Natural History and Botanical Garden of UFMG, in Belo Horizonte/MG. Thus, this article discusses the role and the curatorship features in exhibitions that show digital games.

The EICV is an exhibition space which focuses on the knowledge about the human body. Its proposal has been following the trends of Science Museums not only in Brazil but also in the world by using digital technologies as a way to bring the new generations to the scientific knowledge in a playful way. In such a way, spaces like that aim to provoke in children and young people some interest in science, knowledge, as well as involve them in the scientific field.

The space consists of seven rooms: 1) senses; 2) to feel, to remember and to act; 3) body and movement; 4) heart and circulation; 5) digestion and nutrition; 6) reproduction; cell at hand.

According to the curator Fabrício Fernandino, in

Catalog of Conception & Construction of the Interactive Space of Life Sciences:

(...) the *Interactive Space of Life Sciences* is a project that was implemented in Belo Horizonte, Minas Gerais and gathered the efforts of three major institutions and was a work developed over five years that brought together a lot of creativity, technology and determination to be implemented. (...) The structure was born with the proposal of presenting to the public the functioning of the human body, in a playful, digital and participative approach, a museological trend that is being followed in several museums in Brazil. The EICV has seven representative rooms of the cell and the physiological and biophysical systems of man - besides the reception, where the visitor is already in contact with the first structures on display. Each room deals with one of the subsystems of the organism (...) (FERNANDINO, 2013, pp. 5-8)

The exhibition is made of anatomical models, 2D and 3D animation videos, as well as interactive digital installations and digital games. The exhibition design is composed by the instructions in the screens and projections of the digital works, information totems and plots in the walls and the floors. By using these elements, the visitor is invited not only to see the exhibits, but to participate in them and to be registered by them during the interaction (Figure 1).

The great news about the place is that all the digital pieces were created exclusively for their permanent exhibition, composing a whole projected through research and development.

The work was developed by research groups, professors and researchers who thought the space up together (More information can be found at: <http://www.mhnpj.ufmg.br/eicv/eicv.html>).



Figure 1 Screen of *Digestion Game* Source: Research database and EICV

Related works

This proposal is a specific development of a research project that studies the exhibition space towards the presence of digital technology. In addition, it is the result of the reflection originated in the Laboratory of Front Poetics (CNPq/UEMG – <http://labfront.tk>).

As this work is a cut of the project, it will focus only one exhibition space: the EICV. In this way, it will not analyze and compare the exhibition spaces in its use of digital technologies with the exhibition spaces that do not use them.

As the EICV was inaugurated in 2013, there are no studies on it yet. In addition, the discussion on the exhibition spaces formed by digital technology is recent. We have, for example, the works of Fabbrini (2008), Paul (2008), Santos (2010; 2012) that deal with the issue of exhibition space and new technologies, besides some of those papers undertake the debate from the curatorship issues.

Between exposing and playing

Technology and Exhibition

The contemporary context allows the formation of new fields of knowledge. This work comprehends a reflection that combines the issue of the exhibition, and its expography, with digital technology. Contemporary digital technology, and its relation to art and culture, is a consequence of almost two centuries of approximations, separation, controversy and confrontation.

Knowing that the common idea between technology and art is at the origin of the word “technology” and the idea of “art” (from the Greek *techne*), we can assume that It is not by chance that we have been seeing the

expressions of culture and technology merging into a common construction to all in the globalized context more and more each day.

In the nineteenth century, more precisely in 1826, with Niépce and Daguerre, the technique of fixing images using light was achieved as photography (written with light). This technical base has become, over time, also an artistic base. Because of that it was possible to form two fields of action. The first field, of industrial interest, would allow the sale of the equipment known as “camera”, and in its use, it would allow the possibility of reproduction of the photograph.

The second field, of artistic interest, allowed new ways of working the image through the technique of reproduction of what is seen. If before an artist used to make a lot of effort trying to reproduce another frame from the skill acquired with his hands, with the camera the reproduction became easier as the technology has been improving (BENJAMIN, 1987a; 1987b).

With the Lumière brothers cinematograph at the end of the nineteenth century, it was created not only the possibility to fix the image but to give those fixed images the impression of movement (CARRIERE, 2006; EISENSTEIN, 1990). The fixed images by machine have begun to move and the arts have remained in crisis towards the emergence of those new techniques, enabling new ways of thinking art and its role. But the advancement of mechanical reproduction techniques, as we can see, has made possible new forms of **exhibition** since its beginning.

Another form of exhibition of images (XVIII and XIX centuries) was studied by media archaeologist and theorist Erkki Huhtamo (2013, p. 35). In the book *Illusions in motion* the **peepshows** appear as hardware that people can put images inside: like software inside a machine. Peepshows invite spectator to see your images and made their body change to adapt to a specific way to see “what’s happening” inside the machine.

In twentieth century the technological evolution continued with television, which emerged from the patent registered by Vladimir Zworykin (1923/1924) establishing itself as the beginning of an entertainment industry. With the evolution of the industry we got to know a more accessible way to record and reproduce what was produced: the video (MOTA, 2001; 2010).

Video means “I see” in Latin. That meaning is not by chance. The evolution of the video has an intimate relationship with what was called by Walter Benjamin, in

the third decade of the twentieth century, of technical reproduction. For him technical reproduction, as a technological evolution, allowed not only more people to know the art, but also brought people closer to that world, reducing the separation that existed between those who make art and those who appreciate it.

Technical reproduction is the possibility of making indefinite copies of an artistic object. And more than that, in the case of film and video, it is a primordial mode of those forms of expression, because to see (and expose) the product (in that context) it is necessary to copy and reproduce it.

Video, as an evolution of those new technologies of the nineteenth and twentieth centuries (photography, cinema and TV), becomes a representative technique of the culture of the second half of the twentieth century (DUBOIS, 2004), the culture of the media. Surviving to the present day, and with the advent of digital, that cultural formation has started to compose a digital culture.

For Lúcia Santaella, when thinking about media culture, we have to: With the emergence of equipment and devices that enabled the emergence of a culture of the available and the transient: photocopiers, videocassettes and video recording devices, walkman and walktalk equipment, accompanied by a remarkable industry of video clips and video games, along with an expansive industry of video films to be rented at video stores, all culminating in the emergence of cable TV. Those technologies, equipment and the languages created to circulate in them have as main characteristic to offer individualized choice and consumption, as opposed to massive consumption. (SANTAELLA, 2003, pp. 26-27)

In this context, the lower cost of equipment in the digital culture, and the access to those equipments allowed them to be modified for other uses. As photography is used today to make 3x4 photos and at the same time we have artists like Sebastião Salgado taking their images in his exhibitions around the world, the computer is used to perform digital art. At the same time, knowledge exhibition spaces use digital technologies to promote culture, science and technological innovation.

The idea of exhibition is inaugurated, in a modern way, with the Universal Exhibition in France (as well as in the United States and England) in the nineteenth century. Brought up by Walter Benjamin in his work called *Passages* (BENJAMIN, 2007), the exhibitions -

or the great art salons from which they originated in a sense - had as their role exposing the art made during its time, and from earlier times, to artists and critics by establishing new canons and artistic paths.

Universal Exhibitions did more, according to Benjamin. They made it possible to place, in the exhibition space, objects that were not exposed: the creations of the industrial revolution.

It became possible - and common - to display wonderful machines that would make the job easier and would be present in factories soon. Also, incredible productions of the human being with the use of the machine were exhibited.

At the same time of that change, the artistic vanguards of the early twentieth century also problematized the artistic exhibition space. Due to the happenings and various interventions, there was a rupture with the classical spaces of art, whether those of visual art that erupted into people's daily life, the musical art that could be conceived in people's day by day and with the participation of the public, or of the theater which happened to have moments of intervention beyond stage, incorporating the spectators as object of its execution.

These events pointed out as something strange to their time. According to Giorgio Agamben (2009), the notion of contemporary has an intimate relation not with the idea of actuality, but with the notion of nonactuality. For the author, that which is contemporary is what is formed as non-actual. While nonactual and existing at the same time as people of its time, the contemporary is able to see that time more skillfully by being in a privileged place while making up its difference. In this way, the artist and his work, when nonactual, reach a space of reflection on their time.

Unlike Agamben, and specifically thinking about art, the philosopher Arthur Danto (2005; 2008; 2009) considers that contemporary art has as its main contribution to its time the composition of a class of philosophical artists. That means that contemporaries are precisely the artists who through their work are reflecting on the world and what composes it.

The fast availability of digital technology in various sectors of society is something that surprises people, just like artists - and Walter Benjamin himself! - were amazed at the exposed capitalist industry products such as the work of art in the nineteenth century and earlier.

The surprise becomes smaller every day, especially when people start to get used to the touch screens, with

the various sensors that identify the movement and proximity of individuals, sensors that map their bodies as in biometric technologies etc. The multiplicity of digital devices causes the usage and prior preparation, as well as the taste of people for them.

It seems inevitable, considering the ability of artists to reflect their time and the emergence of digital technology and its various devices, that the technology appears not only in works of art but also in the various places in the society. It remains to study the modifications that the emergence may or may not provoke from the exhibition space.

New Exhibition Spaces

At the same time that material means allowed the appearance of digital reproduction modes, the advent of a large number of new exhibition spaces in contemporary society is related to the evolution of material conditions and the access that it brings to the new digital goods (BRUNO, ARAÚJO, 1989; SANTOS, 2010; 2012; OBRIST, 2010).

Due to the technological advance, the public space for exhibition (whether made up of private or public funds) has become the scene most recognized by the people. Not only the museum as a place of exhibition, but all public spaces mingle with the private (and vice versa) inciting what had already happened with the arrival of modernity.

The “appearing” in contemporary space generates a greater interest of people for what was, rather, the domain of the private. Then the memory, something exclusive of who constitutes it, becomes an important object of interest of the people. The creation of blogs since the origin of the internet in the 1990s was only the beginning. Memory needs and the search for what was private are now found from the microblog format and as profiles on various social networking platforms. Considering that, it is understandable the taste for biographies and autobiographies, as well as the growth of biographical studies in various areas of knowledge, and the emergence of the genetic critique of artistic works.

Life exposed widely in the digital environment is only the surface tip of the discussion. Surface that shows the subject submitted (sic) to the need to make available his life, whose memories were only his, in the digital public space (GOBIRA, 2010).

Since that, some questions arise, such as: is this overexposure due to digital media only? Is it just a new custom of exposure in the digital environment that

stimulates the appearance of new exhibition spaces in which digital technology is not a mere medium or has a supporting role, but it starts to become a great part of what is understood as exhibition design today?



Figure 2 Gallery of the International Electronic Art Festival (FILE), Brazil, 2015 Source: Research database

As it is known through several studies (KERN, 2011; RUPP, 2010; OBRIST, 2010), the curator is responsible for keeping the collections on display or making them available somewhere to have works exhibited. He is responsible for the organization and constitution of the meaning that carries what is exposed, especially in the relation between the objects that make up the same exhibition space.

The curator, too, is one of the mediators in the relationship between the public and the exhibit and also between the artist and the public (HONORATO, 2012; HOFF, 2013). In this way, we see the immense responsibility of the curator in an exhibition space as well as his importance in understanding the needs of a curatorial project to be constituted each time an exhibition space is established or modified.

It is the curator or body of curators who are responsible for understanding exhibition design.

In the case of the EICV under review, we have the curators David W. Ellis, Fabrício Fernandino and Jeter Jorge Bertolotti who are responsible for not only for the curatorship of the exhibits, but also for the conception and contents.



Figure 3 1980's Arcade House Source: Research database

Thus, when we affirm in this work that the EICV, as an interactive space, selects the play as a central discourse when organizing what is exposed in it, we are affirming that there is, in a way, an exhibition design of the action of “playing”. The exhibition design of “playing” can be, in a way, compared to that of the old and current arcades (and game houses) (Figures 3 and 4).



Figure 4 Hotzone Park at a mall in Campo Grande, Brazil. Source: Research database

Another concept that can correspond with this new reality is “gamification”. The exhibition space influenced by games is in a process of “gamification”. Gamification is understood (2014, p. 510) when we bring mechanics of games to a traditional non-game place. But with this we have to ignore that other places have ludic characteristics.

For this controversial concept that ignores a ludic presence in all human society, as taught by Huizinga (2001), we have an important discussion by the imminent game theoretician Ian Bogost. The scholar

considers “gamification” a “bullshit” because of its major marketing uses (2014, p. 65). From one way or another we can consider the exhibition space with game presence as a gamified place.

The most imperative is to comprehend that we are having modifications in exhibition spaces as not seen before. We have industrial technologies of all types inserted on exhibitions. And we have industrial game technologies inserted in all kind of exhibitions, since art, history until life science, like we have here. It all is changing the way as we see what is exposed just like photography, peepshow machines, cinema, video, television did before.

The Exhibition Space as an Arcade House

In portuguese, the other name to “arcade house” is “fliperama”. The use of the word “fliperama” (arcade house) come from the junction of the word “flipper” with the suffix “rama”, and came up with the electronic (and mechanical) machines of Pinball (Figure 5), in which game balls are struck by a part much like a flipper.



Figure 5 Pinballs Source: Research database

The “fliperamas” (game/arcade houses) are establishments that exposed those machines to consumers to use them. Over the years, the Pinball machines started to live with arcades, electronic machines with video games that have become very popular in many cities around the world. The use of the term “fliperama” (arcade house) to name those spaces became common during the 1980s and 1990s and continued with the advent of digital technology when video games evolved technologically and could be purchased for use on televisions in homes around the world. The use of this term in this work is related to the focus of the study while it is a metaphor

that seeks to problematize critically the contemporary exhibition space.

By stating that an exhibition space such as the EICV is different from a traditional exhibition space, we also affirm that its exhibition design differs from traditional ones. The exhibition design, from what is read in Desvallées (1998), is the inscription in the space of objects or events through the search of a language. Usually, this registration and research is conducted by the curator. Exhibition space, therefore, is the place permanently or temporarily dedicated to the physical (or non-physical) exposure of objects (or events). The role of the curator is essential for the configuration of the senses of the exhibition or of the space itself.

As we all know, digital technologies are increasingly taking part in contemporary social dynamics. Digital machines are “hidden” (ubiquity) in various objects of our daily life: from telephones to televisions, from vehicles to appliances, etc. It was to be expected that the exhibition spaces would suffer that insertion at some point.

That insertion influences the space in order to modify not only the process of exposing but also seeing and existing in that space. If before the visitors were considered like that, we now understand them as interactors, because their enjoyment is based on the interaction with the exhibits. If before his vision about the work was decisive, now it is allied to the other senses, because one hears, touches, and/or is seen by cameras of an interactive installation.

In this way, we are dealing with something that since the end of the 20th century has been called “new intelligence technologies” (LÉVY, 1993), since those new technologies have influenced the way of seeing and existing in the world. When they are included in the exhibition space, they also change their specificities. And in those spaces, they relate to the formation of a new way of interacting with the exhibit. Mainly because the exhibit is often not just material objects, but formed by projections on walls or appearing on screens.

The Interactive Space of Life Sciences, when analyzed as an exhibition space, contains several elements that bring it closer to the “flipperama” places. Their colorful plots on the walls and the sounds of the installations as soon as we enter the environment already explain the first sign of the game environment and provoke in the visitor an immediate desire to know what is exhibited (Figure 6).



Figure 6 Digestion Game, in EICV-Source: EICV's Website

That first impression can be reached by looking at Figure 6 and Figure 7.



Figure 7 Heart and Circulation Room in the EICV
Source: EICV's Website

Even if the EICV was not made up of games like the Memory games, the Digestion Game, the other forms of interaction based on the motion capture of the interaction and response already establish the play element in the relationship between the body of the visitor and those interactive installations. The configuration of a new relationship between the visitor and the exhibit, as in a game, creates a new world, new rules, a reality of its own that is established from the door into that space. The stimulus to the knowledge of this world and its new and particular rules lead the visitor to the world of Life Sciences, the theme of that exhibition space.

In addition to all this, the artistic creation involved in the production of games and the visual production of space (and screens) is an invitation to visitors and

lead to determine the forms of that new world. That image constitution - and why not imaginary? – based on research and artistic production, is performed in diverse teams as necessary on the productions of digital games.

We are facing a technological convergence that makes the exhibition space really look like a game space. The production of that exhibition space also resembles that of the production of digital games for industry, distancing itself from it only in the establishment of a curatorship specialized in the exhibition space of art and/or science.

Final Considerations

The Interactive Space of Life Sciences really reminds us of the well-known game spaces of the 1990s: the “flipperamas” (game houses). As soon as we entered those spaces, with or without visitors, we heard the noise of the arcades and the pinball machines. When there were visitors, in addition to the sounds of the games, we also heard the screams, cheers and taunts of the players and spectators who watched the players beat each enemy or stage.

In the EICV that scene is reproduced during the visits of classes of students or other groups and the interest is proven through the interaction and the playing generating learning. The visitor becomes instigated to build a world view from their relationship with those games and those facilities, from their interaction. The learning that takes place through what is shown by the machine extrapolates in part the metaphor of the arcade and its space in which learning turns to the game itself, its rules, its magic circle (HUIZINGA, 2001).

In an exhibition space of arts or science, we see the learning focused on reflection which is caused by the object: artistic or non-artistic; physical or virtual; ubiquitous or explicit.

The learning does not only concern the direct narrative that the game evokes: that of the spermatozoid process in the game Sperm race; or attaining the completeness of a food pyramid, within the rules of Digestion Game. It is instituted new regulations that serve not only for the game but for the life of the visitor. We see the exhibition space incorporating the game seriously (serious games) in which is essential its relation with society and with what this society produces, researches, studies and with what it has the potential to create.

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PRESERVATION OF ELECTRONIC AND DIGITAL ART IN THE CONTEXT OF MUSEUMS: An Information Management Perspective

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Abstract

This article aims to elucidate two fields of interest on the aspect of information management by museology and other actors of “art systems”. The first field refers to the issue of the preservation of “digital” information focused on the perspectives and dilemmas in digital arts. The second one seeks to discuss memory issues through the access of information present in the context of management, curatorship and mediation, mainly in the context of digital arts and inserted in the perspectives raised by the article, regarding information capacity to perform and allow such processes, access and memory.

Keywords

Information, Museology, Digital Preservation, Digital Art, Heritage.

Introduction

Initiating the reflection proposed by this article, it is essential to keep in mind some guiding aspects about information processing. One is the understanding and extent of the data, information and knowledge. While the first word can be represented by a cluster of codes collected by various systems in a systematic way, “information” can represent the meaning extracted from the set of data that becomes or carries a particular value. The “Knowledge” can be treated more broadly, as the set of information that promotes tangible and intangible aspects in several fields of knowledge in constant transference.

For a long time, society has been facing the influence of media developments, whether through digital, electronic and computational devices provided by mass industry and the economy, or through the unprecedented growth of global communication in contemporary societies, mediated primarily by virtual and remote access of data (internet).

Giving that, and considering museology as a manager of symbolic and aesthetic value’s information, and also the relations of cultural spaces in contemporary society, as well as its memory, the dynamics of acting and

concepts have produced structuring changes in the last three decades. Among the most important changes we could mention, it is the perception that its object of study is not unique. On the contrary, it addresses several fronts that will include, besides the object itself, a context of broad analysis of “social objects” complementary to the constitution of memory when it comes to collections.

This study does not include the implications of the use of information to museum administration and information science for technical purposes. On the contrary, it seeks a reflection on the issues of materiality and immateriality of information, ephemerality and obsolescence of information itself and the systems in which it is inserted - stable and unstable - under the proposal that they can be subject to some attention in the present, with the perspective of maintenance and perpetuation of material and immaterial access by societies. “Information, after all, as it is understood and practiced in Information Science, is above all a cultural and political fact, not a technical one” (MARTELETO, 2007, p.25). Thus, we discuss preservation in an information management perspective, but not in a technical way.

Therefore, the issues of digital preservation and information through this highly generative system from the infrastructural point of view of special languages and codes, besides the material issues of physical and virtual networks and media are very peculiar. The same occurs in relation to the electronic and digital arts, which are part of the “arts systems”, where museums, collections, professionals, curators and mediation activities are found.

Concerning these and other aspects it may be possible to establish correlations between information management, the role of institutions that safeguard collections and museums - also in the central condition of mediation - the field of quality, process and quantity of information for the access of contemporary culture and history, towards the paradigms of the “digital” and

the massive information society. Discussing these inputs is a current and recurrent need, especially in the field of digital arts.

Information in Museology

“The actual object of the museum is the transmission of pertinent information, of which form of showing is not necessarily and exclusively the three-dimensional object” (SOLA, 1987, p.258).

Using very few words, Tamislav Sola is able to analyze the role of information in contemporary museology. The museological phenomenon should encompass the entire context beyond the aesthetic object of the museum, or through it, develop contributions that may allow new interpretations and recognitions about realities, cultural history and the contemporary time. It must reflect on memory and its access by society.

The new museology widespread, mainly in the 1980s by the ICOFOM (International Committee for Museology), allowed an expansion of the understanding that “data” are sensitive parts in the construction and building of sites and knowledge on the part of museums and their collections.

It occurred, in the same period, the expansion of new conceptual fronts that enlarges the performance of museums, mainly because of the broad notion of “Heritage” as suggested by Mathilde Bellaigue (*apud* CERÁVALO, 2004, p.260). It means, in brief synthesis, that society in its diversity belongs and is part of the belonging of social, cultural and political construction with reflections in the institutions present in this community and social system. While information is present in all these moments of space and time, whether through absorption, creation or diffusion, the community itself is a central collaborator of informational processes. It is not reasonable to imagine it as systems isolated or encapsulated from the constructive process of museums, collections, the institutions as a whole.

“(…) museums should be recognized by the communities, it would be a result of them, their commitment and their participation. The roles would be reversed: museums should not be made for the community, but with it. (...) (...) “a more advanced form of contemporary museology” (RÚSSIO *apud* CERÁVALO, 2004, p.261)

The participation of a system with several “Inputs”, or the insertion of data and contributions, begins through transdisciplinarity, in which many disciplines cross over

lines of interest in museology, determining contributions to the scientific field. This has been already foreseen in the “theory of systems and museology” reported by Stránsky (1995).

The conceptual, synthetic and accentuated cut proposed at the beginning of this article, aims to elucidate the role of information in the context of institutions, but mainly in the perception of the society development towards information in the contemporary world. This can help the awakening of considerable and structural changes not only in the academic field, but in the image of the communities and their institutional structures.

For this study’s purposes, the deepening of such dynamics and role of the social system formed by society and its constructions of information and knowledge should be observed under the prism of preservation and memory in digital media, which can occur in actions of “self-archiving” between individuals and small institutions, with direct or not direct relations to museology and preservation policies or institutionalized practices through collections, museums, and media centers.

Questions related to the “Digital” are too complex. In museology, the theme is variably peculiar when it comes to the aspects of science information, because of the various subtopics that are inscribed in the “problem”. Some of them are: the virtualization of museums, the use of digital technologies in museum mediation, the construction of databases and the use of information amid unconventional norms and standards, adaptability and curatorial processes of documents, public policies related to digital preservation and digital culture itself, among many others.

In an even more exclusive topic, the problems of preservation and memory of electronic and digital arts are related, on the pretext of future collections, conservation and accessibility. What chronic fields is the information on digital art work lost in, in a medium and long term? What are the alternative determinants of museology as a field of interest in information science, perpetuation of data works based mostly by the obsolescence and transience of technology and the stream of Information Society itself?

These are some questions that become central to the idea of accessibility of contemporary history of digital arts in the future and even in the present time. Contemporary art as a whole is not excluded from this context. In Lidia Alvarenga’s paper (2003), on the representation of knowledge in digital time and

spaces, quoting Lancaster (1991, p.38), it is clear that in the perspective of secondary representation, i.e. the representation (non-ontological) of information through systems and access for identification, treatment, organization and recovery, there is no guarantee, if access to the original and essential files is not allowed.

In the study proposed here, digital arts, and the “digital” in the context of collections for later accessibility, and the compaction of concepts and processes represent a reality, as well as a certain fragility of patterns that denote a future without memory, and therefore, without information.

Ephemeral in Digital Arts

The theme of ephemerality in the arts, especially in contemporary art, is a constant debate on aspects of preservation, exhibition and memory. There are a large number of professionals and entities involved in discussions about regulations, methods, concepts and problems that surround the universe of artists, museological institutions, collections, and educational institutions, among others (TADDEI, 2011).

In digital art it is commonplace to contemporary art, artistic movements and manifestations such as photography and performances, some questions about its volatility towards different factors, which include its ability to keep itself in the “present time”. In this article, time is understood as being subject to permanent access and expographically visible when requested by curators and institutions.

As an artistic field, electronic art by means of the so-called “new media” tends to suffer strong influences from some sectors, such as Design, industry in general and strongly from electronics, technology and communication sectors. Thus, the first concepts about ephemerality applied to digital arts are formed, considering their avid dependence on technological vanguard. It is susceptible to all the variety and nuances of areas which are sensitive to contemporary society, being influenced more directly by economic, political and social issues. There are other meanings about ephemerality that will be mentioned later.

Still speaking about the characteristics of the artistic field of digital arts, it is important to reflect on other topics: the distinction between human questions and language. Besides them, support issues that fall upon two other subcategories: instability of Software and instability regarding Hardwares and/or Interfaces.

In the problematic sphere of human related issues,

it will occur a tension between human language and computational language. The production of special language is related to computers for the production of tasks and data processing. In this area of observation, since the 1970s, the conflict of the adaptation of human universe to the world of machines (and vice versa) has been presented. Just as it is possible to enumerate the advantages of robotics, equipment and programs developed around and for the biochemical and biomedical sciences (nanotechnology just to mention some) in the field of the arts, this capillarity and acceptance does not go with the same flow and at the same pace. However, it is noticeable its increasing presence in the space of the arts. What might be relevant to reflect is that the development of professionals in the artistic fields, including art systems (museums, galleries, curators, artists), is seen as strange and, mainly, with technical and professional distance to deal with new issues, such as technology and computer language. There is a disparity - even temporary - of “non-native” and “digital-native” professionals.

Regarding the second survey about the media, the hardwares - referred as all the electronic devices of different complexities mainly by management through digital and electronic systems - suggest new focuses. One can be observed in the great discussion in contemporary world, about the “programmed obsolescence”. Since the industrial era, the sense and concept regarding the “object of desire” promoted by industry, communication and economics have come to represent an irreversible dynamic of technological and volatile cycles over the less and less use of functionality of time and space.

The direct relationship with digital arts will be primarily referred to the maintenance of these devices. In the arts, industrial and commercial logic deconstructs and redefines the sense of use and functionality. The objects and supports will not have the same purposes for which they were designed. They are technically undue appropriations to industrial logical thinking and pertinent to artistic creative “thinking”, with the purpose to bring technical and libertarian solutions, of which result will be the whole of the “work and thought” of art and not a single and previously defined product. Therefore, if obsolescence is programmed industrially, in the long term, it may cause irreversible damage to the artistic work which shows no provision for substitution of materials, supports, and more technically and specifically, the exchange of something essential to the operation.

From the perspective of softwares (computer systems programs), the advantages of the use of free standards, in relation to those of private and intellectual property, have been discussed worldwide in various instances of society, such as industries, public administration, education, collecting and preservation institutions, artists, especially members of the new media community. In most cases, it involves computer language programs. However, the problem is more complex than making a simple pattern choice.

Recent studies (distributed and open practices in FLOSS art by Aymeric Mansoux et al.) show that there is a problem common to free programs patterns (Open Source), in which users from all over the world contribute to the developments of the platform. In spite of the multiple contributions of professionals of special computational languages development, there is no consensus for usability and functions by users who depend on more stable systems in the long term.

An example that can portray these users is the development of special databases for collections of all kinds, including museological and artistic ones. Artists are another example of people who work with native and primary computational languages of the first systems in open source platform and still make use of these or others derived from them. In both cases, there are mutations of linguistic kind of the programming. Some metadata are permanent in open source platforms, which include some rules and regulations, but these languages also undergo some acceptance of the digital community that provides knowledge and professional use. This means that it will not be always possible to maintain native bases in activity, or that some of them can migrated (jump from one system to a more recent one) or emulated (reproduced as the old bases but processed in new ones) in the long term.

The observation denotes a complex context to the field of digital arts considering its artists, collections and public that depends on certain stable parameters. The concept, the work's unit and meaning, and mainly, the relationship with its audience in the way they were conceived by the artist, author and curators depend on a minimum stability of data and files.

Among the characteristics of works that use new media, is their intentionality in co-authorship through the interaction and effective participation of the public in the works, which can also be dynamic and generative, possessing singular and multiple values. Interactivity

is part of the context of contemporary work of art. (FERRARA, 1981).

These are key questions from the point of view of memory and preservation of contemporary and digital art. As we will briefly see below, they do not just deal with processes, documentation, migration, emulation, and re-creation. There is a more constant ephemerality in all these processes, especially concerning the subjectivity of the works, the intentionality of the artist and the public interaction. If it is not well dynamized in relation to the above considerations, experiences and future accesses will not be allowed.

Some Issues of Preservation and Digital Memory

Memory is one of the most relevant themes of the 21st century, especially in the field of the arts. Countries such as Canada, the United States, the Netherlands and Germany have made efforts for three decades on the subject in the field of new media. Therefore, digital preservation has as pioneered institutions, ZKM art and media center in Germany, ARS Electronica Center in Austria, Berkeley University, Guggenheim Museum, NIMk media art institute in the Netherlands.

For some years, by means of forums, seminars and researches of each of these institutions, besides group actions and cooperation between some of them and others, practices of how to think and act in the preservation of digital arts and digital document, were discussed.

We could say that after some time, most of these procedures were widely disseminated by the countries. Some of them had a greater or lesser degree of protagonism in the area and possible contextual adaptations from the perspective of the collection type, artistic and museological practices, as well as public and private policies of institutions and governments.

In order to elucidate a guiding axis for different cultural scenarios, four crucial and comprehensive topics on digital art have been defined. Some projects and institutions such as Variable Media Network, Avant-Garde Archive, GAMA-Gateway, DOCAM - *Documentation and Conservation of the Media Arts Heritage*, have set standards for this axis. There are four distinct moments and stages that are applicable: documentation, emulation, migration and re-creation.

The documentation follows the museum and collection practices when texts, images, and complementary information will be conditioned to a detailed work,

aiming to increase the number of data and information. It is necessary to define the “enlarged view” as an objective, both by the artist and audience’s perspective, as stated by Pip Laurenson (*apud* MARCHESI, 2011) from TATE Modern.

Emulation and migration are somewhat conditioned to a logic of maintaining access to the work in an original form, but without being it. In the emulation process, sensitive responses regarding support performance (hardwares) and informational management systems (software) or program behavior to the sensorial responses of the work in media art, are reproduced in updated copies of the same media (hardware, software) in a copying and imitation procedure. It reproduces the digital artwork, supported by a more current (physical or virtual) system, that is, the “new” plays the role of “old”. In the migration process, as a difference in relation to the previous process, we must consider an important factor from the projecting perspective, and from the point of view of Design. The final result, that is, the dynamics of the devices’ behaviors in the relation established by the interaction of the work and the public does not suffer changes. However, the work is structurally modified, either by tangible measures on devices and computational language, or in the issues of intangibility about the originality and context of the same devices.

Re-creation is one of the most intrusive possibilities in the process of preservation and memory, in the sense of reviewing. It would be the use of the documentation from less contextualized references. The “new work” would be the most important one (or at least a “brand new” or a “renew” one). The construction of a new media art in another time, by means of media that is different from the its previous versions, will produce a new context, a new work of art and maybe a new critical narrative.

It is important to remember that the four aspects signed at this section is focused on information of the artwork. Even re-creation will concentrate on information (got from documentation) to construct the artwork again. So, we understand that manage information has an important role on preservation of digital art, permitting conservators and curators to construct the first efforts to maintain the digital art memory at collections and museums.

Although some consensus on these four preliminary aspects of the preservation of digital in media art works through various actors in the system of related of correlative arts and institutions are constant, dichotomies between theory and practice, involving

all these interconnected networks are also constant. Christiane Paul (2007) brings a collaboration on this aspect when she says that art through new media is flexible, and demands a new standard to be established by the art systems.

It is not possible to say that these standards are being established on some considerable scale and order to preserve the future of contemporary digital art, as well as preserve its memory in even more usual terms, such as the preservation of documents relating to it. A Dutch compilation of the Virtueel Plataform project, proposed for the theme and organized by Annet Dekker (2010) by means of articles and interviews with professionals working on several fronts such as designers, audiovisual artists, curators, editorial directors, galleries and collections managers, denote, through its vicissitudes, some problems encountered in complying with the widely disseminated manuals of good practices. They also contribute with surveys about some alternatives to the issue of preservation and access to the increasingly emerging digital memory.

Anne Laforet (2010) refers to the open code called open source, from the perspective of the “corrupted code” view, when programming changes will not allow any of the re-creation steps. A pattern of awareness is necessary for the maintenance of strong and robust databases that do not change in the long term, as it occurs with closed source programs by market developers.

Richard Rinehart (2004), from the Variable Network Media project, disseminates a concept and a practice of “self-collection” and “open museum”, based on the accountability of subjects individually arranged in a network, not centralizing in the entities in the roles of protection and access. There is a great tendency to the role of actors’ responsibilities in the arts system, especially in relation to artists who work with new media.

The content is absolutely extensive and overly complex, from studies and practices to digital preservation of new media arts. For the context of this article, it is important to establish some basic notions in order to perceive the ephemerality of processes and how peculiar the demands of digital arts in the field of information management are, having in mind, preservation and memory.

The Accessibility of Digital Arts in Exhibition Spaces and Museums

In the conceptual surveys discussed so far in this article, it was proposed the attention towards some of the complex connections between the issues of ephemerality of digital art and the issues of “programmed obsolescence”. So, the same thing that gives life and an effervescence of possibilities in a constant technological revolution of the knowledge society leads, at the same pace, to its own memory absence, or even its material extinction as an expository object.

According to another observed topic, there is a volume of existing variables regarding the data and information present and measurable in the attempts of preservation, maintenance of access to digital art, whether these are dynamized by some methods such as documentation, emulation, migration, recreation among other practices propagated by the diverse actors of this system. We must consider the related circuits as the industry, the economy, the politics and the own cultural movements.

Given these scenarios here elucidated, concerning the concepts listed at the beginning of this study about the management of information and knowledge in the field of museology and through information sciences, we could think of some tensions. How can we perceive the use of information considering the capacities of those responsible for it, the accessibility of digital art works, given the volatility of the art system itself in digital media? What is the role of data, information and knowledge management for the contribution of the materiality of digital art as access and re-exhibition of works in the content proposed by them?

We can initially address the issues of digital curatorship and mediation. When working with electronic and digital art, some technical and procedural aspects are required, such as some specific skills different from other artistic fields. The collaborative work is made of professionals from extra areas, such as software engineers, IT analysts, electronic engineers, members who should be consulted in the case of institutions which has not only the exhibition as a mission, but also work safeguarding.

Howard Besser (2014), in his article on the “longevity of electronic art”, proposes questions and scenarios that are rather specific. He problematizes the various forms of representation of digital art, as the internet, performances, installation art, “site-specific art”, and game arts. In each of these situations there will be distinctions of quantity, quality and typology of the

information presented in the works. On the other hand, there will always be a certain endemic unity applied to all these models of digital art, i.e., in the intentionality of the artist towards the work and the interactors that represent the participating public. The concerning about information as preservation or access will be recurrent.

For each case, the main aspects of a certain sense of work preservation should be taken into consideration. In net art works, maybe it will be essential to preserve the data and image processing applications in the WEB environment (Javascript, flash, etc) as well as a constant maintenance of the servers, images of the work in execution and empirical data of user’s experiences. In addition, it is important to record the original computational code base of the work, determining a special database for it, as well as unique physical interfaces.

From the perspective of digital audiovisual performances, the universe of data and information to be collected, recorded and considered, will have other aesthetic, technical and ethical surveys. For scripted, dependent or elaborated performances based on a script, the issues related to audio-visual records, photos and images, technical data of editing (montage/ assemblage), the artist’s own impressions on the action and, consequently, the public’s impressions on the exhibition will be stimulated. However, in performances considered generative or mutant because of the nonlinear algorithm of the computational codes, intentionally arranged this way, the complexity about the information becomes a special topic, in the sense of the qualitative and quantitative values that will be important to its preservation and access in the future.

According to these two cases, what are notoriously important to digital art as information and management in order to have its preservation and future access in a materialized, revisited and rediscovered way? Contextualization? Interpretation? In this analysis, we presented special topics for the museological practices of curatorship, mediation and information management to works of digital art.

It is noticeable that recent studies and institutions such as ZKM, DOCAM, ARS Electronica Center, demonstrate that among the norms and standards disseminated over time on aspects of digital media art, those in which curatorship and mediation have jointly collaborated with the collections in order to perceive the qualities of the information present in the

non-rigid processes in documentation practices, could achieve better results. This had an impact on resignified actions such as oral practices about the public and other participants in the exhibition including technicians and their experiences (MULLER, 2010). There is the strategy of “Print out Internet”, defended by Florian Cramer (EIKELNBOOM, 2010) with a similar connection research by Alessandro Ludovico from *Neural Magazine*, which has in the physical support of paper and printing a relation of double function - registering and transferring, being an aspect quite far from coding problems and digital protocols and its undeniable longevity.

Practices for thinking about information management with purposes of achieving materiality, preservation, memory and access, such as the virtuality of museums, works, performances and spaces as a whole, demonstrate other present forms of data arranged in a wide universe of contents. For this reason, besides memory be the theme of great interest of our 21st century, due to the mass of information produced in these scenarios, curatorship and mediation also gain special attention in our contemporary time.

By making some situational cuts it is possible to perceive that the standards are unfamiliar for some of the fields of information management, if they are thought from the museum, curatorial and mediation perspectives. This can, at one point, become experiences of diversity of performance and perception about data, information and knowledge. In the long run, in order to make accessible and re-view contexts, it is not possible to say whether they will be better driven by consensus or dissent from standards and norms. Ephemerality and digital obsolescence should not be justified to the point of information and its administration. In the field of the arts, a deeper context is embedded, regarding the representativeness aspects of a social, political, contemporary history under constant loss.

Final Considerations

We can finish this brief study by imagining some topics of interest as well as attention to the issue of information management on the part of museums, collections, artists, curators and mediators, extending to public and private managers, even the political spheres present in the system.

Firstly, it is salutary to mention that some studies and surveys on the management of museum spaces, mediation and curatorship have been made and

disseminated from the perspective of documentation and information access. There are some countries that are protagonists in the subject, but it is necessary that the network of practices and mainly museums policies increase, especially in Brazil.

Although we are attentive to the dynamics of the industry supports for solutions of the treatment, storage and flow of data and information, it is necessary in the field of the arts and its systems, to carry out initiatives that are more distant from the industrial and private canons, prioritizing the development of tools in open source and long term, mainly for the context of preservation and memory through indexing of data and assign adaptations to other intelligent and available systems, allowing the exchange of content in a constructive and complementary way.

The policies or the logic of accountability are widely disseminated in the international context. The artistic class, and especially the artists focused on new media, should allow themselves to be attentive to their documentation processes, as it is fundamental to the quality and “reality” of the accessibility of their digital works whenever they are requested. The ephemerality of devices must and will be a constant in the logic of technology. But cultural content and practices should not follow the meaning of symbolic ephemerality. Above all, the art constituted in a triad, “artist-work-public”, must perpetuate as an object and as information, for it portrays a unique context of a constituted and experienced historical time.

The same is not denied to the curator and mediation as a whole. Strict or generalized standards applied to forms, techniques, choice of information and concepts regarding documentary (in a wide sense) safeguarding can generate irreparable losses. Likewise, the absence of cultural, technical and conceptual contexts can lead to the same consequences, given the enormous range of disparate systems and agents that work in this scenario.

The centrality proposed for the issue along this article is based on the perspective of how information management is presented in the scope of the arts and culture through its systems, to the digitally native contents as of the Digital Arts. Will the preservation and memory of digital and digital arts produce representational resources that are capable of materializing from information managed by actors inserted in the established network? And yet, if the materialization of power structures over information and

digital collection and diffusion systems is materialized, will it be through contexts never predicted by its actors (artist and public in the case of digital arts)? These are questions putted and explored by this work, but that will be take place in more long and future considerations.

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symposium, book and articles, as well as participation in national and international events. Tadeus Mucelli, has been working (curator and entrepreneur) in the digital arts since 1998. He is the founder of the *Digital Art Festival – FAD* (since 2007). Organizer of publications; *FAD Catalog Art* (2011), *FAD Retrospectiva* with scientific essays (2012). In 2012 he was awarded the prize for the promotion of art by Secretary of Culture of the State of Minas Gerais - Visual Arts. In 2014, he was awarded the 1st Brazilian Economy Creative Award, through the Ministry of Culture from Brazil and the Official Government Office of Creative Economy - Cultural Expressions / Digital Art for the project of *EAT – Electronic Arts School*, focused on Art and Technology.

Weeping Bamboo: Resonances from Within – Exploring Indigenous Memory

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Abstract

Weeping Bamboo: Resonances from Within is an exploration of new forms of communicating and preserving indigenous forms of oral culture. It is a locational sound art piece offering a site-specific, reactive soundscape that is experienced in public at the Plaza de Bolívar of Manizales, Colombia. The project builds on the notion of resonance, the correlated vibration of bodies, to transmit sonic, tactile, and gestural experiences. It creates a rich layering of different stages of the history of Manizales through an augmented reality experience that merges environmental sounds with a spatialized soundscape. Through a custom-made headset a spatialized audio experience is transmitted by way of the bone structure of the skull, which makes it seem as if it were coming from the space within the listener's head. The multi-channel soundscape merges with the environmental sounds perceived through the ear. Beginning with narratives of indigenous myths in concert with today's environment, the project offers a narrative soundscape that is correlated with the actual geography of the plaza through a GPS location-tracking unit, inertial sensors and a microphone.

Keywords

Soundscape, Augmented Reality, Cultural Heritage, Embodied Interaction, Performance Studies, Interactive Media, Bone Conduction Sound.

Introduction

Weeping Bamboo: Resonances from Within is a locational sound art piece that explores the complex historic layering of the city of Manizales. The aim of the work is to make the layers of the past that are missing from the current situation perceivable. The architecture of the city shows rich traces from periods such as the Spanish conquest, which began in the sixteenth century, and the concrete and steel structures of today's modern buildings. The monument of the Bolívar-Condor is witness to the difficulties of gaining independence from the Spanish rule and the establishment of a new Colombia – but evidence of the indigenous cultures who used to inhabit the area do not have an expression in the current cityscape.

This absence is not only due to the colonial development, political power structures and the exploitation of the area through mining and coffee cultivation, it is also due to very different forms of knowing and transmission of cultural heritage of the indigenous cultures. It is this latter aspect that we are predominantly interested in and which we are aiming to address with the project *Weeping Bamboo: Resonances from Within*. To grasp the difference and practical incompatibility of the forms of knowledge preservation and transmission practiced by the indigenous and the cultures following the Spanish settlements Pierre Nora's distinction between *milieux de mémoire* and *lieux de mémoire* is useful.

Nora distinguishes what he calls "real memory," which is part of the social practice of so-called primitive or archaic societies and modern historiography. The first is continuously instantiated and reinvented in its transmission from the elders of the society to the younger, while the latter is "nothing more in fact than sifted and sorted historical traces" (Nora, 1989, p. 8). A *milieu de mémoire* is a place in which memory is lived as part of an ongoing social practice that keeps it alive. In such a setting the past does not disappear, it indeed does not even become 'past' because it is part of an extensive fabric of memory kept alive by the community. As Nora writes, "memory takes root in the concrete, in spaces, gestures, images and objects" (Nora, 1989, p. 9); in the concrete enactment memory stays alive and relevant. Separated from such milieu, it turns into separated, historically closed moments that are past. History, in this sense, is the collection of ordered traces of past events that have lost their quality of living memory. They are represented by documents, buildings, and monuments in order to extend the presence of the historic traces beyond their lived-in relevance. This detachment is due to what Nora called "the acceleration of history," the realization that everything changes and disappears as the result of an ever increasing speed of modernization.

We can use Nora's model of memory and history to distinguish the forms of knowledge of the indigenous and the colonial cultures. Knowledge in the indigenous culture is not a collection of facts separated from the flow of live and nature, it is not an externalized substance that could be transmitted through representations, it rather is a social practice that is bound to the locations and relies on them to remain alive and relevant. The notion informing this kind of knowledge is not comparable to the enlightenment idea of knowledge that can be infinitely extended and piled up in the form of facts and objects that are dissociated from living practice.

Storage Versus Performance

The gap between the two knowledge cultures is increasing with media and media proliferated lifestyles. Not only do media tend to assimilate cultural differences and alienate users from their environment (the use of GPS-supported navigation systems, augmented reality information overlays, or simply mobile communication devices removes people from the direct experience of their immediate environment, they do not have to orient themselves by finding and interpreting environmental cues anymore) also in terms of memory and knowledge the use of electronic records of digital media accentuates the differences between the two knowledge cultures. In an extension of the enlightenment paradigm our current culture conceives of "knowing" as storing. Nearly all information is stored digitally; with the effect that information that is not expressed in media-conform transcriptions is marginalized or excluded. This is in particular the case for oral cultures, procedural and performance-based knowledge. Most digital storage media are modeled on their pre-digital counterparts and implement equivalents of "documents" of various kinds, such as textual, visual, or sonic documents. They are tailored to function in support of a historiographical culture that cuts off memory inscriptions from their real-life source. Because performance does not fit this paradigm of inscription, it can only be preserved in secondary formats as recording, making it lose its immediate, lived character. This means that media exert a filtering effect on what can be known by determining what can enter the realm of codified and shared knowledge.

Filtering and suppression of oral and performative cultures was not just an artifact of the mnemonic apparatuses of different cultures, it was a way of exerting and preserving power. Diane Taylor states that during

the Spanish colonization of South and Middle America indigenous cultures were suppressed and marginalized as primitive and inferior because they had no practice of producing written historic records. Existing inscriptions were censored, "histories were burned and rewritten to suit the memorializing needs of those in power. The space of written culture then, as now, seemed easier to control than embodied culture" (Taylor, 2003, p. 17). The development of appropriate structures of integrating oral and performative forms of knowing therefore addresses several needs: It makes the social knowledge, memory and sense of identity that is transferred through acts of performance available beyond the select circles that partake in this practice and integrates it into body of shared knowledge. And it is a form of counter-acting the century-long forms of oppression of cultural forms that are considered inferior to the Western culture.

In search for such appropriate structures we can consider digital media as a promising avenue. Nothing in the technical framework of digital media necessitates the emulation of traditional storage media. Indeed, digital media have a lot in common with the ephemeral character of oral and performative knowledge transmission. Information is stored through permanent activation in electronic circuits and on constantly spinning disks. If the continuous supply of power is removed from such systems, the information is gone if it is not stored in traditional inscription-based forms as optical or magnetic patterns. The time-based structure of oral discourse and performance resonates with a timebased structure of digital media, in which operations are executed according to a rhythm that makes sure that the temporal relationship between operations is correct. The clock frequency is essential for the functioning of a computer and the synchronization of its actions.

Sympathetic Vibrations

This resemblance on a functional level is what inspired the media theorist Wolfgang Ernst to introduce the term "sonicity" to describe the a nexus between music and computing, which converge in their mathematical nature based on rhythm. He defines "sonicity" as the meeting point of time and technology (Ernst, 2016, p. 21), making it an appropriate tool for the analysis of temporalities. Sonic phenomena are the prototypical form of structuring and experiencing transient time. Ernst turns to oral poetry to formulate a reframed concept of information storage of past events. As he

writes, “the sonicist relationship between present and past is [...] not a relation between a present moment and an archive of the past but is based on a non-historicist figure of time which in itself is temporal: resonance” (Ernst, 2016a, p. 46).

We understand resonance for our purpose as a way of making a body resonate – i.e. move – in accordance with a movement pattern form the past. This movement can be both, the vibrations of a voice, a sound or the gestures of a performance. Taken in this sense, resonance is a way to rethink the forms of knowing of the computer, which are essentially accumulated storage, and the procedural, enactive forms of indigenous cultures in a new and convergent way. Resonance can be thought as the reactivation of a past movement, a past gesture, voice or a rhythm, which does not have to be transmitted in the form of an abstract inscription, but as a sympathetic vibration. *Weeping Bamboo: Resonances from Within* builds on this concept to make the marginalized forms of knowing of the indigenous cultures of the area resonate with the contemporary culture of today’s city.

Oral and Embodied Knowledge

When Antioquian colonists established their settlement and founded the city of Manizales in 1849, the aboriginal cultures there had already been largely destroyed by a few centuries of colonization. Early colonization began with – at first – not so hostile Spanish conquistador Jose Robles in 1539 and saw subsequent aggression and exploitation by Sebastián de Belacázar and his men from Peru. Before that time, the territory was inhabited by various native tribes such as the Pijos, Ansermas, Armas and notably the Quimbaya who had cultivated a tradition of highly sophisticated work with gold and pottery. W.H. Whites estimates the native population of the Cauca and Antioquia region in northern Colombia to have been somewhere between 2 million to 3 million people. Yet, the Quimbayas became extinct as a recognizable group around 1700 and their language remains unknown (Adelaar, 2004, p. 49).

Native cultures of Quimbaya and Carrapa in the Manizales area had a high degree of development and had attained a broad economic base with robust trade activities among various native nations who spoke different languages. Despite the flourishing cultural establishments that lasted thousands of years, with sophisticated agricultural and technical knowledge, for example about irrigation systems, the natives overall had

an entirely different approach regarding the materiality of their habitats and their environment. As chronicler Cieza de León notes, in contrast to the sophistication of other areas of cultural production, such as the utilization of natural irrigation routes, bridge systems, and an abundant agricultural production, the indigenous people did not put much work to their houses (Llano. 1990, pp. 14-15). White, a British anthropologist, mentions that this aspect of the native cultures in the Manizales area is consistent with the indigenous cultures throughout the North-Western provinces of South America: they did not build monuments and lasting buildings as European cultures would have considered it foundational for the transmission and preservation of cultural identity and heritage.

White argues that this material avoidance is not due to the lack of sophistication of the civilization, but the collective wish of the cultures to hand down their memories to their future generations in respect of their origins (White, 1884, p. 149). The origins of the indigenous people are profoundly linked to what they consider sacred nature locations and the close kinship between the human culture and nature. So preservation of nature is essential to their cultural identity. Cultural rituals are performed to communicate with nature and to reinstate and embody the relationship. Sacred locations are the depository of their knowledge and memories that is essential to continue their heritage to the future generation. This relationship to the nature and practices of embodied knowledge through sacred locations, rituals and oral traditions are characteristics of the surviving aboriginal tribal communities such as Kogi and U’wa in contemporary Colombia.

Weeping Bamboo: Resonances from Within

The project *Weeping Bamboo: Resonances from Within* is an attempt to communicate these traits of the indigenous cultures in a close tangible relationship between aural experience and the specific properties of a location. Building on the notion of *resonance* as a way of transmitting sonic and gestural experiences the project creates a reactive soundscape that can be experienced in the public space. Choosing the Plaza de Bolívar, the project is placed in the historic center of Manizales where the multitude of historic layers constituting the city becomes most tangible and condensed. The physically present traces in which the history of the city manifests, the surrounding buildings, the monument, the

people, the traffic, are the site of a locational sound art piece, which fuses these traces with an experience of indigenous knowledge and philosophy.

The title Weeping Bamboo is inspired by the indigenous Quimbaya burial culture found in the Manizales area, where the tombs were fenced with bamboo poles with holes cut into their stems. As aeolian instruments, they were humming and weeping evocative whistles to the winds. The only way we know of this tradition is through the written records of the colonial witnesses. These records tell about the buried aspect of the poetic and artistic nature of the culture that disappeared and about the fragility of the culture that has been extinguished without vestige of its existence. The indigenous cultural heritage was not preserved in material artifacts, it was a living memory and tradition of practice in unison with the nature; the songs of the Aeolian instruments relied on the wind as most of the myths and narratives relied on oral transmission and a spiritual enactment in sacred sites.

The project presents an augmented sound layer that is superposed on the geographic reality of the current plaza. In a locational experience it communicates elements of the disappeared indigenous culture, such as myth of the origin of the world from water and spirit and the weeping bamboo instruments from indigenous burial culture, in conjunction with the development of the local coffee culture during global colonization, and the reformation toward sustainable coffee cultivation by local farmers in recent history. The soundscape is the result of intensive site-specific research and sonic experiments with authentic as well as recreated instruments, such as the aeolian bamboo instruments.

Experience Set-up

Weeping Bamboo: Resonances from Within is experienced through a portable headset with four channels of spatialized audio. The headset is equipped with four bone-conduction transducers located on the temples, the forehead and the back of the head, transmitting the audio through vibrations applied to the skull which are perceived by the cochlear, bypassing the pinna and the middle ear. This technique allows the listener to hear the spatial differentiation of the sound and locate its directionality while perceiving it as coming from the inner space of the head. The spatial distribution of the sounds is correlated with the actual geography of the plaza in which the listener is tracked through a

GPS location sensing system. Head movements of the listener and the direction she is looking in are tracked through a compass and an inertial sensing unit so that a stable relationship between the listener's position in space and the spatial distribution of the sounds can be achieved.

With its sensors the headset responds to the body movement of the listener, shaping the soundscape in response to location and movement of the listener and in response to the loudness of the environment, captured through a built-in microphone. All data from the sensors and the microphone are processed by a Raspberry Pi computer, which calculates the soundscape in correspondence to the position and situation of the user. The software uses a combination of python and Pure Data to process the sensor data and generate the soundscape. The hardware setup is designed such that it is small and has low power consumption. Battery-powered operation and the possibility to integrate all components into a wearable head-gear were important constraints.

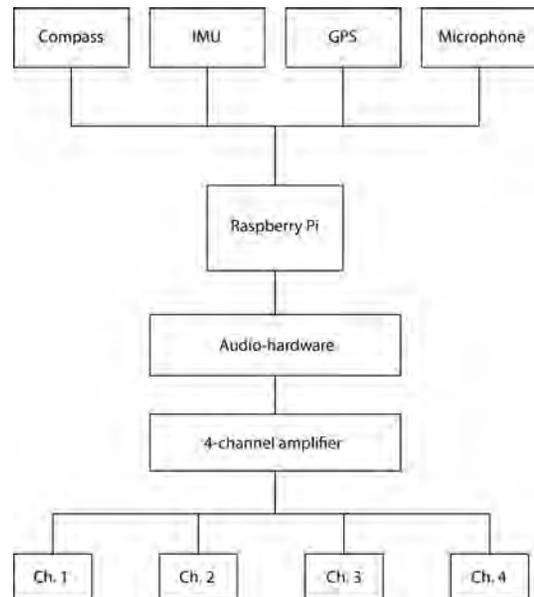


Figure 1. Diagram of the components for environmental and audio data processing

The experience unfolds as a combination of internal and external landscape of sounds and voices that incite the user to feel the tactility of sound and to enact

gestures in tune with the experience. The listener is led to explore the space of the Plaza de Bolivar though the augmented perspective of the soundscape. What starts as an exploration turns gradually into a performance and an embodied relationship with the environment. Through this open and reactive concept *Weeping Bamboo: Resonances from Within* effectively avoids the detachment of a digital media in which the “body is poised to disappear in a virtual space that eludes embodiment” (Taylor, 2003, p. 16). Instead, the experience unfolds in unison with the environment.

The use of bone conduction transducers leaves the listener’s ear open to perceive all environmental sounds as normal. The layers of the environmental sounds and the soundscape merge in the perceptual system of the listener, forming a type of augmented reality experience. In this sense, the project extends a line of research from other augmented reality art works, standing in a tradition of interventionist public art, as practiced for example by artists such as the Manifest.AR group. The focus on sound and the avoidance of image overlays underlines the notion of balanced harmonies and sympathetic vibration instead of the virtual insertion of imagery. The augmented reality layer in our project is not inserted as a foreign layer of separation, distancing the viewer from the environment, instead we are focusing on a close and immediate connection between listener and what is going on around him. As Frauke Behrend’s study of locational media suggests, the sonic layer is more appropriate for our purpose, because “the visual focus in the media world often implies a distant observer - this does not work for sound and locative media as these rely on immersion, not distance” (Behrendt, 2012, p. 288).

The project aims to reinsert the lost forms of knowledge of the indigenous culture to the current environment and merge them with contemporary forms of knowledge. Our goal is to foster a forward-looking synthesis in support of sustainable forms of living in balance with nature and today’s environment.

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Andreas Kratky is a media artist and assistant professor in the Interactive Media and Games Division and the Media Arts+Practice Division of the University of Southern California’s School of Cinematic Arts. Kratky’s work focuses on new forms of cinema and the poetics of the database. It spans the arts, human computer interaction and digital humanities and comprises several award winning media art projects like “Bleeding Through – Layers of Los Angeles 1920-1986”, the algorithmic cinema system “Soft Cinema”, and the interactive opera “The Jew of Malta”. Kratky’s work has been shown internationally in Europe, USA, Japan, and Korea in institutions like the ICA in London, ICC in Tokyo, HDKW in Berlin, Centre George Pompidou in Paris, and REDCAT in Los Angeles. For his work on the modeling software “Xfrog” Kratky was nominated for the Science and Technology Award of the Academy of Motion Picture Art and Sciences.

Juri Hwang is a media artist, researcher and currently a PHD candidate in Interdisciplinary Media Arts and Practice in University of Southern California. Her research focuses on sonic culture and the role of media in the formation of memory. Engaging in an analysis of the cultural shifts of media usage and technologies she investigates the relationship between means of representation and how we perceive and remember.

Through the analysis of still images, moving images, stereoscopic 3D images and sound, her work develops a sensitivity toward the artifacts that media introduce into our perceptual relationship to our environment. Her work includes the award winning project “Bleeding Through Layers of Los Angeles: 1920-1986”, “Three Winters in the Sun: Einstein in California” and “Venture to the Interior.” Juri’s current projects comprise “Somatic Echo,” an embodied sonic experience engaging bone conducted sound, and “Nightfield,” a sound installation exploring the immersive and embodied nature of sonic memory.

Soundscape as a Pedagogical and Reflective Tool for the Preservation, Resignification, and Creation of Narratives about the Colombian Coffee Cultural Landscape: visual arts Laboratories of the Ministry of Culture

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Abstract

The purpose of this paper is to present the theoretical framework, methodology, and results of a laboratory developed in the Coffee Cultural Landscape, which had as the main objective to positively influence the quality of life of the communities through artistic and cultural practices from its sound dimension. The Coffee Cultural Landscape was proclaimed by UNESCO in 2010 as Cultural Heritage of Humanity. This is a reference framework that defines a region of Colombia from an economic activity that has shaped it culturally. This spatial unit suggests new strategies and tools for the knowledge and appropriation of this heritage. Therefore, the sound dimension as a fundamental expression of the identity of the regions is an essential element in the conformation of a territory.

Keywords

Soundscape, Colombian Coffee Cultural Landscape, Immaterial Heritage, Methodology, Pedagogical Tools, Re-Signification, Sonic Identity

REC-On

This article presents the theoretical framework, methodology, and results of a four-year Laboratory with the communities of the so-called Colombian Coffee Cultural Landscape from its sound dimension. The work was located in municipalities of Sevilla, Caicedonia, Riofrio and Trujillo, and carried out within the framework of the ‘Visual Arts Laboratories’ promoted and financed by the Ministry of Culture of Colombia, through which an interdisciplinary group of teachers and researchers linked to Icesi University developed a series of pedagogical workshops.

Each laboratory has had the participation of very diverse groups: high school students, university students, artists and inhabitants of rural sectors. The diversity of participants has led us to develop particular methodologies that seek to understand the sensitivity of each group in order to appropriate the Coffee Cultural Landscape through listening and the representation

of the sound. The overall objective of the laboratory program is to positively influence the quality of life of the communities through artistic and cultural practices. For the Ministry, it is fundamental to promote “cultural diversity, in the light of the contemporary artistic universe, particularly in relation to the concepts: *artistic creation as a process of knowledge and research; aesthetic experience, artistic practice and interdisciplinarity; pedagogy as a source of criteria of value, management and social and cultural transformation*” (Ministerio de Cultura, 2014).

Proclaimed by Unesco in 2010 as Cultural Heritage of Humanity, The Coffee Cultural Landscape is a reference framework that defines a region of Colombia from an economic activity that has shaped it culturally. This spatial reference unit suggests new strategies and tools for the knowledge and appropriation of this heritage. Therefore, the sound dimension as a fundamental expression of the identity of the regions is an essential element in the conformation of a territory. Leisure customs with own music, accents, sounds of the machinery used in the coffee process, or of the fauna and nature, are unique acoustic manifestations that have molded the aural landscape of the region.

In this way, the definition of sound as part of the landscape, as an artistic material and as a field of study (Schafer, 1994), serves us as a starting point for approaching the landscape of a group of populations of the coffee region. For Schafer (1994), the soundscape is a great musical composition in which all citizens, including composers, architects, sociologists or psychologists, must actively participate in the construction of a balanced environment. In addition to the theoretical contribution, the Canadian composer finds in pedagogy a means of interdisciplinary integration between the scientific and the artistic (Schafer, 1994: 205). He also proposed didactic strategies to raise

awareness about the sound environment (Schafer, 1984, 1992, 2006), opening a path to the integration of art and the environment from a creative perspective.

With this reference framework, two lines of work were drawn: on the one hand the re-signification of the landscape from processes of community participation and on the other, the creation of products mediated by sound. Defined the sound landscape as a unit of analysis and media practice, pedagogy as a tool for participation and creation, and the Coffee Cultural Landscape as a field of action, below are our conclusions and considerations about the challenge of bringing the sensitivity of sound to a significant territory for the Colombian imaginary.

To Make, Participate and Interact

The Visual Arts Laboratories are experimentation spaces that pose a particular way of understanding artistic practices, due to the educational approach and social transmission of knowledge promoted by the Ministry of Culture. In our case, the challenge had a special nuance because we worked the sound as the center of our pedagogical experience, which meant the design of exercises and dynamics more on the sensorial and aesthetic side than the artistic understood as a “production regime” (Ranciere, 2012).

This challenge was taken into account from the design of the call for participants, since it aimed to offer workshops that could connect specific expectations of rural communities with a subject that, despite being close in experiential terms, is little known: the sound-scape. In this sense, the previous recognition of the social characteristics of the territory in which the workshops would be carried out allowed us to set pedagogical objectives for each municipality. At this point, it is important to highlight the interdisciplinarity of the team because sociologists and anthropologists contributed a methodology that was conceived as a field of intervention in individual and collective terms, and not only as an added *contextual reference framework* that should justify artistic and pedagogical practice (Laddaga, 2006).

Regarding the theme of the workshops, (the soundscape and its relationship with the Coffee Cultural Landscape), it was sought to strengthen the community sceneries as a means of encounter between the interested residents. For this reason, we designed experimental activities and sensorial recognition of sound agreed as a physical and social phenomenon that mediates and

reproduces relationships with the environment.

These activities constituted exercises of conceptual appropriation, in which the own experience had to serve as individual support to understand the soundscape as an inspiring element of symbols around a territory. Such conceptual appropriation should lead the participants to the development and creation of proposals that would account for their meditations about sound. From this perspective, cartographies, mobile applications, chronicles, sound drifts, radio tables and other experiences that basically built narratives and alternative discourses to the predominant communicative and aesthetic forms in this type of pedagogical and aesthetic practices (Ladagga, 2010).

For the above mentioned, our work focused on facilitating methods to *make, participate and interact* with the soundscape from a natural listening or mediated by technology, from the recognition of the signs that shape the relationships of each of the territories visited (Figure 1).



Figure 1. Recording at Riofrio

This process completed its cycle at the end of each laboratory when the participants presented their work to the community to show it, that is to say, that they were the ones who finally materialized the aesthetic and pedagogical experience within their territory.

Re-signify and Create

Some of the municipalities belonging to the Coffee Cultural Landscape have been affected by the Colombian armed conflict and are associated with violence scenarios. This fact conditions the representation of its inhabitants and the imaginary that Colombians have about these places. One of the main objectives of the laboratories has been to promote the re-signification of the territory

through art and its relation to cultural practices. Through sensitization and recognition exercises, the workshops have sought to make the dwellers of the Coffee Cultural Landscape identify the cultural richness of the place they inhabit and appropriate their territory in order to reconstruct their history. Given the differences and particularities of the participants in the workshops, the pedagogical tools were designed to exploit the knowledge that each group possessed about their territory and to introduce them to an aesthetic dimension little explored in their daily life.

One of the tools used to achieve this objective was the collective creation of social cartographies as a way of sound-spatial recognition of the territory (Figure 2).



Figure 2. Participant presenting cartography

At first, the participants graphically represented the limits of the space they inhabit daily, appealing to their imagination and to the individual and collective referents. In this way, it was possible to identify key places, actors, and objects in their relationship with space. Then, they were asked to locate within the map those sounds that they considered pleasant, upsetting and representative. Finally, they were invited to remember and capture the sounds that had disappeared with the passage of time. This activity sought to deepen the group in the sound dimension of the place they inhabit so that, through memory and their daily experiences, they could recognize that the landscape of which they are part manifests itself in various ways. The familiarity with the environment may result in a lack of awareness.

Another tool of recognition and dialogue used to make a first real and audible approach to the environment was the sound walk. This collective exercise was the starting

point for the participants to perform sonographies of objects and landscapes. Technological mediation offered a new type of listening that helps to distance them from the everyday allowing them to initiate a cleaning of the ears. The diversity of microphones and recording techniques exposed the participants to new perspectives on the sounds that make up their landscape.

During the walks, the inhabitants were identifying sounds that caught their attention, and at while recording, they were also encouraged to comment on the meaning that these sounds had within the territory. The exercise resulted in a sensitization to the soundscape of the place and recognition of acoustic manifestations of their daily life worthy of rescuing or representing. After the exercises and to great surprise, the participants discovered that the territory is not mute, that it has a soundtrack that accompanies their daily life and that is the hallmark of their cultural legacy. They were also aware that the landscape, as a relational unit with great aesthetic power, expresses with sound other elements of cultural dynamics worth preserving.

One of the most interesting cases was the laboratory in Trujillo. This municipality carries with it a strong historical load of violence and terror as it was the scene of one of the largest massacres in the country's history. Our aim with the workshops was to offer participants the opportunity to build a different narrative of their territory focusing on the natural diversity, cultural practices and human quality of their people. Through the creation of sound chronicles, the participants showed a different face of their municipality, a version that few know, given that the narrative that has been imposed is that of violence.

While we are aware that a process of re-signification of the territory is something that takes time and constant work with the community, we can attest that these laboratories serve as a starting point so that the inhabitants of the Coffee Cultural Landscape can perceive and recognize their territory in various ways, and can discover that behind episodes of violence and conflict there is a cultural treasure that prevails, which manifests itself in many ways, and can be used to tell a different story.

For this reason, the development of creative proposals, another of the specific objectives of the laboratories, has found in the exercises of recognition of the soundscape an investigative instance. The sensitization processes, developed from the pedagogical part, seek to stimulate a wider appreciation of the landscape in order for the participants

to construct new representations of the coffee region.

In this group of participants, there have been artists, university students, musicians and communicators among the most common profiles, which enable a great variety of creative exercises. Within these practices, we find several types of works that cross the musical, the artistic and the anthropological. In the first instance, we find sound compositions that use sonographies of the landscape or that use audios as samples to integrate them into musical pieces. This type of creations deepens in aesthetic qualities of the sound, combining them with cultural aspects that enrich the meanings of the pieces. Delicate sound textures of nature collected from natural parks at dawn, everyday sounds or melodies and rhythms typical of the region are examples of the materials used.

In addition to registry possibilities provided by re-cording technology, some participants discovered their power as an extension of the ear thanks to the field recording practices performed in the workshops. This is the case of an exercise of sound drift guided by a powerful shotgun microphone that as a sonic telescope explored details of the soundscape to scrutinize interesting resonances of the aural horizon in Caicedonia (Figure 3). The practice was accompanied by the photographic record that presented images of the places where the sounds were identified and tagged. Subsequently, in an exhibition held in the best-known coffee shop in the municipality, the inhabitants were able to hear and see images of their family environment from a new perspective.

Other works explored the identity of the places of the region, deepening in the daily life from two main approaches. On the one hand, the sound recognition of the material culture represented by the various processes that the coffee suffers from its collection



Figure 3. Art practical in Caicedonia

until reaching the cup. This sound story exposes different timbres from the moment the grain is dried until it is milled, processed in the coffee machine and drunk. All these sounds belong to the daily life of the municipalities and symbolize traditional routines. On the other hand, are the anthropological approaches that investigate in the social narratives looking for the acoustic expression of the interactions that occur through the conversations, the coffee trade, the games of chance, and drinking a coffee. These common acts are modeling traditions that are repeated for generations and leave a mark on the soundscape.

However, creation, as an essential dimension of laboratories, is not limited to the production of sensitive experiences through sound compositions or the creation of art objects, it has also stimulated projects that use ICT. An example is the development of a cell phone application consisting of a sound map of the municipality of Caicedonia. The application, connected with Google Maps, allows future users a relationship with the intangible heritage in a playful way and proposes to listen, identify and record their own sounds.

The projects reviewed above have been identified as results of a methodological exploration that, by insisting on creative stimulation and the production of sensitive experiences around sound, has identified the potentiality of collaborative work. Sensitization exercises become collective pieces of creation as when all members of the laboratory chose pieces from a collection of antique objects housed in our meeting space. Old typewriters, autochthonous percussion instruments, bells, tools and so on, an infinity of fragments of past material culture, were reconverted into musical instruments to extract sounds from another era. Altogether a score was written in which each participant chose his place of intervention as well as the rhythmic pattern of his contribution. The piece started on the count of four.

The collaboration scheme in which participants and we worked hand in hand was also used for the construction of platforms for dissemination of the laboratory results. In the last edition (2016) a socialization strategy called “radio table” was implemented in which, in addition to transmitting the work done (musical podcasts, chronicles, soundscapes and sound postcards), the microphone was opened to all people present with the purpose of constructing a plural narrative and close to the passers-by and people who that day was in the main plaza of Sevilla.

Based on the traditional format of live radio broadcasting, the possibilities of interaction that can be generated in the public space once the daily routine is intervened were tested. A new amplified soundscape was superimposed on the Sunday square for *broadcast* the creations and, especially the reflections that can arise from asking what it means to relate and live in a territory denominated Coffee Cultural Landscape.

REC-Off

After four years of work, it became clear that the public participating in the different laboratories showed two predominant profiles. One group was represented by young artists or students with a high level of schooling and the other by inhabitants of the municipalities and their rural sector, with a strong community relationship (Figure 4). This social division led us to consider two aspects: on the one hand that the group of artists and university students would start creating processes with products of a symbolic character while the inhabitants with more roots in the community would be receivers of the pedagogical tools designed for the sensitization and resignification of the landscape.

Even so, it is important to try to blur the division, and although it is true that the products of each of the groups make evident the type of relationship with the landscape, in the last laboratory it was sought that the processes of signification and creation were integrated. This was achieved by turning the group into a manager of radio content created by them. Through the recording of soundscapes and podcasts about the cultural practices of the region, the participants worked collaboratively in what would be a radio program presented live in the main square of one of the municipalities, Sevilla.



Figure 4. Listening exercise in rural area

The use of sound as a pedagogical tool offers the possibility of articulating cultural values from different perspectives. In the first instance, as a dynamizing agent of daily practices of re-signification and appropriation of collective memory by the inhabitants of a territory. From another perspective and as a reference of artistic production, it allows the development of creative methodologies that derive in transmedia and collaborative projects, focused on creating aesthetic experiences localized and attuned to specific cultural practices.

From the evaluation processes conducted with the participants at the end of each laboratory, we can conclude that the new landscape readings, suggested by the sound and its technological mediations, make visible patrimonial values that have been hidden by daily life and by globalization. However, hardware shortcomings make it difficult to take better advantage of quality sound recording technologies. It is a reality that these pedagogical processes should be accompanied by programs of equipping since the use of recorders and microphones is restricted to the duration of the laboratory leaving a gap difficult to fill.

Finally, in terms of community processes, sound as a communicative medium drives the emergence of stories, formats, and narratives that include other ways of expression and memory. To the extent that these stories are disseminated, thanks to digital diffusion tools, and to foster similar experiences by the participants as replicating agents, we can say that the objective of the visual arts laboratories has been fulfilled. To verify this, it is important to return to the municipalities after the track that the laboratory has left in those communities.

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Preservation of Material and Immaterial Heritage through Interactive and Collaborative Artistic Interventions

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Abstract

The present article elaborates on the preservation of material and immaterial heritage through the production of community-based artistic propositions in Media Art in order to activate the discursive and enunciative potential of blighted urban neighbourhoods rendered invisible. We consider the media art project *Rede_em_Rede 2015/2016* (*Network_in_Network 2015/2016*) based on the concepts of the territory in Gilles Deleuze and Felix Guattari and the actor network theory developed by Bruno Latour. This project builds upon and continues the work of previous community media art interventions, *Aircity:arte#ocupSM 2012* and *Aircity:arte#ocupSM 2013*. The three projects were developed in the Vila Belga cultural and historical heritage neighbourhood of Santa Maria/RS, Brazil.

Keywords

Media Art, Heritage, Territory, Network, Interactive, Collaborative, Intervention, Narratives, Actant.

Introduction

The *Rede_em_Rede 2015/2016* (*Network_in_Network 2015/2016*) project builds and continues the work of *Aircity: arte#ocupSM 2012* and *Aircity:arte#ocupSM 2013*. These projects involve the Vila Belga¹ community in Santa Maria/Brazil and seek to problematise the notion of territory in order to open debate on its social, political, artistic and technological implications, as well as the notion of network in a collaborative social media proposal.

Thus, we question how relations occupy and participate within each other to become established and how networks become woven from informational and urban territories and immanent technological territorializations and the role of social, political and economic dynamics as complex actors in the production of these vital networks—both in the sense of

indispensable and living. Subjectile entities arise from the territory but they do so in ways that are not usually considered subjectile, such as in the timbre of sounds, in visual textures, in affective smells, in tactile images and the adaptation of our steps to the terrain as the active creation of spaces and temporalities as the familiar of the common. And these traces and trails left behind constitute the nomadic net-work of memorial pathways through the landscape of an experiential cartography.

So that is produced in a territory are not isolated subjects, but creative assemblages of human and non-human bodies, of collective discourses, of techniques and gestures which extend, expand and extrapolate subjectile constitutions and which, in accordance with Deleuze, “proceed by intersections, crossings of lines, points of encounter in the middle: there is no subject, but instead collective assemblages of enunciation” (Deleuze & Parnet, 2007, p. 28). In this way, agency is seen as collective, as an expression of the common, since it is not determined by the particular needs or intentions of individuals, but by an interdependent, co-aris-ing social system that involves the participation of human and non-human becomings.

The work of French philosophers Gilles Deleuze and Félix Guattari (1987) develops the conceptual apparatus where the subjectile is considered as an effect of individuation, rather than as a cause. They develop a means of thought that allows one to work with transitory elements, with the unexpected dynamics of flux, as well as postulate the concretized workings of the interactive functional dynamic of the relation between fields of activity. For Deleuze and Guattari (1987), the relations which constitute the linkages between fields are not static or permanent: they are dynamic beings, machinic assemblages, which create expanses of operational fields they call territories. “The spatial, material and psychological components that constitute or deconsti-

¹ Vila Belga is a cultural and historical heritage of Santa Maria/RS, Brazil (lei municipal n°2983/88, de 6 de janeiro de 1988).

tute a society, group, or individual” seen as territories are of key importance to our project because they are the “apparatuses that comprise history as a lived, experiential assemblage of events and circumstances” (Message in Parr, 2005,280).

Technology defines an active and vital realm of potential not as a means but as enabling ecology which interlinks aesthetic and ethical concerns (Brunner 2013). From the stand-points elaborated by Gilbert Simondon (1989) and Felix Guattari (1992) as to the participation of technics within human and non-human assemblages within associated milieus and post-media ecologies, digital technologies provide popular access to the means of production of professional quality content whereas web-based social media provide unprecedented possibilities for dissemination and distribution of cultural production. And to harness their full potential, we need to see them as the intersection of social, mental and environmental ecologies expressive of praxis which “will lead to a reframing and a re-composition of the goals of the emancipatory struggles” (Guattari, 2000) through differential media (Murphie, 2003).

Vila Belga, Santa Maria, RS, Brazil

Vila Belga² is a neighbourhood of the city of Santa Maria, in Rio Grande do Sul, the southernmost state of Brazil. The city currently has 270,000 inhabitants and its economy is based on services, light industry, government, military, education and agriculture. In 1874, the first section of railroad in the State of Rio Grande do Sul was inaugurated, linking the capital of Porto Alegre and the City of São Leopoldo, and expanded from there (Figure 3). In order to realise these works, foreign investment was necessary to finance the construction and machinery, as demonstrated by the Belgian funding which occasioned the construction of Vila Belga in the city of Santa Maria, RS.

The Vila Belga neighbourhood was built between 1901 and 1903 along European architectural lines as a railroad community to house and accommodate Belgian immigrants destined to work in the offices and workshops of the Belgian “Compagnie Auxiliaire de Chemins de Fer au Brésil”. In creating Vila Belga, the concern of all parties involved was not one of simply producing housing for the workers but of genuinely induce the emergence of a community (Oliveira, Hildebrand & Efrain, 2013, p.1).

In the statements made by members of the community, we frequently encounter the assertion that the train was the catalyst at the heart of the community, giving it significance and investing it with a certain importance and dignity: so that the affirming and empowering common emerges from the collective machinic assemblage arising between, within and through the community enmeshed with the railway, the human society and the machinery of rail, as a coherent, functional entity.

Through the railway cooperative and the railway workers’ union, the Vila Belga rail community took care of its own. The railway cooperative saw to the general needs of the community, such as food, clothing, furniture etc. And together with the rail company, they set up technical schools for men and schools for women, built a hospital to serve the community, created a recreational social club, etc so that a sustainable ecology with a beneficent quality of life was in place. The railroad and the trains set the pace to the lives of the residents, determined the rhythm of the community’s activities in accordance to the timetable of the trains’ constant steam whistles, and kept active the productive energies of the community as an extension of the workings of the railway as an engine itself. According to Deleuze and Guattari, “machines are always singular keys that opens or closes an assemblage, a territory” (Deleuze & Guattari, 1994, p. 334). However, after the dissolution of the railroad in 1997, Santa Maria was sidelined and as a result the station and work-shops lost their *raison d’être*, and were thus progressively abandoned. (Oliveira, Hildebrand & Efrain, 2013, p.1). Most studies and research on the railroad in the state of Rio Grande do Sul, and in Brazil in general, focus on the crisis and the dismantling of the railway network. Nonetheless, our research aims to give voice and visibility to other voices and actors that are part of this network. We emphasise other developments that emerge from these potentials, actions that occur at a smaller scale but that transform and produce the commons within these communities.

Aircity: arte#ocupaSM 2012/2013

Thus, in May 2012, various buildings of the now defunct Vila Belga railroad station were occupied by artists, academics and multi-disciplinary researchers taking part in the arte#ocupaSM³ research/creation event for 5 days of intense artistic coexistence to better understand

² https://pt.wikipedia.org/wiki/Vila_Belga

³ <http://arteocupasm.wordpress.com>

the process of urban decay as memorial disintegration (Oliveira, Hildebrand & Efrain, 2013, p.1). As part of the occupation, an interactive immersive installation *Aircity:arte#ocupaSM 2012* was created which occupied the now abandoned main administration building of the Vila Belga Railway. The drive of the project was to activate the “invisible space” as intangible heritage or, in other words, to awaken and activate the virtual aspect of physical location as memorial reconstruction by combining social, political and artistic research/creation methods with digital devices (Oliveira, Hildebrand & Efrain, 2013, p.1). And to this effect, a group of artists and interdisciplinary researchers, namely, Renato Hermes Hildebrand, Andréia Machado Oliveira, and Daniel Paz from Brazil and Efrain Foglia and Jordi Sala from Spain, proposed new possibilities of deriving meaning from the analysis and interpretation of interstitial relations arising between narratives, spatiality, temporality, and urban territorialities by exploring the possibilities of narratives created by media art interventions in virtual and physical space.

Researchers conducted on-site video and audio sampling, recorded ambient sounds and collected digital images to composite with video interviews of former railway employees and residents of the neighbourhood. (Oliveira, Hildebrand & Efrain, 2013, p. 2). But at odds with common sense expectations, the rescue of heritage was not to be solely articulated on the preservation of physical structures. The movement behind heritage conservation in a place such as the City of Santa Maria is not to be restricted to physical spaces or to buildings. When one tries to conserve a site, we must go beyond the architecture and the floor-plans in order to visualise the celerity and slowness of movements, the flow of humours, of luminosity, of the trailings of steps, of memories and recollections, of the imaginary inhabiting that location.

A territory does not consolidate itself according to a physical delimitation, but according to propositions of occupation and engagement, of encounters and separations that take place, of the assemblages between bodies, to rhythms, affective attunements, attractions and repulsions that circulate on, through and within a particular process of territorialization. To discern the various elements which compose on that territory is not sufficient to understand it. The modes of composition and machinic assemblages between constituents must be recognized and the various linkages and bridgings which

communicate and inform them as bodies which compose relation must be comprehended. As Deleuze and Guattari posit, “...we are not interested in characteristics; what interests us are modes of expansion, propagation, occupation, contagion, peopling” (1994, p.239).

The second phase of the artwork project consisted in the gathering of data on-site which could be made to work with software, technologies and techniques developed for other *AirCity*⁴ projects in Sao Paolo and Barcelona. This involved the use of mobile devices, wireless networking, audio re-cording and mapping—all integrated through *PureData* (Oliveira, Hildebrand & Efrain, 2013, p. 2).

The *aircity: #ocupaSM – 2013* project was developed by the artists Hermes Renato Hildebrand, Daniel Paz and Andreia Oliveira combines augmented reality, digital photography, video and audio and underscores the hybrid character of the sited and situational event. During the event, a collective mapping of the event was proposed to the participants and so QR codes were distributed. Participants recorded audio and video, took photographs and documented in various modalities the surroundings and happenings at a particular site. Subsequently, the QR codes were physically affixed to the actual location where the documentation took place and a copy was also posted to a larger mosaic of QR codes which combined the entire collection of documented sites. This allowed the configuration of the project as site-specific interactive installation and as a centralised exhibition which enabled the visualisation of all the documentation (photos, video, audio, geo-references, and *Photosynth* composites) through any mobile device with a QR reader app.

The media used in projects such as *AirCity* allow us to visualise data on a specific location, augment local information and provide visibility on the the cyberspace which is being mapped, mixing physical space and electronic data. Propositions such as this one facilitate the production of informational territories which we are emphasising in this research which aggregate in cyberspace aesthetic experiences and another perspective on the city.

Rede em Rede/2015-2016

The majority of studies and research carried out on the railway in the State of Rio Grande do Sul in Brazil concentrates on the dismantling on the railroad network

⁴ <http://www.mobilitylab.net/aircity/>.

in the country. A need was felt to grant visibility and provide a voice to other actors meshed within that relational web. And although the various communities were not completely silenced by the dismantling of their physical networks, they were still following their own course albeit without the intensity of the heyday of railway transport. Activities and connections were barely alive, and they required new perspectives and technological outlooks to re-establish their former dynamism. The problem here was to re-establish the network which was broken by the privatisation of the rail-way and the cancellation of passenger service. As such, various questions arose: How can the creation of digital narratives in cyberspace, arising from an artistic poesis, promote the rescue and documentation of histories of transformation within the city? Can a network of communicational empowerment and affirmation which existed with the railway net-work be re-activated through the activation of on-line net-works?

Pressing on with the research of the aircity: arte#ocupaSM/2012 and aircity:arte#ocupaSM/2013 propositions at Vila Belga, Tatiana Guerche, a researcher in Visual Poetics from the Graduate Program in Visual Arts at the Federal University of Santa Maria took on the challenge. Her project

*Rede_em_Rede*⁵ (*Network in Network*) proposes a social media network project engaging the almost defunct regional networks in order to create narratives through the collaboration of various communities involved with the railway by engaging popularly available social networking apps such as Instagram⁶, Facebook, YouTube, Google Maps⁷, and a website on the Wix.com⁸ platform. With the site, it was possible to determine the convergence and ascertain the links between the various networks, as well as facilitating the writing of the blog, structure the image and video gallery and a link to the collaborative Googlemap REDE_EM_REDE.

The mapping of the digital narratives traces the local visits and interviews, the online surveys according to social network markers and geolocation tags published by users. The mapping of digital narratives could be accomplished through local visits and interviews, social

network markers from online surveys and through geolocation tags published by users. As such, mobile devices corroborate the principles of cyberculture which assert that anyone can generate data, produce photographic and video images and subsequently make them available online. Through the interaction of mobile devices, a network of senders is created, which in turn form communities, political action, and modify social and communicational practices.

Through these proposals, the research was able to reactivate geographic networks—almost stagnant and deactivated—through their re-establishment in cyberspace as informational social networks. The narratives arising from these digital milieus or cyber environments provide a purposed relational nexus around heritage that gives them new life and visibility. What were only dispersed, fragmented and scattered initiatives would now be provided with a rallying focus which fleshes the virtual and embodies the consistence of the common. “The problem of *consistency* concerns the manner in which the components of a territorial assemblage hold together” (Deleuze & Guattari, 1994, p. 327). The narratives arising from these digital milieus or cyber environments provide a purposed relational nexus around heritage that gives them new life and visibility. What were only dispersed, fragmented and scattered initiatives are now provided with a common rallying focus which fleshes the relations and embodies consistence.

With the goal of reactivating the network of cities tied to railway operations, the cities of Santiago and São Gabriel in the state of Rio Grande do Sul were linked to the Vila Belga/Santa Maria project. In each municipality, we can discern how different styles of city management and community involvement change the attitudes towards the administration, protection and rehabilitation of heritage sites as repositories of social memory. For example, the city administration of Santa Maria effectuates small actions whereas the larger actions are articulated through community mobilisations. Santiago has a coherent policy towards the safe-guarding and promotion of cultural projects and assumes an active role in the dissemination of materials relative to its railway history. In contrast, the city of São Gabriel there’s a total disconnect with its heritage from part of its administration and the community. Within these three municipalities, the project encompasses three distinctly different approaches towards the conservation of the railway stations by the managers

⁵ <http://tatiguerche.wixsite.com/redeemrede>

⁶ @rede_em_rede

⁷ https://www.google.com/maps/d/viewer?hl=pt-BR&authuser=0&mid=1Uh_GfLnjjKBMuUrRkTA9vMHHIM&ll=-29.677883087055765%2C-53.808009587195215&z=18

⁸ <http://tatiguerche.wixsite.com/redeemrede>

responsible for these buildings. Vila Belga relies on the support of the Association of Vila Belga Residents to try to construct a museum as a way to centralise the railway memorial site of the city and since 2015 has been holding a street fair, the Brique da Vila Belga, every second Sunday.

Thus, using digital communication devices and mobile media, the research aggregates the participation of people living in the three separate communities. The use of digitally generated data from various sources and locations can be used to create a new perspective on these spaces, give visibility and a voice to communities, beyond the recording/construction of informational territories which allow the constitution of informational fluxes within cyberspace.

Cities are much more than a projection of streets, buildings, and landmarks onto a flat sheet of paper. And the activities and interactions which occur within the depicted locals are rarely featured once “the action is borrowed, distributed, suggested, influenced, dominated, betrayed, translated” (Latour, 2005, p. 46). Further, these tend to be of a hybrid nature in that they happen between elements of different species, material bases, cultures, languages, modes of knowledge and regimes—human and non-human, technical and organic, analog and digital, etc. Thus, one can not only think of a human-human interaction within a given space but a hybrid interaction.

The project *Rede_em_Rede (Network_in_Network)* raises questions about the traditional function of maps as a tool or strategy for localization. Whereas traditional land-based cartographies look to make fast the relative positions of physical features in the world as correspondences on striated grids of various scales, the cartographies born from hyper-space and emergent within the fluid territories of virtuality, emphasize and identify relational potentials as a function of proximity. In addition to producing hybrid spatialities which combine actors from different strata of variegated activity, these relational mappings activate potentials differently at each visualisation depending on the actual conditions within a territory. The possibility of reconfiguring mappings also allows the re-articulation and visualisation of relation and relational relevance between systems and networks via the flow of data, affect and intensities.

These dynamic visualisations give rise to new relational configurations relative to the physical

world which articulate subjectivity through the collaboration of individuals within the network as collective assemblages. The collaborative participation in the elaboration of these virtual mappings leads to a movement of flows, of interests, of affirmations and affects not only as social media but as a socialization of media and a common subjectivity. Through these new visualisations the abstract could be made concrete, the virtual, actual and the invisible, visible.

The use of technological devices for the creation of informational territories is indispensable. Such devices have significantly altered modes of relation in many spheres of activity including the economy, politics, and art. According to French digital artist and art theoretician Edmond Couchot (1997), the technical relation between artist and audience allows instant interaction, making it possible for the public to become associated directly with the production of the work, thus accelerating the production of meanings. Still, the author contends that the development of digital technologies now enables a more elaborate and expanded manner of participation. Each one is allowed to associate directly not only with the production of the work but also with its diffusion (Couchot, 1997, p. 137).

Actor-Network Theory (ANT)

In elaborating our research, we used Bruno Latour’s (1994) Actor-Network Theory (ANT) as a sociology of associations focused on the construction of the social mediated by technological innovations. With the ANT, we were able to identify existing networks, mediators operating as a defined association. The intention here being to identify the actors contained in the actions and thus highlighting their characteristics and traces. The common is at the origin of the associations and is that which explains the associations. Actants are everything and anything that generate action over another actant, whether human or non-human, and react to some action. They are constitutive of networks and are networks themselves, simultaneously parts and wholes. Actants are the consequence of aggregations where each association influences the expansions of other actants, as a mediator which transforms and translates meaning within the information or as intermediaries which simply convey or communicate without transformation (Latour, 2005, p. 39). For Latour (2005) it is the attentive description of actants, mediators and networks and their temporary stabilizations, which is the relation between

local and global agency in the social as the focus of ANT. “We have to lay continuous connections leading from one local interaction to the other places, times, and agencies through which a local site is made to do something (Latour, 2005, p. 173).

Bruno Latour, in his Theory-Actor-Network, also runs counter to any substantialist approach which banks on purity and essence by positing that both the individual and society are produced within the relations between human and non-human mediators and establish links between the global and the local by way of the specificity of each association: mediators generate meaning and are not simply intermediaries that only carry meaning. Latour seeks a site-specific *modus operandi* for the mediators in order to examine the controversies that dwell there, even if they are temporarily relegated to black boxes. He introduces technology not as a tool, but as an actant, and proposes an artistic and political being-doing with machines that provoke other ways of relating, or of living. In communities comprised of humans and machines, we are led to inquire into the type of power relations between humans and machines, between humans and humans, and between machines and machines.

This displaces the idea of society to the collective as a continuous process of associations that establishes emerging and micro-narrative connections. These integrate heterogeneous elements such as the social, the political, the artistic, the technological, etc. to the composition of the collective. Such a collective is populated by human and nonhuman act-ants who transform and are transformed by the social plane, resulting in collective intentions and shared responsibilities among the various actants within that network.

These elements of ANT are brought into the media art poesis. Firstly, we need to understand that a network is not the internet or the railway, but the fluxes, circulations, alliances, dislocations. They are the movements carried out by human and non-human actants which are composed through action and at the same time interfere with and which are subjected to action. Actants in this research are the agents involved in the network of activity—in fact, anything human or non-human which can be said to leave a trace and can be followed. Thus, the train, the artists and collaborators, the narratives, the mobile devices, the buildings, the politicians, the policies etc are all actants and the

translation or remapping from a flatland cartography to an Actor Network is configured by the movements established by the association of actions. By choosing the rail network as the theme for this proposal, we seek not only to rescue its memory, but rather seek to (re) collect and update memory as an actor network and define afresh associations in the present through their actant materiality and immateriality and through its various temporalities and spatial configurations.

Conclusions

Through the research carried out in the production of the AirCity artworks: arte#ocupSM 2012 and 2013 and *Rede_em_Rede* 2015 and 2016, we come to understand that the deactivation of the railway system extinguished the social, political and economic lives of various communities leaving only traces of memory as eventual potential for the regeneration of that community. These memories are a vestigial machinic assemblage of an Actor Network whose primary purpose at one time was that of transportation logistics, i.e. carrying passengers, yet became the heart and driving force of an entire community where the reactivation of the existent social networks is a different machinic assemblage which depends on the deactivated train itself.

In interviews conducted for the aircity: arte#ocupSM art-works, Vila Belga community residents spoke of the loss and longing for the community life left behind and emotionally recounted their memories regarding the railway. “We go from final products to production, from ‘cold’ stable objects to ‘warmer’ and unstable ones” (Latour, 1987, p. 21). For the residents, the train still represents a complex, multi-level network of connections, work, dignity, political involvement, sustainability, belonging and more, where living in Santa Maria’s Vila Belga and being a railroad employee defined belonging and contributing to the active and productive life of the community.

In *Rede_em_Rede-2015/2016* (Network_in_Network-2015/2016) the intent was to provoke the community towards the development of different perspectives on the common and the social in order to foment (re)connections with the urban heritage and the cultural background. From these different points of view, we drew attention to the existence of links between the human and the non-human since most studies only consider the human activity and disregard the imbrication of the human with the non-human and the materiality/immateriality of heritage.

The artistic proposals thus instate an open-access collaborative and cooperative communication which affirms the political role of web-based interactivity to possibly result in the visualisation of individuation through the creation of experiential narratives of data. Where the initial phases of the unfolding of the process, of the relational participation in the practices, of affirmative empathy-building, of ethical involvement in community, of the event-based integration, the last phase requires the construction of the discursive image of the subject of study.

We underscore that the elaboration of this research contributes towards the production of a collective commons, which differs from that which is public and also from that which is private. The collective commons is produced as an assemblage, that not only takes into account the public/private duality, but which considers the collective as produced through different lines and productions—it is composed through diversity. Communities form themselves around something because they are aggregating formations.

The cities of Santa Maria, Santiago and San Gabriel are thus activated in terms of their geographical dimensions for the constitution of their informational territories. The digital images and narratives drive the intuition to instigate the first movements towards the relinking of these places and to provide the constitution of a connected community. Such movements are not only tracings but triggers which invoke flow within the network and interaction within the community since these flows course between city and cyberspace without dissociating them. These are the productions of the collaborators that offer another aspect onto the existing narratives linked to the rail network, in the REDE_EM_REDE research the city connected in cyberspace is delineated from the multiple gazes and collective and collaborative productions.

Our studies were modelled on a machinic system that goes beyond the mechanics of a railway system, even if the railway is a system that works mechanically in the quotidian. Our research is based on transdisciplinarity via machinic assemblages of collective knowledge and practices as product and producer of multiple subjectivities where being actualizes the virtual in experience to allow the invention of practices in the actual. Assemblages that cannot be reduced to the relations between subjects—to the human—but to everything that happens in and through a territory and as the territory itself.

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Media Culture and Heritage: Curating Outsidership

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Abstract

This article looks at current and future issues in the field of art, science, and technology—from the challenges of its own historicizing process to the curatorial exclusion of cultural heritages usually located at the margins of mainstream research. It argues the need for “other” histories and knowledge inclusion from overlooked sources such as oral cultures. With a few curatorial examples coming from Brazil, the paper emphasizes the social inequities in that country, as well as a deep-rooted colonial mindset, unfortunately still dominant in many circles. By emphasizing critical and original examples of artists, critics, and curators who uphold contemporary art alongside heritages from black, indigenous, folk and outsider groups, the paper examines strategic uses of technology, for instance, in the phenomena of the *rolezinhos*, and that of a nomad museum.

Keywords

Brazil, Heritage, Margin, Mário Pedrosa, *Technophagy*, Technological Disobedience, *Rolezinhos*, Virtual Museum.

Introduction

In a recent message to the art, science and technology community, Roger Malina, the executive editor of *Leonardo*, celebrated the 50th anniversary of this significant publication by asking us to reimagine the next fifty years of the organization. In this paper I address the future by reflecting upon past exclusions of knowledge and heritages. How can one envision a future that is less socially polarized and weaponized, in which identities are hybrid and fluid, agency distributed, and colonialist mindsets rendered obsolete? The follow excerpt from Malina’s email points out to how much has been accomplished since 1968:

Leonardo will be celebrating its 50th anniversary soon, marking the first published issue in 1968. How the world has changed. And with those changes, many goals of Leonardo’s founders have been achieved. The international art/sci and art/tech communities of practice are thriving; university programs for hybrid

art-science-technology professionals have emerged; companies are hiring “T-shaped” experts who bridge art, design, science and engineering disciplines; and artists can now write professionally about their own work, bypassing the art critics who insisted in the 1960s that “if you can plug it in, it can’t be art.” ... But our community still faces many problems and new opportunities have arisen in a world that is being disrupted by life-enhancing and life-threatening changes, from digital culture to climate change.¹

Certainly gone is the new media optimism of previous decades, when artists and theorists such as Vilém Flusser in the 80s, hoped that the two-way exchange of telematics would bring about an added freedom. But, as the curators of the exhibition *Without Firm Ground: Vilém Flusser and the Arts* pointed out, Flusser’s hope for a global telematic community based on dialogue “has its back to the wall at the beginning of the twenty-first century”². Nevertheless, there are multiple examples of curatorial and critical reflections that expands the field while envisioning less dystopian future developments.

Media Histories and the Pursuit of the New

For those with access to the latest technology, cultural production has entered a new stage of remix in which the never-ending archive of digital material can be employed in ever more generative ways that did not exist prior to the time of new media.³ This idea of the

¹ Roger Malina, “A Special Message from Leonardo”, email from *Leonardo/ISAST*, November 17, 2016.

² The exhibition, *Bodenlos — Vilém Flusser und die Kunst [Without Firm Ground — Vilém Flusser and the Arts]* was curated by Siegfried Zielinski and Baruch Gottlieb in cooperation with Peter Weibel, and showcased by two German venues: the ZKM in Karlsruhe, Aug. 14 and Oct. 18, 2015, and the Akademie der Künste in Berlin, Nov. 19, 2015 to Jan. 10, 2016; in addition to one Dutch venue, the West Den Haag, from March 19 to May 7, 2016.

³ Eduardo Navas, “Regenerative Remix.” accessed October 23, 2016,

constant generation of new material, increasingly in real time, is not, however, without its own paradoxes. Consider, for instance, the difficult task of preserving media art from the 1990s.

The ambitious archival project “Net Art Anthology,” being developed by *Rhizome* in partnership with the New Museum, faces many challenges in its goal to preserve Web art from the 90s decade (when the World Wide Web was a new unconstrained medium, an anti-hierarchical, utopian, uncharted space). Among the trials of revisiting these artworks are technical and ontological questions faced at every step of the restoration process. They mostly relate to system upgrades, as “browsers from fifteen or twenty years ago won’t work on today’s computers, and computers from that era are hard to come by and even harder to keep working.”⁴ Recreating these artworks for today’s computers and browsers inevitably changes them, as well as the way one experiences them.

Our growing ability to archive everything—every image, sound, and text—and to use data to generate multiple forms, is nevertheless continuously haunted by pervasive surveillance and porous boundaries between private and public realms, remembering and forgetting, transparency and opacity, fact and fiction. It is worth emphasizing that media are not transparent, whether in the form of verbal language, html code, or photographs, any medium, simultaneously reveals and conceals, enables and constrains. What should be preserved? Which cultures and species can or will be combined through molecular engineering? Who gets to decide?

Choices to preserve, create, reenact, or transform cultural artifacts, as well as life forms, are contentious, whether we are examining the relics of past modernities, the extinction of species, or attitudes towards the use of wireless communication by poor communities, which traditionally did not have access to digital technologies.

For more than a century we have been celebrating the new and the now. For instance, when enamored with technology in 1909 Filippo Tommaso Marinetti proposed in the Futurist manifesto the destruction of museums as a way to get rid of the weight of tradition. The history of modern avant-gardes is full of beginnings, abrupt ends and restarts in pursuit of the new man and a new social order, ironically envisioned equally in high or low resolution, and by capitalist and communist

societies, fascist and socialist countries alike.⁵

How can practitioners, curators, and historians of contemporary art approach collective memory and collective traumas while forging less fractured futures? How does one have equal access to cultural artifacts, knowledge, and wisdom across diverse traditions and generations?

Other Histories and Lost Lessons

In “The Cultural Logic of the Late Capitalist Museum,” Rosalind Krauss pointed to the institutional changes produced by the 1980s art market, when museum directors began to talk about collections in terms of assets, as economic investments, instead of the traditional notion of the museum as the guardian of community memory and the public patrimony.⁶ The practice of institutional critique, according to Krauss, originates mostly with minimalism, conceptual, and feminist art in the 1960s. But her analysis, largely based on Euro-American developments, ignored innovation from elsewhere.⁷ Indeed, the role of the art market in assigning value to contemporary art is paramount and it is redesigning the boundaries of the art world with implications that are not only economic and political, but simultaneously ethical and conceptual, technological and methodological.⁸

⁵ In architecture, for instance, two sobering examples of modernist failure are the abandoned Nakagin Capsule Tower in Tokyo, a mid century project for a new society; and the housing projects, such as the Cabrini Green, the last one in the U.S., which was recently demolished in Chicago.

⁶ Rosalind Krauss, “The Cultural Logic of the Late Capitalism Museum,” *October*, Vol. 54 (Autumn, 1990), 3-17.

⁷ See the MoMA New York series, which is expanding the Western canon with translations of important twentieth century art writings into English. The first volume in 2002 was

Primary Documents: A Sourcebook for Eastern and Central European Art. It was followed by a trilogy of key personalities and moments in the history of Latin American art: the anthology

Listen, Here, Now! Argentine Art of the 1960s: Writings of the Avant-Garde (2004); *Alfredo Boulton and His Contemporaries: Critical Dialogues in Venezuelan Art, 1912-1974* (2008); and *Mário Pedrosa Primary Documents* (2015).

⁸ The literature on museum ethics, curatorial and media histories is ever growing. Examples include Giselle Beiguelman and Ana Gonçalves Magalhães, *Possible Futures: Art, Museums and Digital Archives* (São Paulo: USP, 2014); Terry Smith, *Thinking Contemporary Curating* (New York: ICI, 2012); *The Routledge Companion to Museum Ethics* (London: Routledge, 2011); and Michel de Certeau, *Heterologies: Discourse on*

<http://norient.com/tag/regenerative-culture/>

⁴ Frank Rose, “The Mission to Save Vanishing Pixels,” *The New York Times*, October 23, 2016, p. Art-18.

In Brazil, public policy towards art and culture has traditionally been discontinuous and characterized by short-term cycles.⁹ Original and critical approaches to mainstream culture in the twentieth-century, which challenges binaries such as self and other, subject and object, include the contributions of Oswald de Andrade's Cannibalistic Manifesto from 1928; the media performances of Flávio de Carvalho's *Experiencia #3* in 1956; concrete and neoconcrete movements of the 1950s; Lygia Clark's and Hélio Oiticica's legacy of participation and interactivity from the 1960s-70s; the leadership of curator and critic Walter Zanini in the promotion of electronic and experimental art in the 1970s; Mário Pedrosa's engaged criticism and visionary projects such as the *Museum of Origins* in 1978; and Paulo Herkenhoff's use of "Cannibalism" as the organizing principle of the São Paulo Bienal of 1999. Further decolonial perspectives today are coming from the ancient knowledge of indigenous cultures, which are joining discussions of the anthropocene, and other examinations of human action and impact on the environment and other species.

Significant in this regard is the work of artist Ernesto Neto with indigenous rituals, and the books *Metafísicas Canibais* [Cannibal Metaphysics] by Eduardo Viveiro de Castro, and *A Queda do Céu: Palavras de um Xamã Yanomami* [The Falling Sky: Words of a Yanomami Shaman] by David Kopenawa and Bruce Albert, both books entering the cultural debate from an anthropological perspective that allows one to see contemporary culture through the eyes of the other, in this case, a millennial culture from an area deep in the Amazon region between Brazil and Venezuela.¹⁰

the Other (Minneapolis, Minnesota: University of Minnesota Press, 1986). In relation to Latin America, see also my chapter "Post-Periphery Performances: Reclaiming Artistic Legacies, Histories, and Archives" in *Performing Brazil*, eds. Severino J. Albuquerque and Kathryn Bishop-Sanchez (Madison, WI: University of Wisconsin Press, 2015).

⁹ From a Brazilian perspective, examinations of outsidership include, *Outras Histórias na Arte Contemporânea*, Cauê Alves, Simone Osthoff and Priscila Arantes, orgs. (São Paulo: Paço das Artes, 2016); and Adriano Pedrosa and Lilia Moritz Schwarcz, *Histórias Mestiças* (São Paulo: Cobogó Edt. and Instituto Tomie Otake, 2015). Emphasis on a hesitation towards the future include the exhibitions "Live Uncertainty" the São Paulo Bienal 2016, and "Insecurities: Tracing Displacement and Shelter" at the New York MOMA in 2016.

¹⁰ Eduardo Viveiro de Castro, *Metafísicas Canibais: Elementos para uma antropologia pós-estrutural* (São Paulo: Cosacnaify, 2009), pub-

Cultural loss can be the result of the neglect of public policies, and also of natural disasters. An example of an original project in response to a natural disaster is the *Museum of Origins*, conceptualized by the art critic Mario Pedrosa, which unfortunately never left the drawingboard. I find it worth describing in detail because of its lesson. It rethinks historically marginalized cultures and curates outsidership as part of contemporary art.

Pedrosa's proposal was created as a response to a devastating disaster: the large fire that consumed the Museu de Arte Moderna of Rio de Janeiro on July 8, 1978, destroying 90% of the museum collection, along with the exhibition *America Latina: Geometria Sensível*. This important exhibition included an eighty-painting retrospective of the Uruguayan Joaquim Torres Garcia, the artist who created and theorized the *School of the South*, promoting a constructive universalism rooted in the geometric traditions of the ancient cultures of the Americas. Like Torres Garcia, Pedrosa was a cosmopolitan visionary and cultural activist who promoted a decolonial aesthetics in place of Eurocentric attitudes that positioned Europe as *The Brain of the World's Body*, and Latin America on the receiving end of a one-way cultural traffic.¹¹

Pedrosa's new model for the Museu de Arte Moderna was explained in an interview titled "Indigenous Art: The Choice of the Critic Who Grew weary of the Avant-Garde."¹² He designed the reconstruction of the MAM-Rio as the *Museu das Origens* [Museum of Origins], integrating five cultural traditions: indigenous art (in line with research developed in Peru and Mexico); black art (Brazilian and African); virgin art (outsider and self-taught art along with the art of the unconscious and children's art); folk art (from all regions of the country); and modern and contemporary art. If realized, this museum could have promoted in the visual arts, what

lished in English as *Cannibal Metaphysics* (Univocal, 2015). David Kopenawa and Bruce Albert, *A Queda do Céu: Palavras de um xamã yanomami*, Beatriz Perrone-Moisés, trans. (São Paulo: Companhia das Letras, 2010), published in English as *The Falling Sky: Words of a Yanomami Shaman*, trans. Nicholas Elliott and Alison Dundy (Belknap Press, an imprint of Harvard University Press, 2013).

¹¹ Donal Preziosi, *Brain of the Earth's Body: Art, Museums, and the Phantasms of Modernity* (Minneapolis, MN: University of Minnesota Press, 2003).

¹² Mário Pedrosa *Primary Documents*. Glória Ferreira and Paulo Herkenhoff, eds., translation Stephen Berg (New York: The Museum of Modern Art, 2015).

Brazilian popular music had more easily accomplished, especially after the Tropicalist movement of 1968-9: the creation of a music of resistance that preserved regionalisms and combined international and national sources, with delicacy and inventive new forms.¹³

Pedrosa's original emphasis on indigenous, black, and mestizo cultures, as important overlooked roots of Brazilian civilization, was at the same time an ethical and critical position stated in a matter-of-fact and urgent way. For this remarkable critic, modern art was part of the imperialist expansion of the West, therefore, his project anticipated the discussions that would unfold in the 1980s around the issue of "primitivism," a debate that intensified after the 1984 controversial exhibition at the New York Museum of Modern Art titled *Primitivism in 20th Century Art: The Affinity of the Tribal and the Modern*.

For Pedrosa, emphasis on indigenous, African, folk and outsider art, alongside modern and contemporary art, was an effort to counter a colonial and elitist mentality, unfortunately still dominant in large parts of the world, despite the hopes of new media theorists, such as McLuhan, Vilém Flusser, and Roy Ascott, that technology would forge alternative dialogical communities. Pedrosa shifted the focus of discussion in the early 1980s away from postmodern trends, which he saw increasingly as the production of luxury commodities for an international art market. For the critic, colonialist attitudes towards culture had important methodological, historiographical, and institutional dimensions that needed to be challenged then, and I argue, increasingly now, when the field of contemporary art continues to expand and art and tech developments become part of the mainstream art world.

Media and Margins in Brazil: Cannibalizing Technology

The São Paulo pioneer media artist and curator Giselle Beiguelman has been examining the social and political impact of new technologies in Brazil for almost three decades. An example is the media exhibition *Technophagy*, which she curated in São Paulo in 2012 at the Center Tomie Otake. It showcased artists who combined high and low technology in various mixtures

¹³ Continuing in the legacy of the *Tropicalists'* aggressive fusion of different genres is the series of podcasts titled *Brazil Music Exchange* focusing on new Brazilian sounds organized by the *Guardian* of London in 2016. It examines the country's rich sound and mixture of cultural and rhythmic heritages.

of ancient and cutting-edge knowledge, often privileging a DIY aesthetics. The exhibition also focused on what she termed a "technophagic emergence"—a concept she developed in a paper presented at ISEA-Ruhr 2010, calling attention to the tendency of the digital culture in Brazil to devour and grind technology into new production modes for collective use.¹⁴

The term, *technophagy* updates Oswald de Andrade's influential *Cannibalist Manifesto* of 1928, a metaphor based upon the personal gain of eating the flesh of an enemy one admires, thus literally incorporating his/her strength and making it one's own. "Technophagic emergence" reflects on the economic changes Brazilians experienced over the first decade of this century when about eighteen million people rose out of poverty for the first time, in addition to another thirty-five million from the lower middle class, to whom the economic boom of the Lula government gave access to the market of commodities. Credit and mobile technologies were at the forefront of this transformation.

While Brazilians come to terms with a dramatic economic and political crisis in the second decade of the 21st century, the hope that the country could become radically modern is simultaneously accompanied by a growing doubt in the country's capacity to ever achieve that dream. And yet, the country's patriarchal and colonialist class system, which traditionally relegated creativity, at least for the poor, to the realm of carnival and soccer, is being challenged from below. Living in the poor outskirts and slums, many people are using and combining technology with a DIY improvisational and creative attitude while a heritage of racism, classism and misogyny is being discussed on social media for the first time.

Beiguelman is interested in the micropolitical effects of technology and consequently examines notions of citizenship, uses of technology on the streets, and practices of consumption in precarious contexts. By calling attention to a "technophagic emergence" she additionally engages the concept of "technological disobedience," theorized by the Cuban artist Ernesto Oroza,¹⁵ in relation to the Brazilian political context.

¹⁴ Giselle Beiguelman "Technophagic Emergence: Creative and Critical Trends of Digital Culture.Br" was presented at ISEA2010 RUHR, the 16th International Symposium on Electronic Art, August 20–29, 2010.

¹⁵ Ernesto Oroza theorized "technological disobedience" in his book *For an Architecture of Necessity and Disobedience*, 2006 in which he explores the efficiency and ingenuity of Cuban citizens under the Castro administration and their approach to self-made solutions for everyday

An example of “technophagic emergence” employing social media is the disquieting phenomenon of the *rolezinho* [Fig. 1]. Wireless technology is central to the activism of a new generation, which employs social media to organize and denounce racism, misogyny, and other forms of discrimination and oppression.



Figure 1. At the Plaza shopping mall in Niterói, a suburb of Rio de Janeiro, young people gather in what is known as a *rolezinho*, or stroll. Photo credit: Yasuyoshi Chiba/Agence France-Presse — Getty Images.

The *rolezinho* is Brazilian slang for little stroll.¹⁶ The *rolê* [stroll] was created by twenty-first century “*flâneurs*” who began to organize in large numbers and stroll through the luxurious shopping malls of Brazil’s large cities. Coming from poor neighborhoods in the periphery, they are young, mostly black or mulatto, and organized “flash mob” meetings through social media. This young generation in Brazil claims access to public spaces to which historically they have been barred from, due to unspoken laws of “propriety.” By simply moving through public areas traditionally “forbidden” to them, the *rolezinhos* challenged social and spatial hierarchies, while instilling class fears in shop owners and upper middle class shoppers alike.

On a theoretical level, in the early days of the World Wide Web, Brazil’s original combinations of modern art and oral traditions were valued by a few scholars as a

needs. Oroza’s “Technologies of Disobedience” is a political and aesthetic attitude that echoes both the figure of the *bricoleur*; and more important, the *Cinema Novo* manifesto “Aesthetics of Hunger”, written in 1965 by Glauber Rocha, which Oroza admires and quotes.

¹⁶ Pedro Erber’s “The Politics of Strolling” (unpublished article in preparation for submission to the Journal of Latin American Cultural Studies), examines a number of newspaper articles, both from Brazil and the U.S. from 2013-14 about the phenomenon.

fertile mixture of technology and samba—as the work of Hélio Oiticica suggests, for instance—and seen as charged with transformative potential, with new ways of turning information into knowledge.¹⁷ Today, however, the harsh social and economic inequities in the country continue to be at the heart of an economic, social, and political crisis, following an exceptional decade of growth and consumer expansion. Such profound changes are ongoing, complex, often violent, and without short-term solution.

Project *Ex-Paço*: Forging Alternative Curatorial Strategies

A second curatorial example of technology employed for survival in face of the oppressive political and cultural crisis in Brazil, comes from an institution, which recently became nomad. The *Paço das Artes*—a contemporary art museum connected to the cultural branch of the São Paulo state government, which has a unique characteristic: it does not have an art collection, but an important role in fomenting young and emerging talent.

Priscila Arantes, the director of that institution since 2009, is a media curator and historian who has employed new technologies to rethink archives, histories, and curatorial perspectives, and in the process, is creating more fluid connections between making, displaying, and historicizing media art. She first organized a comprehensive and accessible database, an archive of all the institution’s memory and history—the exhibitions, publications, curators, artists, and scholars who worked with or passed through the *Paço*.

More recently, she created the innovative project *Ex-Paço*, in response to the political crisis that resulted in the loss of the *Paço das Artes*’ building in 2015, located on the campus of the University of São Paulo. Therefore, as the director of an institution without a space, Arantes collaborated with 3D designers to create *Ex-Paço*—a virtual reality gallery for exhibiting media artworks, and also used to encourage new curatorial formats and to reflect upon public reception and interaction.

Conclusion

Although crumbling city infrastructures, social segregation, and the concentration of wealth in a few hands seem to be the political consequences of an

¹⁷ Gregory Ulmer, “The Miranda Warnings: An Experiment in Hyper-rhetoric,” in *Hyper/Text/Theory*, George Landow, ed. (Baltimore: Johns Hopkins University Press, 1994),367

economic system based on profit and accompanied by the normalization of war and surveillance, in addition to the growing privatization of the commons, a few media artists, curators, and historians continue to embrace technology looking for ways to oxygenate the public sphere. In this process, they envision alternative developments in the field of art, science and technology over the next fifty years. There is power in the margins, as Boris Groys reminds us: “It would be wrong to think that this kind of powerful outsidership can be completely eliminated through Modern progress and democratic revolutions”¹⁸. Among the challenges in the future decades of advanced research is our ability to integrate knowledge from these other margins, thus continuing the decolonization of thought.

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Author’s Biography

Simone Osthoff—Professor of Art and Critical Studies in the School of Visual Arts, Penn State University—focuses her research upon contemporary art and decolonial histories. Osthoff holds graduate degrees from the University of Maryland and from The School of the Art Institute of Chicago, in addition to a Ph.D. from the European Graduate School. She is a Fulbright Fellow, a frequent participant and organizer of symposia, and since 2013, part of the editorial board of the journal *Flusser Studies*. Among her multiple publications is the book *Performing the Archive: The Transformation of the Archive in Contemporary Art from a Repository of Documents to an Art Medium* (Atropos, 2009).

¹⁸ Boris Groys, “Politics of Installation”, E-Flux no2, January 2009.

And the Earth Sighed a Case Study **Julianne Pierce, Leon Cmielewski, Josephine Starrs**

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Abstract

A tipping point is a critical threshold at which a tiny change can dramatically alter the state of development of a system tipping past a point of no return. Exploring these thresholds through artworks provides an experience for the audience that encourages engagement and contemplation on the catastrophic effects of climate change. Human beings form bonds with the landscape in which they live, but losing a surrounding landscape while we still live in that same place creates a form of homesickness for which we had no word until recently. A new term was coined by Australian philosopher Glenn Albrecht (2005) after interviewing citizens living in farming areas surrounded by encroaching coalmines. The term “Solostalgia” means an emplaced or existential melancholia experienced with the negative transformation of a loved home environment. “Solostalgia is a form of homesickness one gets when one is still at ‘home’”.

This state of mind is being reflected in a new global genre of artworks. “and the earth sighed” is an immersive media art installation that re-imagines the relationship between nature and culture by presenting aerial views of landscapes dynamically manipulated in ways that reveal their underlying fragility. The artists filmed landscapes and seascapes using drone technology and used post production techniques to create large-scale visual and sound environments.

Keywords

Climate, Land, Landscape, Sea, Seascape, Tipping Point, Solostalgia, Video, Installation, Drone.

Introduction

Land art is a form of practice that could be seen as slow art, embodying a long-term relationship and response to the heritage of land and landscape. It embraces longevity and evolution over time and encourages contemplation and stillness. Starrs and Cmielewski have made this the focus of their work with landscape and have embarked on an approach to life and art that defers to ecological thinking and the environment, being involved in long term tree planting projects and slowly witnessed the return of birds and native fauna back to the land. It was

also a small contribution to offsetting emissions through planting trees to sequester carbon, help reduce soil salinity and combat wind and water erosion.

Solostalgia

Connection to place is a universal human experience that comes with a life lived in a home environment, but Albrecht (2005) contends that this connection can be extrapolated to a global scale through media:

I claim that the concept has universal relevance in any context where there is the direct experience of transformation or destruction of the physical environment (home) by forces that undermine a personal and community sense of identity and control. Loss of place leads to loss of sense of place experienced as the condition of solostalgia. The most poignant moments of solostalgia occur when individuals directly experience the transformation of a loved environment. Watching land clearing (tree removal) or building demolition, for example, can be the cause of a profound distress that can be manifest as intense visceral pain and mental anguish. However, with media and IT globalisation bringing contemporary events such as land clearing in the Amazon basin into the lounge room, the meanings of ‘direct experience’ and ‘home’ become blurred. I contend that the experience of solostalgia is now possible for people who strongly empathise with the idea that the earth is their home and that witnessing events destroying endemic place identity (cultural and biological diversity) at any place on earth are personally distressing to them.

The Artworks

The artists’ connection to land is continued through their artworks over the last ten years, predominantly focused on video and audio installations, capturing and manipulating images of the landscape to talk

about human impact. Works such as *Seeker* 2007 (fig. 1) comprised of three large projections and interactive touchscreen to explore migration, territorial boundaries, conflict commodities and human displacement, while *Incompatible Elements* 2010 (fig. 2) configured the land as active, to imagine it being able to speak and comment.

As an artistic duo, Starrs brings to the partnership her background as a photographer and Cmielewski his skills as an accomplished animator. Their desire is to bring these elements together in a way that encourages a very personal and intimate relationship with the photographic image. They seek to capture imagery of the land and manipulate it so as to bring it to life as a living entity, organism or body.



Figure 1. *Seeker* 2007



Figure 2. *Incompatible Elements* 2010

And the earth sighed is the current iteration of their long term project of imaging and re-imagining landscape. Presented at Arts House, North Melbourne Town Hall, as part of the PSi22 Performance Climates conference in July 2016, (figs. 3, 4, 5) this large-scale audio video installation invites the audience into intimate contact with projected landscapes.

The installation is arranged into two parts. For the first part, the audience are invited to ascend a staircase to a three-metre high platform where they look down on projections of arid land, ocean and Australian scrub. The landscapes are video and photographed aerial views, shot in high resolution from a drone. The audience then move down a second staircase into the installation space, where they can walk across the images, sit with them or lie flat and blend into the projected surface.

The artists are deeply concerned with our human impact on the environment and do not present these images lightly. They are born from long periods of research and residency with scientific agencies, where data has been gathered and lengthy discussions with experts on climate change have informed how the landscaped is filmed, manipulated and represented. Each landscape presented in the work has been chosen for its degree of threat, erosion or irreparable damage and the process of capturing the image is as significant as the final Artwork. It is a three-year project which has taken the artists to locations around Australia including Lake Eyre, Lizard Island research station, Great Barrier Reef, Western New South Wales, Western Victoria and the Mallee District.



Figure 3. *And the earth sighed* 2016

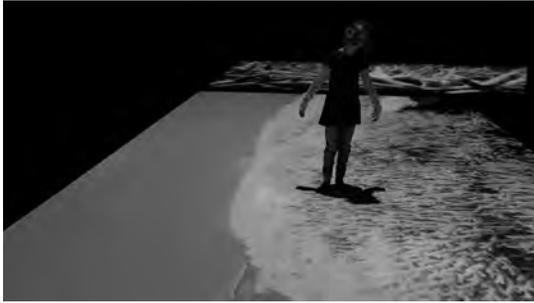


Figure 4. *And the earth sighed* 2016

And the earth sighed is made up of two twelve-minute video projection loops and accompanying soundtrack by sound designer Alex Davies. Both video tracks are comprised of imagery, which has been shot by the artists with additional photography of the Great Barrier Reef supplied by the Australian Marine Conservation Society. The predominant theme is to explore the tipping points in these ecologies, the point of no return caused by flood, fire, drought and coral bleaching.

The experience is designed as a journey, to initially view the landscapes from a height, followed by a more close-up encounter. Central to creating this immersive experience, the artists continued experiments with aerial photography and imaging. They have an ongoing fascination with aerial landscapes, as seen from an aircraft or from a cliff top or eyrie as a “god’s eye” view. A long distance view that becomes abstract and reduced to shapes and patterns, is followed by a discovery of the detail as a progressively more intimate experience. This relationship with landscape is for the artists an exploration of the concept of “affect”, where the body and mind experiences something before it is more fully comprehended.



Figure 5. *And the earth sighed* 2016

The sense of affect is created by manipulating the original footage of the land and seascapes in postproduction. As a work about climate change, there is an urgency in the consideration of the rapid destruction of Australian landscapes and reefs and the viewer is confronted with a flood surge over a desert landscape, dead and dying coral or the burnt remains of a bushfire. The soundtrack heightens the sensation of landscape in distress; it is at times eerie and foreboding and at other times a low rumbling scream bubbling below the surface. The viewer is a witness to the scanning of a body of landscape, like a surgeon scanning flesh to find the right area of skin to make a cut or incision. But instead of blood or tears flowing out from the land, words emerge as if speaking or crying out in anger. From under the surface of the desert landscape the words AS THE DARK FLOOD RISES emerge formed from water. Taken from the D.H. Lawrence (1932) poem “The Ship of Death”, this is a powerful poetic phrase that speaks of the deluge to come. Written in 1930, the same year that Lawrence died, it is used by the artists as a portentous omen of a dying planet:

And everything is gone, the body is gone
completely under, gone, entirely gone. The
upper darkness is heavy as the lower,
between them the little ship
is gone
she is gone.

It is the end, it is oblivion.

From an Australian landscape, eroded and besieged by noxious weeds, the words THE DESERT OF THE REAL emerge as a quote from Jean Baudrillard spoken by Morpheus in the film *The Matrix*, as the devastated world is revealed to the protagonist Neo. It is a

contemporary reference that speaks to how the human species is deluded, living in a fantasy world, which we believe is real and abundant but actually faces an unknown and uncertain future.

The use of footage taken from a drone is essential to the artists' current project and is an extension of their long-term interest in how military technologies are adopted and adapted into the mainstream. In the words of the artists "... if we think a technology is scary then we want to play with it." In works such as the short video *a.k.a.* 2001 they looked at surveillance and CCTV footage and in *Trace* 2002/2003 explored how governments collect digital data from citizens through means such as passive recording of people's presence using simple video surveillance through to forced extraction of biometric data by saliva or tissue sampling.

For *and the earth sighed* the artists have worked with two types of UAVs (unmanned aerial vehicles) to capture video and photographic records. The first is a quadcopter, a small helicopter-like video capture device that gathers aerial footage and is freely available to purchase without a licence. The second vehicle is an autonomous fixed-wing drone supplied through project partner C-Astral Systems, an aerospace enterprise and solution provider based in Ajdovscina, Slovenia. Founded by Marko Peljhan, C-Astral extends his interest and research into surveillance, unmanned systems and the conversion of technology from the military to the civilian field. As a project partner, C-Astral connected the artists with another company, Synergy Positioning Systems, based in Queensland and New Zealand) to provide both the UAV drone system and a pilot. The advantage of using the drone is that it can be programmed to fly for up to two hours taking multiple high-resolution images. The quadcopter is very versatile and easy to use, but can only carry a small camera or go-pro resulting in limited low-resolution imagery. In contrast, the drone is operated by a pilot who instructs the aircraft to take high-res image scans of the same area of landscape, creating a dense and layered image which the artists can control in the post-production phase.

With their interest in aerial photography, The artists bring home the everyday consumption and normalisation of the earth viewed from above. The Google project, to capture natural and built environments in 3D as maps and satellite imaging, makes the world continually available through technologies that have been develop

Executive Producer of Blast Theory from 2007 to 2012, based in Brighton in the UK. She is currently Creative Producer at The Art Engineers who specialise in producing unique 'theatrical adventures' that cross art forms.

Leon Cmielewski and Josephine Starrs are Sydney artists whose long-term collaboration is concerned with the relationship between humans, machines and nature.

Starrs and Cmielewski's media artworks are situated at the juncture of cinema, information visualisation, and data mapping, playing off the tensions between the large and small screen, and between information and sublime landscape.

Over the last five years they have focused on exploring how artistic practice can have a relevant and meaningful dialogue around ecological concerns. Their current work and the earth sighed was shown at Arts House Melbourne in July 2016 was supported by a Creative Australia grant from the Australia Council.

Their other recent project with dancer Alison Plevy explores human responses to drone technologies, recording site specific performances in natural and industrial locations. Dancing with Drones was performed Liveworks, Performance Space, Carriageworks 2015, at Siteworks Bundanon in 2014 and was shown at ISEA 2015 in Vancouver Canada.

Their previous work has been widely exhibited, including at the Maldives Pavilion at the Venice Biennale 2013, Museum of Contemporary Art, Taiwan 2012; Guangzhou Triennial, China; Ars Electronica, Austria; Australian Centre for the Moving Image, Melbourne; Seoul Media Art Biennale, Korea; Transmediale, Berlin; Museum of Contemporary Art, Chicago; Videobrasil, Sao Paolo; Pompidou Centre, Paris; Australian Centre for Photography, Sydney and Performance Space, Sydney.

They have won awards for their work including an Award of Distinction for Interactive Art from Ars Electronica, Austria, and they are both a past recipients of New Media Art Fellowships from the Australia Council.

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Curatorship and New Media: Possible Dialogues

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Abstract

One of the discussions related to contemporary curatorial practices focuses upon the impact of new media and digital media in the formats and exhibition circuits. In addition to only exploring curatorships that showcase digital media art projects, what interests us in this article is to investigate how certain characteristics of media culture – such as collaborative processes and networking – are present in current curatorial practices. Examining this premise, we divided this article into two parts. In the first, we conducted a small curatorial history to show how the curatorial procedures have been adapted to the changes occurring in the field of contemporary art. In a second part, we use as a study case the curatorial projects developed by the Paço das Artes¹ such as the *Livro-Acervo, MaPA and Ex-Paço*.

Keywords

Curatorship, New Media, Digital Culture, Exhibition, Contemporary Art.

Introduction

The principle of curating, as we know, is linked to museums, which in turn refers to their origin in the cabinets of curiosities. The obscure *Wunderkammern* began to emerge in Europe during the Renaissance. They were collections of zoological, botanical, and archeological objects, historical and ethnographic relics, paintings and antiques. Unlike traditional museums, however, which have among their responsibilities the documentation, organization, and arrangement of objects in accordance with a filing methodology aimed at the conservation of artifacts for future exposure, cabinets of curiosities lacked the concept of cataloging. Their standard for the exhibition

In spite of the fact that the curator was historically

¹ The Paço das Artes is a contemporary art cultural center of the São Paulo (Brasil) Department of Culture. Created in the 1970's, its mission is to disseminate, promote and make room for young Brazilian contemporary art.

linked to the maintenance and display of collections, in recent decades the curator's role has gained new dimensions. The curator has ceased to act merely as a head conservator for museums, and started to carry out independent curatorial projects as well, quite often imposing an authorial perspective to the exhibitions. It is clear, in this sense, that there is a change in the role of the curator as keeper of collections and head conservator of museums – whose primary concerns are about the permanence and integrity of collections – to the curator who often articulates a personal vision within temporary exhibitions. These authorial perspectives often incorporate other spaces and exhibition formats into the curatorial practice.

We should remember that until the 1960s, it was the artists themselves who organized their shows. In fact, one of the characteristics of modern art was the initiative of certain artists to come together to set up exhibitions, beginning with the example of the precursor *Gustave Courbet*. He built a temporary structure to exhibit some of his paintings, which were rejected by the *Exposition Universelle de Paris* in 1855.

Courbet's example was followed by other exhibitions organized by artists who were on the fringes of the *Salons* or who had artworks rejected by the Academies. In 1863, having had two canvases rejected in the official salon of French artists, *Manet*, along with other artists, organized a parallel exhibition to the official salon. It became known as the *Salon des Refusés* [Salon of the Rejected]. After its exhibition, various artists such as *Renoir, Degas, Cezanne, Monet* and *Morisot*, began to organize their own exhibitions.

Some of these exhibits, developed by one or more members of a group or of a movement, established the independent exhibition. Those were organized by what today might be called the artist-curator, or artist/etc, as Ricardo Basbaum refers to it. A good example of a precursor to the artist-curator was *Marcel Duchamp*,

who was invited by the surrealists to put together two exhibitions. One of them – *First Papers of Surrealism* – was held in New York in 1942. That show became famous for the white threads with which Duchamp entangled the whole space, thus hindering the movement of visitors in the gallery as well the visibility of the paintings.

But it is from the 1960s that the role of the curator and the curatorial practice begins to appear more prominently within the system of the arts as a component for conceiving, producing and disseminating an exhibition. In the 1980s, following the explosion of the market accompanied by the growth of temporary exhibitions and contemporary art museums, the activity of the curator indeed expanded (in response to the phenomenon of globalization, the privatization policy of the governments of Reagan and Thatcher, and the opening of new markets). Many people attribute the phenomenon of the emergence of the figure of the curator as the author of a concept, to the emergence of the mega-exhibitions – biennials, Documentas, manifestas – whose organization would be almost unthinkable without the presence of the curator. Others suggest that changes in the art's system, as well as in the practice of art itself, which began to incorporate all sorts of media productions, were responsible for the expansion of the role of the curator in the 1980s.

It is important to note that the expansion of curatorial practice brought about the creation of new formats and exhibition circuits, often in dialogue with parameters that exist in the production of art itself: curatorial projects based on process, curatorial practices that manifest themselves in circuits beyond the institutional exhibition space, collaborative and networked curatorial projects, are among the examples we could list.

Curatorial Practices and Contemporary Art: New Formats and Circuits

The exhibition *When Attitudes Become Form*, by the curator Harald Szeemann, held in 1969 at the Kunsthalle in Bern, was one of these milestones. The idea of designing a theme for the exhibition *When Attitudes Become Form*, besides being unprecedented, reversed the usual process of an exhibition and marked a major change in the methodology of structuring an exhibit. Until then, exhibitions were conceived according to predetermined formal categories, styles, and chronology, or based upon artists who were part of the same movement. Normally, traditional artworks were completed. They were cho-

sen by the curator and subsequently exhibited. Harald Szeemann proposed a challenge to the artists. Based on the suggested concept, he allowed artists to present concepts and actions, which could be accomplished in the actual exhibition space, or even outside of it. The essence of the exhibition was not in the exhibited artworks, but rather in the —attitudes! arising from the creative process. The theme promoted by Szeemann was —take over the institution.

Because of this, the artist Lawrence Weiner cut a 90 x 90 cm hole in the plaster of one of the walls of the Kunsthalle, which became one of the most emblematic works of the concept of the exhibition. Joseph Beuys filled the corners with his well-known —fat! and Richard Long removed a piece of the structure of Kunsthalle and took it on a three-day hike through the Swiss mountains.

In Brazil we must mention the role of the curator Walter Zanini, not only in the 16th and 17th São Paulo Biennial (1981 and 1983 respectively), which abolished the setting up of spaces reserved for certain countries, but also in exhibitions and proposals such as *JAC's* (1972), *Prospective* (1974), and *Visual Poetics* (1977), which were held when he was the director of the MAC – Museu de Arte Contemporânea de São Paulo.

In *JAC's – Jovem Arte Contemporânea* (1972), for example, besides the fact that Zanini opened the space for the production of new media (xerox, video, etc.), he raffled off spaces in the museum for artists to produce their work while requesting in the registration form, that the artists attempted to give greater emphasis to the artistic process over the finished object. *Prospective 74* was further groundbreaking, in the sense of creating a network of known artists, in which each one would invite another one, and so on and so forth... This network of friends resulted in an exhibition with over 150 artists who produced works that exceeded the limits of conventional media, such as video art and mail art. In addition, *Poéticas Visuais* (1977) were ever more innovating by giving the public the chance to select artworks, which they would like to take home with them. This exhibition provided the public with photocopies of the documents and artworks displayed, thus setting up the spontaneous participation of the viewers who were able to create many potential portable exhibitions.

It is important that we mention Seth Siegel's *Xerox Book*, 1968, one of his best-known curatorial projects in the form of a publication. For that show, seven artists – Carl Andre, Robert Barry, Huebler, Joseph Kosuth,

Sol LeWitt, Robert Morris, and Laurence Weiner – each contributed a 25-page work. The title *Xerox Book* was a bit misleading. Although inspired by photocopying, the book was made utilizing traditional offset printing due to the high cost of photocopying at the time.

On the other hand, it became common among contemporary practices, in dialogue with artists exploring circuits outside the traditional ones, that curators invite artists to hold exhibitions in unusual places, such as shut-down factories, churches, abandoned hotels, occupied neighborhoods and parks, radio stations, advertising venues, among others. An example is the exhibition the *Chambres d'Amis* (A Friend's Bedroom). This audacious curatorial project was conceived by the Belgian curator Jan Hoet in 1986. The curator had previously requested that some residents of the city of Gent, Belgium, make their homes available for 50 artists to do installations or interventions in one or two rooms in their homes. Armed with a map, visitors could go door to door and visit the —exhibitions! for two months. Most of the spaces used by the artists were living rooms, gardens and passageways, such as stairs and doors, except Daniel Buren, who chose the master bedroom to paint red stripes on a white wall.

Another example of exhibitions in this context was the show *Arte/Cidade* [Art/City], which took place in São Paulo and had its first edition in 1994. Created by Nelson Brissac Peixoto, each edition includes new curators invited to define the theme, the participating artists, and the locations of the public actions. The former Municipal Slaughterhouse of Vila Mariana was the first site chosen to reflect on the weight of abandoned buildings in large cities, with the theme: *City Without Windows*. The following year, the theme was *The City and its Flux*, using the top of three buildings as a base for artists to work on concepts of lightness, light, movement and scale. Laura Vinci made use of a hole in a flagstone to propose an installation in one of these buildings, turning two floors into a large sand hourglass. In the 2002 edition, Krzysztof Wodiczko presented an alternative for scrap paper collectors by building a 'utopian' aluminum cart with a canvas awning to protect the scrap paper collectors from exposure to the rain and sun.

However, it is not only in the transformation of sites in the city that curators today seem to be interested. Many also explore cyberspaces, networks, and the Internet. It is worth remembering the exhibition of net art *CODEDOC* (2002) curated by Christiane Paul for the

Whitney Museum. This show made explicit the criticism of the monopolization of technological knowledge. For this exhibition, the artists were invited to create codes with a specific theme: connect and move three points in space. The strategy of the presentation *CODEDOC* was unique: before —seeing the work!, the viewer-user was asked to access the source code of the work. In this way, the curator made her objective clear: not only to explore the source code as a fundamental part of the work to be developed but also to stage discussions about the democratization of the access to information and free software. Among the showcased artworks we highlight the Sawad Brooks Perl, a project in which the source code changed and interfered with the home pages of three major world newspapers.

Curatorial Collaborations

Many of these curatorial undertakings conceptually rooted in contemporary art, dialogue with the idea of relational practices in the form of collaborative narratives. On occasion, they also include the space of the Internet in their web. Within this perspective we can highlight the project *Do It* by the Swiss curator Hans Ulrich Obrist, an exhibition that is somewhere between the actual and the virtual, between repetition and difference. This project is modeled as an open exhibition (like an open work of art in constant motion) in which artists, invited by the curator propose work instructions that can be activated by the public who that way become the —maker! of the work. Whoever wants to make the performance, the installation, the drawing, ultimately follows the script of the artist who created it. The project is ultimately authored by all participants.

In a similar perspective, we can highlight the curatorship of (*Approximadamente 800cm3 of PLA*) designed by Gabriel Menotti and presented at the art gallery of the Federal University of Espírito Santo and also through the website *800cm3*. The project explored the relationship between 3D printing and the —supposed! immateriality of digital means putting into question the illusion of technology as an inexhaustible source.

Unlike traditional curatorial procedures where the artwork is usually chosen a priori by the curator of *Approximadamente 800cm3 of PLA* used the feature of —business call! as a trigger for the curatorial process, in which any artist and/or interested party could sent their proposal to be displayed on the site. What defined the curators criteria, so to speak, was the amount of raw

material available for printing: a roll of 3D Printing Filament, containing approximately 800cm³ of material, thus giving its name to the exhibition.

Between scale variations and malformations, the printed articles have created a kind of curio cabinet containing algorithmically generated sculptures, cartoon characters, computed tomography, and three-dimensional models of trash cans, made by more than thirty artists from around the world.

Approximadamente 800cm³ of PLA sought to employ in an unusual way, the digital manufacturing technologies, by testing their limits against idiosyncrasies of certain fields established for human knowledge and action. As the name implies, the project takes as its starting point, the plastic raw material of the most popular type of 3D printing. More specifically, a limited amount of plastic; a standard roll of 3D Printing Filament.

The curators shed light upon discussions regarding the use of 3D printing technology for preservation and access to art works in museum collections. *Approximadamente 800cm³ of PLA* sought precisely to question certain assumptions by providing the technology for the production of anything submitted to the project on the basis of —first come, first served. In this way, the exhibition intended to challenge the museographic hierarchy by calling attention to what is less important and mundane, thus recovering the notion of curiosity which existed in the old cabinets of curiosities—as a guiding principal of the exhibition. In this sense, the curatorial concept not only worked through a collaborative form and on the network as well, but touched upon a very important point when we think of museums and curators: the collection and its accessibility.

Curatorship and Collections: Livro-Acervo, MaPA and Ex-Paço

To question traditional museographic standards, to create more experimental curatorial structures, as well as to make the collections more accessible to the public, have been some of the strategies utilized by the Paço das Artes.

Given that the Paço das Artes is not a museum in the strict sense of the word (it does not have a collection of artworks), in addition to its active promotion of the emerging young Brazilian contemporary art, it makes its archival and research work, the cornerstone of its — collection.

We could say that the actions of the of the Paço das Artes constitute a kind of imaginary museum, as defined by Andre Malraux: The Paço das Artes collection are the artists, the Paço's activities, curators, critics, educators, and the public that passed through its doors. It was in this perspective of opening up the debate and discussing issues related to collections and archives, that the Paço das Artes curatorial and exhibition projects Livro/Acervo, MaPA and Ex-Paço were conceptualized.

Livro-Acervo

The first project, *Livro-Acervo*, was designed by me in 2010 for the commemoration of the 40th anniversary of the Paço das Artes. The initial idea of the project was to develop a — big! curatorship that could not only rescue the memory of the Paço das Artes—the actors and agents who were part of its history—but also offer the public the opportunity to have access to a curatorial example beyond the traditional exhibition space.

It was in this perspective that a new idea was born: to develop not only a curatorship in book form — portable and of easy circulation — but to also develop a curatorial concept based upon the concepts of the —archive and —collection of the institution, thus rescuing one of its most important projects: A Temporada de Projetos [an annual open call for projects].

This large project was composed of three main parts²². In the first part, the thirty artists who went through the annual *Temporada de Projetos* were invited to develop a new work on paper (such as the flip book *Shipwreck*, developed by the artist Laura Belém). These works were printed as hard copies for distribution and inserted together with the other items comprising the project. In the same folder of notebooks worked on by the artists, we have the Encyclopaedia, the second part of the project, with information about each of the artists, curators and jury who participated in the *Temporada de Projetos* since its first edition. The third part of the project consisted of a sound work of up to one-minute-long, recorded on a CD-ROM, developed by artists and curators, who participated in the *Temporada de Projetos* since its first edition. It is noteworthy to mention that the project (consisting of these three parts) were given in the form of a box / archive alluding precisely to the idea that this device contains an important part of the

²² From the initial idea of the project, we invited the artists Artur Lescher and Lenora de Barros as curators overseeing the development and design of the first edition of of the *Livro/Acervo*.

history of the *Paço das Artes* and its share of emerging Brazilian art.

MaPA

Giving continuity to the project *Livro-Acervo* implemented in November 2014, *MaPA: Memória Paço das Artes* (MaPA Memory of the Paço das Artes), a digital platform for contemporary art, brings together all the artists, critics, curators and members of the jury who have participated in the *Temporada de Projetos* since its inception in 1996.

The platform consists of a database with more than 870 images of works exhibited in the *Temporada de Projetos*, and approximately 270 critical texts and video-interviews that have been especially developed since 2014 for this project. Bringing together more than 240 artists, 14 curatorial projects, 70 art critics and 43 jurors, the platform was built as a relational device and a *work-in-progress*, offering the researcher the opportunity to access information and existing relationships within the *Temporada de Projetos*.

On the *MaPA* home page, the public is presented through a random system, to a number of names (of artists, critics, curators and jury members who went through the *Temporada*). By hovering the mouse over any of these names-links, the map highlights in bold the other names involved in that particular year of the *open call for projects*. That is how one starts the research on the *MaPA* platform: as a relational device that allows one to know the trajectory of each artist alongside those of the critics who evaluated him/her, and the jury that selected him/her. The emphasis given to this — relational history is explained in the dialogue with the *Temporada de Projetos* proposals, which in selecting artists, curators and critics early on in their careers and serves to validate new talent into the art scene. It is for this reason that the organization of information and references on the platform are made through the names of the artists, curators and critics. It documents their trajectories and the creative development of all those involved in the production and circulation of contemporary art, therefore validating the trajectories and creative development of all those involved in the production of contemporary art system.

Finally, the *MaPA* could be seen not only as a recovery device for the trajectory of the *Paço das Artes* and the institution's archives, but also as a research device for all those interested in the trajectories of the young

Brazilian contemporary artists. Last but not least, the map is a trigger vehicle for developing other narratives on the history of Brazilian art, the young Brazilian art, which quite often has no opportunity, or does not appear in the official discourses of art history.

Ex-Paço

As the final project of this trilogy, I would like to highlight the work in progress of *Ex-Paço* conceived and designed by myself and Sergio Nesteriuk.

The *Ex-Paço* is a three-dimensional virtual replica of the *Paço das Artes*, with outputs for computer (local and online), mobile devices, and cardboard virtual reality goggles. Modeled in 3D from the last site of the *Paço das Artes*, the *Ex-Paço* is not only a space for memories in the sense that it recovers, in virtual reality, the former building where the institution previously existed, but rather a digital museum dedicated to housing different curatorial projects and contemporary art manifestations.

This new interactive space, located in virtual reality, is the starting point for thinking about new curatorial and exhibition dynamics enabled by new technologies. It is not, therefore, just digital artworks exhibited in a museum or site, but rather it is the exhibition space itself that is now digital, virtual, thereby opening up new creative possibilities in the curatorial and exhibition fields.

If in the *Livro-Acervo*, and on the *MaPA* digital platform, what was in focus was the access to the strategies and information about the *Paço das Artes* activities — in the sense of contributing to new narratives of the emerging Brazilian Contemporary art — in the *Ex-PAÇO* development project, what is at stake, is not only the creation of a digital museum for the development of online curatorship, but especially the highlighting of the of the *Paço das Artes* as a space for artistic creation and experimentation.

The interface between curatorship and new media could offer us interesting ways to understand the changes in the spaces and current exhibition formats. These new formats often dialogue with questions concerning the very *modus operandi* of art and of contemporary media culture. Curatorial process, curatorial collaboration, online curatorship, curatorial projects developed on and for the internet, are some of the strategies adopted by us, the current curators.

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Author Biography

Priscila Arantes is a researcher, curator, professor and museum director. Currently she teaches in the Master and PhD in design program at the School of Arts, Architecture, Design and Fashion of the Universidade Anhembi Morumbi She holds a PhD in Communication and Semiotics from PUC/SP and a postdoctoral degree in Art Criticism and History from the Penn State University. She is currently artistic director and curator of the Paço das Artes, a museum of São Paulo, since 2007. Her publications include *Arte e Mídia: perspectivas da estética digital* (Art and Media: perspectives of the digital aesthetic), *Arte: história, crítica e curadoria* (Art: history, criticism and curating) and *Re/escrituras da arte contemporânea: história, arquivo e mídia* (Re/writings of contemporary art: history, archive and media). She has curated a number of exhibitions. Recent curatorial projects include *Arquivo Vivo*, *Projeto 5X5* and *MaPA*, held at the Paço das Artes.

Retracing the Story of Bourges's Institute of Electroacoustic Music through Exploratory Programming and Live Visualizations

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Abstract

Bourges's Institute of Electroacoustic Music (IMEB) has been created in France in 1970 by the composers Françoise Barrière and Christian Clozier who directed it until its closure in 2011. During its forty years of existence this institute has been heavily involved in the development of electroacoustic music both on national and international scales. Its activities have included among others musical research, development of music-making software, creation of instruments and organization of music festivals and competitions. From 2005 to 2011, this Institute has donated all of its archives to the National Library of France that is to say a complete set of multimedia data about the history of electroacoustic music and its worldwide diffusion. In this paper will be describing the work that has been done to retrace the story of the international competitions organized by the IMEB using interactive data visualizations and multi-agent systems (MAS) that have been modeled based on the study of living organisms' behavior. The use of MAS will be presented as a way of exploring wide set of cultural data and retrieve new information stored in a database from the study of click streams.

Keywords

IMEB, Electroacoustic Music, Digital Humanities, Data Visualization, Exploratory Programming, Multi-Agent Systems, Machine Learning, Live Visualization.

Introduction

Bourges's Institute of Electroacoustic Music (IMEB) has been created in France in 1970 under the name "Groupe de musique électroacoustique de Bourges" (GMEB) by the composers Françoise Barrière and Christian Clozier who directed it until its closure in 2011. In 1994, the Bourges's Group of Electroacoustic Music became an Institute recognized as a National Center of Musical Creation by the French Ministry of Culture. During its forty years of existence this institute has been heavily involved in the development of electroacoustic music both on national and international scales. Its activities have included among others musical

research, development of music-making software, creation of instruments and organization of music festivals and competitions.

Artists all over the world have participated in the activities offered by the IMEB. According to Christian Clozier, 274 artists from 43 countries have worked in their studios on 765 different audio compositions and 4836 composers from 82 countries have presented their work during the competitions and music festivals they have organized over a period of more than thirty years.¹

From 2005 to 2011, the IMEB has donated all of its archives to the *Bibliothèque nationale de France* (BnF) that is to say a complete set of multimedia data about the history of electroacoustic music and its worldwide diffusion.

In this paper will be describing part of the work that has been done to explore these archives as part of a research project directed by Geneviève Mathon and that has been financially supported by the Arts-H2H Labex. We will only report the work that has been done to retrace the story of the international electroacoustic music competitions organized by the IMEB from 1973 to 2009 using interactive data visualizations and multi-agent systems (MAS) that that have been modeled based on the study of living organisms' behavior. The use of MAS will be presented as a way of exploring wide set of cultural data and retrieve new information stored in a database from the study of click streams.

Exploratory Programming

The IMEB's archives located at the BnF are composed of very different types of documents, both digital and analog. To retrace the story of the international competitions organized by the IMEB has been used mainly the minutes of each competition, and the digital

¹ Between 1973 and 2009, 14206 audio works have entered the competitions and 6637 have been interpreted during the festivals.

part of the IMEB's archives including a vast amount of information about their participants and the works they have submitted over the years to enter the competitions. The minutes of each competition organized from 1973 to 2009 reveal the name and the address of each participant, allowing us to count them but also to determine the number of submissions by composers and their provenance. The minutes also give information about each musical creation that has obtained a prize, letting us know their existence but also collect data about the evolving set of categories used to organize them each year.²

In addition to the minutes of the Bourges's international competitions, the content of 6292 digital folders has been explored. These folders have been created by Françoise Barrière and Christian Clozier. Together, they provide a rich panorama of the actors of the contemporary musical creation of the second half of the 20th century. Each folder regroups information about an electroacoustic composition that has been at least submitted to one competition or has been publicly presented during the music festivals "Synthèse" organized by the IMEB. It contains one uncompressed audio file that corresponds to a record of an electroacoustic composition, but also information about their author. Each folder includes a picture of a composer that has been associated with a bibliographic record. It contains fragments of a missing database too that report key information about the audio composition itself like its duration or its number of tracks. Several folders also include layouts for multichannel compositions like the one referencing the fifth element of the acousmatic work *Tao* composed by Annette Vande Gorne between 1989 and 1991 and named "Earth".

Context

The multimedia data contained in these folders represent a significant amount of information that doesn't share a common space of visibility. The information can't be perceived as a whole. The system that has been used to store the data doesn't offer an overview of the content of the folders nor provide an easy way to access the information related to a specific composer. The structure of the digital archive doesn't authorize to access all the folders containing an audio composition

² The evolution of the categories proposed by the IMEB to enter the competitions has been depicted using a Sankey diagram accessible at this address: <https://goo.gl/gaVND3>.

created by a specific artist or presented during the same edition of the international competitions. In order to retrieve the record of a specific audio composition we need to consult a table made by Christian Clozier that details the content of each folder.

Our work represents an attempt to facilitate access to the collected information by designing multiple interfaces that provide an overview of the content of the digital folders previously introduced but also let us browse and combine different types of data. Our intention is to present a combination of interfaces that can be used together to retrieve requested information but also permit their users to explore a digital archive without having beforehand a clear understanding of its richness and its structure.

The interfaces that are described below intend to become available in the BnF reading rooms in order to give access to the part of the IMEB archives they relate to. Their conception falls within the field of digital humanities. They respond to the need to create interfaces whose appearance and functionalities are intimately tied up to the nature of the data they let retrieve. We need interfaces that provide insights about the archives they give access to, and allow their users to reflect on their navigation paths.

The interfaces that are presented in this paper don't aim to replace any of the interfaces that the BnF already proposes to access information about electroacoustic music. They relate to the BnF general catalog by using the International Standard Name Identifier (ISNI) to uniquely identify each electroacoustic music composer that appears in the IMEB archives. Our project aims to link the data present in the digital folders that are part of the IMEB archives to the information about electroacoustic music already accessible to the public using application programming interfaces (API) provided by the BnF. Our intention is to give a better visibility to the selection made by Françoise Barrière and Christian Clozier while providing hyperlinks that let users access complementary sets of data.

The organization of a first hackathon in November 2016 inside the premises of the National Library of France reflects the willingness from this institution to open their databases to new practices by allowing third party to propose new ways to use and represent their data. The interfaces presented below reflect the same desire for openness.

They distinguish themselves from generic interfaces

by trying to provide an appearance and a set of features that has been specially designed to take into account the main characteristics and the specificities of a particular digital archive. These interfaces aim to be viewed as “generous interfaces”, an expression coined by Mitchell Whitelaw to describe rich and browsable interfaces that are able to “reveal the scale and complexity of digital heritage collections” (2015).

Process

To give more easily access to the content of the 6292 digital folders an interactive index has been designed. This index has been created upon a database that will regroup in the long term all the information contained in these folders but also other information found in the minutes previously mentioned in order to give an overview of all the composers that have participated in the competitions along the years.

The database that has been created doesn't only regroup data about composers mentioned in the digital folders. This database has been created to store information about all the composers that have participated in the competitions organized by the IMEB in order to be able to create data visualizations that allow their users to evaluate the representativeness of the content of these digital folders. The mention of all the composers that have been part of the history of the IMEB allows us to represent not only the information that is already accessible but also the information that is still missing and could be added gradually. It changes the way of seeing a database by presenting it as “forever incomplete” despite the large amount of data that has been gathered and its diversity.

In order to create the database, a multi-agent system (MAS) has been designed. First, the role of this MAS was to analyze the name, the first name and the address of each composer listed in the minutes in order to detect spelling errors but also to identify as a unique person each composer listed several times in the same minutes (or in different ones) using machine learning techniques.

The same MAS has also been used to determine the country of each composer and to enrich the database accordingly with this information. To sum up, this dynamic system has enabled us to gradually add information to the database, minutes by minutes, while identifying spelling errors and the participation of new composers each year by comparing them to each other. Then, the collected information about all the composers

listed in the minutes have been compared with the one already archived in the 6292 digital folders in order to give, with data visualizations, more visibility to the composers whose works have been conscientiously selected and archived by Christian Clozier. At the end of this process, 1202 different composers (that have participated in one competition or more) have been identified as having at least one electroacoustic composition archived in the digital folders.

Interactive Index

An interactive index has been created (see Figure 1) using all the information that has been collected and stored in a database. This index is able to give access to all the compositions that have been submitted to the international competitions and are part of the selection made by Christian Clozier and Françoise Barrière in order to be archived by the BnF.³ As a collection, they symbolize the quality and diversity of the electroacoustic compositions submitted to the Bourges's international competitions. The interactive index gives access to all of these compositions by referencing each of their authors with a gray square followed by at least one colored square.

The number of colored squares indicates the number of competitions each composer has entered while their color specifies the year of each of their participation. The red ones represent the first edition of the competitions organized in 1973 while the purple ones point out the last edition that took place in 2009. The colors go from red to purple passing by orange, yellow, green and blue. They allow to quickly identify composers that have participated in more than one competition but also the ones that have contributed repeatedly to the activities of the IMEB over a period of more than 30 years. The “long tail” distribution of electroacoustic compositions became immediately apparent. Most composers have only a small amount of their audio compositions archived, while the work of few of them is very well represented. For example, the digital folders about the work of the Swedish composer Åke Parmerud contain records about twenty different pieces.

Françoise Barrière and Christian Clozier had

³An online version of the interactive index is accessible at this address: <https://goo.gl/mlK68z>. To respect copyright laws, this version doesn't give access to any audio records available at the National Library of France.

already created lists of the winners of the Bourges's competitions. They have published statistics about the quantity of works that have been submitted each year, the number of composers that have been involved or the number of countries that have been represented. Some of them have been published in the numbers 6 and 7 of the magazine "Faire" released in 1985.

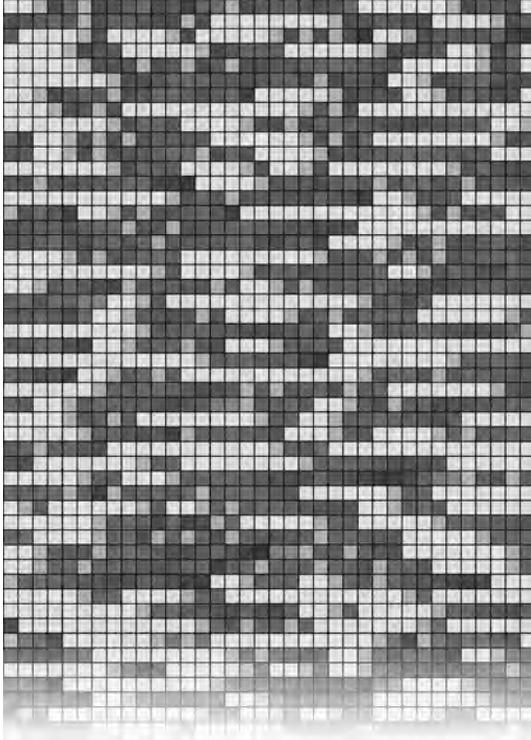


Figure 1. Part of the interactive index generated to give access to the IMEB archives

Compared to the information already communicated by the IMEB, the interactive index has the advantage to directly link a global representation of the competitions to all the elements that have made its construction possible. It gives access to all the data associated with the composers registered in the database, including information about their electroacoustic pieces that have been archived at the BnF. The design of this interface follows the "seeking mantra" defined by Ben Shneiderman to explore digital collections: "overview first, zoom and filter, then details-on-demand" (1996). First, the interface gives access to an overview of

the collection. Then, it lets its users choose between different parameters to filter the displayed elements as the one allowing them to hide all the rectangles referencing the work of composers who have less than x audio compositions archived. The parameters enable focus on a subset. Finally, a detailed information on a specific composer can be displayed. For example, selecting the rectangles that referenced the work of Maggi Payne lets us access the information concerning twenty-four electroacoustic pieces that have been archived including audio files. The works of Colombian composers like Germán Toro Pérez and Carlos Mauricio Bejarano Calvo are also indexed. A total of twenty-one electroacoustic compositions made by Columbian composers are accessible via the interactive index and associated with metadata about the compositions themselves (duration, date of creation, number of tracks, type) but also about their connection to the competitions (mainly category names and editions chosen by their authors to submit their works). If a user is looking for information related to a certain composer, he can also use a search bar to pinpoint the rectangles referencing its work. The interface emphasizes the exploration of the database but lets us also query it.

The interactive index has the ability to evolve in response to the edition of the database used to build it. The way the information is displayed shows that the database doesn't contain data about all composers. The role of the interactive index is to reveal not only what documents are accessible but also what information is missing and could still be added. It reveals the absence or scarcity of information about some composers. A void that can have as much meaning as the multitude of information available about other ones.

All the composers whose works are not present in the digital folders archived at the BnF (but are listed in the minutes) are part of the interactive index. The rectangles used to list their submissions are rendered with a semi-transparency in order to distinguish them from the composers whose works have been made accessible (see Figure 1).

The desire to show what information is missing has guided the work we have done to widen access given to the IMEB archives. It has played a decisive role during the design of the interactive index. Showing what electroacoustic compositions are missing permits us to evaluate more easily the representativeness of the selection made by Christian Clozier and Françoise

Barrière to keep track of the quality, the diversity and the evolution of the electroacoustic compositions made by artists from all over the world for more than 30 years. The visibility given to missing data lets us also explore the database by choosing to consult in priority information about composers whose work is mentioned several times and has been particularly well protected. It also guides users that are unfamiliar with electroacoustic music by highlighting famous composers' works.

In the next section of this paper will be presented another data visualization used to widen access given to the IMEB archives. Like the interactive index, its design keeps track of the information that is still not available. It also shows information about the content that has been already consulted and may have been overlooked.

Live Visualizations

Despite the time we spend using them, digital interfaces don't change so much. Few of their parameters can be modified or personalized based on the use we have of them but not many interfaces are able to adapt to the content they are giving access at a particular time. They don't change over time based on the information that has been consulted. The properties and features of digital interfaces belonging to national museums and libraries mainly respond to a need for consistency and standardization in order to facilitate access to their main catalogs and collections.

However, the capacity for an interface to evolve based on the nature of the data that has been consulted by a user can be very useful. It's particularly true when an interface gives access to the content of a database that cannot be fully explored in a short period of time due to the vast amount of data that has been archived or its complexity. We use the concept of "live visualization" to define a certain type of interfaces elements that evolves with the content they give access to.

The interactive index previously presented has been associated with one of them. Live visualizations are constructed based on the information a user is accessing. They are built in real time by analyzing click streams. Each time a user interacts with one of the rectangles that are part of the interactive index, a new element called agent is added to a live visualization. The node of information that has just been accessed using the graphical interface defines the new element properties and its behavior.

The colored squares of the interactive index are

used to list all the electroacoustic compositions that have been archived for a specific composer while a live visualization uses the information that has been consulted about a specific composer to create an autonomous agent. The term autonomous agent refers to an entity that can act on its virtual environment by itself without further orders given by a user or another digital entity. An autonomous agent has no leader. It processes the information from its environment and calculates an action (Shiffman, 2012). To sum up, a live visualization corresponds to a running multi- agent system. Each time a user interacts with the interactive index, a new agent is created using the node of information that has just been retrieved from the database.

A Bio-Inspired Approach

The multi-agent system has been defined based on the study of the behavior of living organisms. It doesn't intend to recreate nature or the complexity of its living organisms. This system has been designed to create group dynamics by following rules that have been elaborated from the observation of living organisms like fireflies.

Fireflies are known to emit flashes at regular intervals when isolated. They are also known to be able to synchronize their light emissions when they are in a group, their pulses converging upon the same rhythm until they synchronize. This collective behavior is the result of actions taken locally by insects that share the same environment and choose to get in synchronization with other living organisms that surround them.

The designed MAS use the same technic to create an overview of the content of the database that has been retrieved. Each agent is created from an information node that has just been requested by a user. This information node represents its genetic string. It determines its appearance (color, shape) and behavior (movement speed, actions). It allows them to appear with distinct colors and act differently based on the nature of the information they carry on.

Like fireflies, each agent has the ability to interact with other agents that are spatially closed to him. These interactions serve to create group dynamics. They are being used to compare information nodes and reveal the properties they have in common from the result of these local comparisons.

Then, the list of properties that are shared by most of the agents can be used to reorganize the whole

system. They became part of the interface of the live visualization allowing its users to choose between them in order to create new grouping between agents.

The main characteristic of this MAS is to be able to evolve in order to show in real time the main attributes of the information a user is accessing. It adapts to a constantly changing context in order to be able to use new properties to reorganize and to browse the data that have already been accessed.

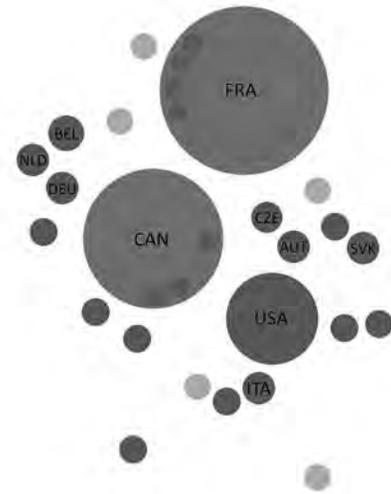


Figure 2. Example of live visualization created by analyzing click streams using a multi-agent system

The first version of the MAS that has been created gradually regroups by countries all the nodes that referenced a music composer.⁴ First, the agents that are part of the system interact between them to determine the attribute they have in common. Then, they choose to regroup with the ones having for this attribute the same value as them. They give birth to a new agent that represents this attribute and value: a country like France or Canada, for example. This agent represents a common point between at least two other primary agents that become its child nodes, nodes extending the one that has been created. This transformation and not disappearance

⁴ An online version of the multi-agent system is available at this address: <https://goo.gl/CIGMiY>. To respect copyright laws, this version doesn't give access to any audio records available at the National Library of France.

of nodes that share a common value (associated with the same attribute) permits us to keep track of all the nodes that have been consulted while regrouping them. Any node that becomes a child can be reached (as the information it transports) by selecting its parent.

Figure 2 shows parent and child nodes both. The gray elements are information nodes sharing any attributes with other ones while the green nodes are grouping of several nodes that can be opened to discover their content. The yellow ellipses are parent nodes that have been opened in order to access their child nodes.

Live visualizations can generate multiple groupings between agents based on the common attribute chosen to display them. They allow a user to acquire knowledge about its click stream. Live visualizations use common attributes that share the data that has been consulted to map out a navigation path and propose new directions to continue the exploration of the IMEB archives. MAS are a powerful tool for exploring databases. They let us build interactive interfaces that are able to evolve rapidly with a minimum of user input and knowledge about the content and structure of a database.

SMA allow us to do groupings that are not predefined. Groupings are the result of interactions between autonomous agents. This property allows the system to evolve based on the retrieval of new information nodes. They let us group the information that has been accessed by types. In this case, each agent can represent either a composer, a country or an audio composition and can be grouped accordingly. But the type of each information node is only one of many variables that can be used as a common denominator to gather multiple agents. The data type represents a property (as the provenance of a composer or an electroacoustic piece) and any property can be used to connect (or separate) two agents.

The role of the MAS is to detect by interaction the main properties that are shared by its agents in order to give to a user the power to choose one of them to map out its navigation path based on the property he is interested in. In the case of the IMEB archives, the MAS allow for example not only to group the composers by country but also to order the consulted audio compositions by categories (abstract music, program music, electroacoustic music with instruments, sonic art work, etc.). This possibility appears automatically once the information about several electroacoustic compositions belonging to the same category has been accessed.

While live visualizations have been primarily designed to regroup information nodes that have already been consulted, they permit their users to discover new elements of information too. Each primary node can be individually selected in order to access all the data associated with a specific composer or an electroacoustic piece.

Conclusion

Associated with interactive indexes, live visualizations let us imagine new ways to browse the content of any multimedia collections while displaying information about paths that have already been taken to explore them. By giving access to an interactive image that is able to reconfigure itself based on the choice made by a user, live visualizations emphasize browsing and visual exploration.

The interactions between agents create overviews that provide insights about browsing history and act as a guidance tool while a user is navigating through the records of a database. In the case of the IMEB archives, the live visualizations offer fragmentary views that reveal the richness and diversity of the electroacoustic compositions that are part of the digital archive.

Like any visualization tools, these live visualizations have their own limitations and do not claim to be able to replace other interface elements like search boxes to query databases or ordered lists to show data. They represent with the interactive index introduced in this paper, additional interface elements that work together. These navigation instruments have been designed to explore a specific archive, but we hope to be able to use the same technic to explore in the future other digital collections.

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Un-Earths: Landscape, Memory & the Global Map Lawrence Bird

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Abstract

This paper addresses the failures of the modern mapping project understood through three creative works in video and projection-mapping, discussing them in terms drawn from Bernard Stiegler's writing on industrialized memory. The three works harvest moving satellite images associated with significant geopolitical frame-works: the 49th Parallel, the Greenwich Prime Meridian, and Canada's Dominion Land Survey, exposing anomalies and opacities in imagery gathered there. One of these videos, *parallel*, is being screened at ISEA 2017. The paper articulates these works as amplifications of the failure of the modern project to transparently map the world. Rather, such frameworks -- in both their historical forms and their contemporary manifestations in GPS, GLONASS, the International Earth Rotation and Reference Systems, and popular tools such as Google Earth -- are rife with anomalies and errors. Counterintuitively, such failures are built into the industrialization of knowledge; as Stiegler puts it, the straight line generates the bent. This is even more the case as the mapping project becomes a temporal archive.

Keywords

Mapping, Video, Projection Mapping, Epistemology, Stiegler, Borders, Parallel, Latitude, Longitude, Meridia

Introduction

This paper is spurred by a perplexing question: why is it that, at the end of three centuries of attempts to perfectly map the globe, are we not yet in possession of that map? Why does this modern promise remain unfulfilled?

We might well look at this failure as hopeful evidence that in the end our lives as citizens and our work as creators can-not be circumscribed. I will make my argument on two fronts. The first of these is a set of creative projects in video and video projection mapping. The three projects are my own; I beg the reader's indulgence for this. The projects employ imagery harvested from popular Geographic Information Systems (GIS), specifically Google Earth. These popular systems are at first glance instances of the promised global map:

probably its most widespread and accessible form today. As any of us who have used them know, their navigation functions not infrequently drive us into error. But more than this, they are built upon some of the most sophisticated mapping technologies available: imbricated with the military technologies and agendas which constitute an inescapable political dimension of this phenomenon. They are in fact representatives *par excellence* of the technological, epistemological, and political project which is the modern map in its current manifestation. Numerous other artists have used tools like Google Earth to represent damaged modern spaces; for example Mishka Henner, Jon Rafman, and Doug Rickard. Projects by artists like these make critical use of the images offered to us by popular GIS. The ostensibly neutral, accurate and dispassionate infrastructure which gathers such images is revealed by the artists as in fact broken, shot through with anomalies and ruptures, and offering an unexpected poetics.

The three projects I will discuss involve screencaptured video from Google Earth: *parallel*, which tracks the 49th parallel of latitude where it coincides with the international border between Canada and the USA (screened in various iterations since 2012, in 2016 at Inter/Access Gallery, Toronto, and *Coder et Décoder la Frontière à l'Aube du 21ème siècle*, Université Libre de Bruxelles, and most recently at ISEA 2017); *Transect*, which follows the Greenwich Prime Meridian and Antemeridian around the world (installed at Queen Anne Court of Greenwich Naval College, United Kingdom, as part of the conference *Digital Research in the Humanities and Arts 2014*); and *Dominion*, a project currently in development, which will chart the Western Canadian territories and the 19th century Dominion Land Survey. Each of these takes as a starting point the grid of latitude and longitude, the basic framework that carve ups the world for modern knowledge, control and consumption. The moving images in these videos

amplify the many digital flaws and anomalies in popular mapping systems, as well as the physical scars and distortions in the landscapes they document -- features often generated by our own attempts to map and manage those landscapes. The projects intend a close and patient study of our modern manipulation of geography and image, while revealing something of the surprising potential for poetics therein.

That will be my first piece of evidence. My second will be theoretical, and will draw on Bernard Stiegler's writing on industrialized mnemonic systems. In his masterful work *Technics and Time 2* Stiegler makes the case that, far from establishing a perfect and absolute memory, modern technological systems by their very nature generate a condition of *différance* (Stiegler, 2009). In Stiegler's terms, Google Earth would be an example of such an industrialized mnemonic system. It offers not just a spatial but also a temporal map of the world's form, albeit a very young one; it is not only a database of places but also an archive.

In his earlier work *Technics and Time 1*, Stiegler makes the case that technics have always been constitutive of our humanity (Stiegler 1998). We become human through our manipulation of tools and technical devices, not despite it. And error is foundational to that use: while technics compensate for our shortcomings, our creation of technics (the prescient Prometheus illustrates that capacity) is the twin of our insufficiency (which is represented by the Titan's forgetful brother Epimetheus).

Stiegler is my theoretical lens for this paper, but I should briefly place my claims in relation to the observations of several other writers on knowledge (and maps). GIS might be seen at first glance as a manifestation of Borges' map, the model which came to rival the Empire that it represented (Borges, 1999); and its more seductive variants as perhaps resonant with Baudrillard's simulacrum, the episteme which succeeded the modern mirror of science and came to not just rival but replace the thing it modelled (Baudrillard, 1994). Resonances to the latter might seem most obvious, but as shall become apparent, the phenomena I will be describing exist in the end only in relation to materiality, not in its replacement. For thinkers like Casey (1997), Malpas (1999) and Pérez-Gómez (2016), GIS would be seen as an important contribution to the modern changes whose spatial impact has been the annihilation of place. Of course they are, but my assertions about the results are perhaps less pessimistic. I am presenting

evidence that what comes out of these systems and their interplay with the physical world is a place complicated and damaged by our modern condition -- but a place nevertheless. While such systems can in significant ways contribute to the impoverishment and evacuation of the meaning of space, my point is that their products also somehow, in strange ways and perhaps unintentionally, seem to enrich the world they represent. I will assert that such places, and our imagination of them, add to an existing material reality as Paul Ricoeur asserted fiction adds to reality (Ricoeur, 1984). They do this not in the generally accepted sense of "augmented reality", a layer added on top of an image of an existing world. Rather, in them material and image, landscape and its representation, intermingle. Stiegler's work itself seems to me resonant here: in a technological world, it is only through acceptance of technics as constituent of our humanity that we might find a way forward, indeed that we might recognize technology as what it is, our "saving danger" (Heidegger, 1977).

Parallel

The first project I will consider takes as its point of departure the 49th degree of latitude, the border between the US and Canada. *parallel* is an evolving single channel video which originated in 2012 and has since been through several iterations, each incorporating more recent and higher-resolution imagery.



Figure1. Courtesy Google Earth, ©2016 Digital Globe

Using functions internal to Google Earth (especially *historical imagery*), the project harvests satellite imagery captured along the length of the border as multiple sequential high -resolution images, collected, sorted, and edited into a single long aerial tracking shot from west to east, 7 hours in duration. Audio in this piece

comprised three superimposed tracks: found music, ambient sound from the International Space Station, and audio from an MQ-9 Reaper drone (these drones patrol the border today), all modified.

parallel runs 2,000 km from the Strait of Georgia in the Pacific Ocean to Lake of the Woods. If one follows the long pan long enough, anomalies become apparent, both in the landscape and its image. In Fig. 1, where the parallel approaches Lake of the Woods, the landscape and its image present a rich tapestry, in which the border itself has an ambiguous presence. Running vertically in the centre of the image (the pan moves slowly upwards), we can identify the line of latitude only through differences in land use: forest and wetlands have been cut away to create farmland, but only on one side of the border. Even on the farmed (American) side, distinct territories of land ownership and occupation can be identified; like the border, these are created by arbitrary lines of ownership. As the border approaches the edge of Lake of the Woods, it dissipates; all permutations of land use give way to a shoreline ecosystem.

This amalgam of land is further complicated by another phenomenon. Google's machinery has spliced together satellite tiles collected at two different times; the border between them parallels but does not equate with the political border -- there is a displacement of some hundred metres. The result -- a cloud cut as though by a knife, and the sharp edge of a dark and shadowy territory bordering the bright lakeshore -- suggest distinct and contradictory realities coinciding in one space. What would happen, we might wonder, if we were to follow that curving road from the bright land into the dark one? This single image, one of many thousands that might be harvested from *parallel*, presents a complex ecology of image, material, nature, artifice, space and time; an ecology that provokes narrative.

If in this hybrid world a digital artifact begins to take on the qualities of a territory, this condition can be even more pronounced. In Fig. 2, the 49th parallel can be identified in the faint line running down the centre of the image. Just to the right another, blurred, border is apparent where two satellite tiles (each captured at a different time of year, and collaged by Google's image processing system) meet and feather into each other. The image to the right was taken in the summer of 2005, when the Antler River overflowed its banks in one of the prairies' periodic floods; the one on the left dates from 2003. These two landscapes represent two

distinct but related prairie geographies, one terrestrial, the other aqueous; one controlled by human artifice -- engineering works can be identified clearly along the river bank -- and one escaping that control utterly. So the image speaks of the natural cycles of the prairie and our inability to control them. But another phenomenon is apparent: an inundation of another order encroaches on the image from the far left. Google Earth's algorithms have spliced a satellite image from an earlier time into this one, a lower-resolution image distorted through the machinery of Google's image processing. As we look closely into this pixelated and artefacted swath, it begins to adopt its own qualities of darkness, light, opacity and texture. It becomes a landscape in its own right. There are many other instances like this along the entire length of *parallel*, and they are often provoked as is this one by the temporal nature of Google Earth's map. Google Earth is not just a database of current satellite tiles. It is also an archive of historical images of the Earth dating back to the 1990s. Images like these reveal the unevenness of the data acquired and integrated into the archive at different times. Gathering images from the early 2000s for example, there is an obvious asymmetry between the imagery on the American side of the border—highly defined—and the Canadian side—highly pixelated, if present at all. But the temporality of this phenomenon seems integral to even the most recently collected imagery. Satellite images are not captured simultaneously. They are gathered by a space-based camera moving along a path above the surface of the Earth, and are recorded in sequence before being recomposed as tiles into one composition of the world. The border between two satellite tiles thus represents a seam in time rather than merely space. Different moments in one day are juxtaposed between separate images. Different seasons coexist.

This strange splicing of times, responsible for the generation of new and contradictory landscapes where we might have expected to see a straightforward, uncomplicated representation of a physical reality, seems characteristic of contemporary conditions of media, and it is Stiegler who will help me understand this. But for now I would like to point out that this strange, occasionally eerie, contemporary condition follows a long history of mistakes made with earlier technologies. The 49th parallel was always an arbitrary boundary. The border was originally defined through a series of negotiations between the United States and the United

Kingdom following the Louisiana Purchase of 1808. In principle it was defined as the watershed between the Missouri/Mississippi river basins and Hudson Bay. But that line was in practical terms impossible to find, just as impossible conceptually, given the geometries understood at the time. Hence it was substituted by the 49th parallel; but even that simplified border could not be pinned down. It was laid out in several land surveys culminating in the 1880s, and cumulative surveying errors led to the border monuments straying hundreds of feet from the 49th degree of latitude. Subsequent treaties have defined the border not as the parallel itself, but as the wavering line demarcated by these (inaccurate) monuments. In the evolving iterations of the video work *parallel*, the path of the camera kinks imperceptibly to more precisely follow the original surveying errors which define today's political border. As it does, it records a land-scape whose technological mapping was compromised from the beginning.



Figure 2. Courtesy Google Earth, NASA, USDA Farm Service Agency

Transect

Such are the disruptions introduced into the simple and precise demarcation of the Earth one might hope for from a single line of latitude. Yet, it gets more complicated. At the time the 49th parallel was being surveyed, European powers were gathering to standardize the different systems of latitude and longitude used in their scientific and colonizing projects, around a common or Prime Meridian.

Pinning down latitude and longitude had always been a challenge. Latitude defines one's position along the circumference of the Earth at a given angle from the equator, and is easily calculated trigonometrically based

on the elevation of the sun above the horizon at noon. As one moves north the highest elevation of the sun in the sky (on a given date) decreases. Longitude, the distance in degrees of the earth's circumference west or east from a given reference line, is not so easily measured. In the 2nd century Hipparchus (who first devised this system) proposed to measure longitude by comparing local time to a place with an absolute time: a prime or zero meridian passing through Rhodes. By knowing the precise time at the zero meridian, even when one was at great distance from it, and knowing the movements of the sun and stars through time, in principle it became possible to measure, from their locations in the sky, one's location on Earth east or west of the Prime Meridian.

But knowing the time back at the zero meridian depended on access to a clock which accurately kept that time even when moved from the point of reference. And such a clock would not be developed for centuries. At the end of the 16th c CE Galileo proposed that the movement of the moons of Jupiter could serve as such a clock, and in the second half of the 17th c Cassini was able to use it to plot the latitude of the island of Goree in the West Indies relative to Paris. The Royal Observatory in Greenwich, England, was built to allow observations of the stars and moon precise enough to allow the Earth's own moon to be used as such a clock. The problem of time was thus in principle solved for land measurements, but there still remained the problem of achieving the necessarily accurate measurements from the moving deck of a ship at sea. By the middle of the 19th century, methods to measure time (and thus longitude) had been developed based on increasingly reliable timepieces.

Yet even as time became standardized, the choice of which line running north-south along the Earth's surface should be taken as the base line from which time and distance were measured -- the zero or prime meridia -- continued to be disputed. Prior to 1884 any European power with scientific or political ambitions had its own Prime Meridian. In that year the International Meridian Conference standardized the global system of latitude and longitude based on Greenwich's Prime Meridian. While France held out, employing a Paris meridian until 1911, the matter was otherwise settled: the epistemological, technical, and political division of the world in space and time had been universalized around a single reference line. Yet even as the capacity to precisely delineate such instrumental frameworks was becoming

stronger and stronger as we moved forward into the 20th century, their arbitrariness, ultimate indeterminacy, and resistance to control became, counterintuitively, more and more pronounced. This is the subject of the next piece I will discuss, *Transect*.

Like *parallel*, *Transect* pursues its path along a single reference line, the Prime Meridian (zero degrees of longitude) running through Greenwich, England, and its analog the Antimeridian on the opposite side of the world (180 degrees of longitude). These two lines form a great circle, a single long transect of the planet. Traversing this transect, so important to the European -- or Anglo-Saxon -- division of the world, the video project isolated many of the same phenomena identified by *parallel*. In Fig. 3 for example we can see an arbitrary line dividing the city of Tema, Ghana, invisible on the ground but apparent (displaced approximately one minute of longitude west of the Prime Meridian itself) in the line bisecting a cloud, where images from two times are spliced together. As did the earlier images, this one too folds the passage of time into its representation of space - a space itself bearing the marks of different times. The meridian crosses a complex polity incorporating a military installation and former detention centre Michel Camp, adjacent informal settlements, and the roadways and highway cutting the camp off from its surroundings. This landscape is a contemporary product of European manipulation of African political space, manipulation which made use of arbitrary geospatial lines, ignoring existing national identities and local definitions of place, to dissect the continent in ways that worked for Europe. *Transect* traversed many such spaces as it followed the Prime and Antimeridians around the planet.



Figure 3. Courtesy Google Earth, ©2016 Digital Globe

While *Transect*, like *parallel*, was single-channel video composed of thousands of high-resolution sequential stills, in this case the images formed the basis of a projection mapping project. As already mentioned, Greenwich Royal Observatory was the building created to perfect astronomical observations for the accurate navigation of the Earth by the nascent British Empire. Several of Britain's Prime Meridia have run through this building, culminating in the Airy Meridian established in 1851 and adopted as the International Meridian in 1884. The Royal Observatory sits atop a hill above the Greenwich Royal Naval College (1696-1712). This complex was designed by Sir Christopher Wren (architect but also an astronomer himself), with Nicholas Hawks-moor. The College and Observatory together were arguably the most significant building complex dedicated to global mapping and navigation at that time. On two nights in the summer of 2014 *Transect* was projected onto a courtyard portico of Queen Anne Court of the Royal Naval College.

The videos captured from Prime and Anti-meridia were superimposed, sampled, and projection-mapped onto the portico (Fig. 4). On the first night, moving images from along the Prime Meridian were mapped onto the portico's pilasters, and those from the Antemeridian onto the interstitial wall. On the subsequent evening these roles were reversed. These projections effectively collapsed the two sides of the planet onto each other, amalgamating their image with the architecture from which the Prime Meridian originally emanated. As real and fictional landscapes flowed past each other over time, repetitive yet ever-changing, they became a patina for the 18th century architecture: a liquid patina in which image and material mingled.

Today the arbitrariness and indeterminacy inherent in the choice of any Prime Meridian have been exacerbated by the shifting of the Greenwich Meridian 5.3 arcseconds (at Greenwich, this amounts to approximately 102m) eastward to form today's International Reference Meridian (IRM). The IRM is maintained by the International Earth Rotation and Reference Systems Service; it forms the basis of the Global Positioning System operated by the United States Department of Defense, and widely used for civilian navigation systems. Yet if this meridian was ever considered fixed relative to the Earth's surface, a certain and definitive base-line, it is no longer: we now know that the planet's tectonic plates move ceaselessly under it. The IRM is today instead space-based, defined as the weighted average of hundreds of reference meridia running through Earth-based stations and communicated through two dozen Global Positioning Satellites. Derived from this system, the network of latitude and longitude is now mobile, having no fixed relation to any point on Earth, nor to the reality of political borders. It is today charted not by just one GPS network but by two, the second being the Russian GLONASS system which feeds into a growing number of cell phone navigation systems.



Figure 4. Image courtesy of the author

The IRM and GPS frameworks, and their precise yet ambiguous delineations, are the frames of reference by which Google Earth's machinery composites captured satellite imagery. If *Transect* brought that imagery back to the places where these reference systems originated, Royal Greenwich Observatory and the Royal Naval College, it is appropriate that its appearance there was fluid and temporary.

Disorientation & Time

Before I turn to the final video project, I would like to revise some of these observations through the lens of Bernard Stiegler's writing on technology.

Stiegler's key thesis in the re-reading of Martin Heidegger through technology which is his series of books *Technics and Time*, is that the technical is and always has been constitutive of our humanity: of our human movement through life, through time. We humans have always been incomplete, and have always striven to complete ourselves through prosthetic devices: tools, weapons, instruments of artifice and art. Prosthetic objects, and prosthetic devices, form a technical support for our individual becoming, and our becoming as a species. And as I have already mentioned, failure and error are inherent in this condition. As Stiegler puts it, in completing ourselves through technics we are caught up in an *Epimethean complex*. This term refers to the forgetfulness of Epimetheus, for which the work of his brother Prometheus – his imagination, his anticipation of the future, and his inauguration of technical and technological projects – compensated. For Stiegler, while Prometheus's successes represent our fulfilment, in fact are our only path through to our becoming, Epimetheus's failure represents humanity's failure; the Epimethean condition means our success is never unalloyed (Stiegler, 1998). Our attempts to map the world in the modern era are exemplary of this dual condition of success and failure.

In the second volume of *Technics and Time*, subtitled *Disorientation*, Stiegler develops ideas on the implications of the Epimethean complex in current conditions of media. He develops his argument primarily in response to the writing of Derrida and Husserl. The prosthetic processes of which he speaks include the recording of history: our memories are insufficient, and to complete them we have employed an array of mnemonic tools since time immemorial, or rather since time *memorial*. There is no original or originary time, no pure experience or memory; we access history, and experience after the fact, only through prosthetic forms of recording. These constitute our humanity. Stiegler understands industrialized media in the context of a long evolution of technical frameworks supporting memory, whose first substantial manifestation was orthographic writing.

In *Disorientation* Stiegler's underlying preoccupation is the relationship between orthography (whether in text or image) and *différance* – the term Derrida used to

refer to written language's failure to pin down meaning, eternally deferred as it slips elusively between differing definitions. Meaning is inherently unstable. A common assumption in our time might be that contemporary conditions of media imply the occlusion of *différance*. Ostensibly based on a positivist epistemology, the very notion of "Information Technology" implies the flattening or reduction of all knowledge to information, the elimination of the gap or delay between sign and thing within which meaning can remain ambiguous or multivalent. The immense scope and scale of today's mnemotechnological systems, their reduction of information's value to capital, and the prevalence of instantaneity and speed in the transmission of data result, for many, in the denaturing of knowledge and writing; that is, its erasure of *différance*.

Disorientation argues that the opposite is true. Stiegler makes the case that the human experience of time and being, in all its ambiguity and indeterminacy, is generated paradoxically out of our attempts to record and communicate with precision, orthographically, with no gap. He embarks on an analysis of our foundational engagement with memory and technology, addressing his subject with reference to the image and to text to demonstrate its production of *différance*. Drawing for example on Barthes' writing on photography, he emphasizes that the photographic image has built into it delays: between opening and closing of the shutter, between exposure and development. As he puts it,

'the photograph contains an objective melancholy binding time and technique together; yet throughout the entire history of visuality, time and technique have been constituted solely through the refraction of their instrumental and technical surfaces: *différance* as a single movement of spacing and temporalization.' (Stiegler, 2009, p. 18).

Through Lacan he demonstrates the more general significance of the image, making the case that a preoccupation with the image (*imago*) derives from the mirror stage of human development. The mirror stage is 'a particular case of the function of the *imago*, which is to establish a relationship between the organism and its reality... altered in humanity by a certain dishesion within the organism itself, but a primordial Discord... The *mirror stage* is a drama whose advent is precipitated by an insufficiency of anticipation – and which for the subject, caught in the lure of spatial identification, fabricates the phantoms that are succeeded by a

fragmented image of the body into a form we call orthopedic of the totality.' (Lacan, cited in Stiegler 2009, p. 26-27)

Our attempts to reflect the world – to record and mark it orthographically – have incoherence and fragmentation built into them. In other words, the lag between the Epimethean and Promethean movements, inherent in our imagination, production, and use of technics, is what generates *différance*. Text, no less than any other expression of the orthographic tendency, produces such gaps and ruptures. And as these two illustrations underline, this is no less true in the case of the orthographic *image*. The industrialized map of the world is perhaps the most significant example of such an attempt at orthographic imaging; and as I have tried to show, it is a generator of *différance, par excellence*.

As he develops his argument, Stiegler tackles the long-standing bias within phenomenology against the technical. Following Derrida and Paul Ricoeur, he discredits Husserl's understanding of primary, secondary, and tertiary memories. These refer to degrees of separation from direct experience: from our retention of immediate experience, to its recollection, to its recording and recollection through reference to (orthographic) documentation. For Husserl's phenomenology these are all pale shadows of direct experience, and usurpers of its value. But for Stiegler, they are integral to it; the intimacy of direct experience is inseparable from its record, even as it pulls away from it:

'primary memory [retention, production] can no longer be any more opposed to tertiary memory than to secondary memory [recollection, re-production]: the already- there *qua* what, the third world- historial, is constitutive of a temporality always already emerging from its strict intimacy.' (Stiegler 2009, p. 199-200)

Stiegler thus validates not only textual memory, but also all forms of record- keeping. Indeed, if memory is always about memory *loss*, about forgetting as much as it is about remembering (the Epimethean complex), tertiary memory is even more integral to our Being than is the original experience: it represents our recovery from loss. (Stiegler, 2009, p. 222). In terms of Stiegler's larger thesis, tertiary memory – memory supported by a technical framework – is a key instance of the prosthetic processes through which we become fully human, always in relationship with time. The moment passes, we record our memory of it, we recall it through that record(s); a never- ending loop of forgetfulness

and recollection constitutes us. Imaging systems, to the extent that they become not just databases but also archives engaging time and memory, invest us in and are themselves invested in this loop.

For Stiegler the simple act of archiving, of recording history, builds delay (which is at the root of *différance*) into our relationship to the world. Delay is not erased by industrialized memory, but constitutes it. We might sense this in our own experiences with technology failing at its limit of speed and capacity and its impact on our perception: communication feeds breaking down, images and audio fragmenting into noise, from which we might seek to piece together or invent an elusive, indeterminate meaning. It seems as though the closer we get to the instantaneous communication of information, the more turbulence we produce, the more disruptions, delays and deferrals emerge. As Stiegler puts it, referring to our attempts to annihilate space through “real-time” communications, in fact ‘Real time is a derealization of time, as if time were really real only in remaining unreal, chronically diachronic, asynchronized, late for itself’ (Stiegler 2009, 124).

Stiegler identifies a specific kind of object native to this media space: the *temporal object*. These are objects generated out of montages of memory, currentness, and “real time”, which mark and bear traces of the passage of time, and are entwined with it in a complex relationship which even allows them to add to history:

‘A combination of new texts/data and instruments make an entirely new mobilization of the *already-there* [the historical] conceivable. Citation and arrangement of the various elements furnished by available patrimonial and informational sources open the possibility of a qualitative leap from a new reading and writing at ‘light-time’ laminated onto an other, deferred time.’ (Stiegler, 2009, p. 148)

Furthermore Stiegler asserts that temporal objects tend to ward a specific form of expression:

‘(The) secondary memory in which the past can be recomposed... enacts as image-consciousness, strictly speaking, namely, by its transcendent representations such as icons, drawings, photographs, tracings of all sorts...’ (Stiegler, 2009, p. 221)

That is, they tend toward the visual, and the spatial. We might well see the works and tools I am discussing as instances of Stiegler’s temporal object: images laminated, composited, juxtaposed, overlaid, rubbing up against each other and generating thereby a friction

from which a space of ambiguity and deferred meaning might arise. Despite the aspiration to unite the entire surface of the world under one intuitive navigational scheme, labelled with a coherent and universal system of symbols and markers, in Google Earth as in other platforms a plethora of information, cross-referencing and inputs (often user-generated) provoke a condition of heterogeneity, uneven unequal spaces, but also times: hours, days and years laminated onto each other.

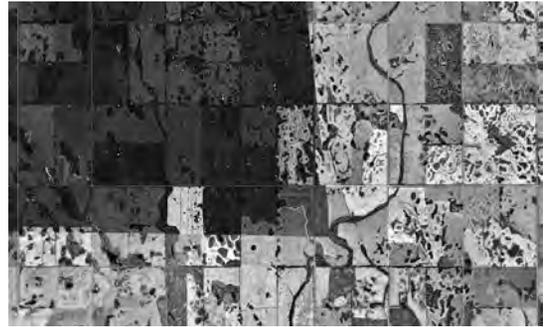


Figure 5. Courtesy Google Earth, NASA, ©2016 Digital Globe Dominion

Dominion

There are several points to reiterate here. First, our creation of the orthographic image itself generates *différance*. The straight line generates the bent, the attempt to determine provokes the indeterminate. Second, photography is a specific instance of this. Third, orthography today manifests in industrialized knowledge bases and most importantly mnemonic systems. Geographic Information Systems are of course a form of industrialized orthography. They can also be mnemonic systems: Google Earth is one example of a spatial database which is also an archive. And it integrates, profoundly, the image or images of the world, images in which *différance* and delay are not only not *erased* by industrialized memory: they are actually *provoked* by it. The images display both the past, and various forms of future: lines laid out on the landscape over a century ago in anticipation of development to come, lines which failed at their inception and periodically fail again before the changes of seasons and the passage of time, lines laid out in anticipation of settlements of tomorrow; lines which must be redrawn again and yet again. Embodying the Epimethean complex, these lines project forward the imagination of a world united in and managed by one vision at the same moment that they look back at what we missed.

There are implications in this for the entire project of human mastery of the planet, and that is the focus of the third video project I will touch on, *Dominion*. The project addresses the Dominion Land Survey (DLS), the 19th century project which divided the Western Canadian prairies into the grid of perhaps one million one-mile squares we still see today. The DLS has its own Prime Meridian, just west of Winnipeg, Manitoba. The survey's title refers to the Dominion of Canada, the British term for that territory; but of course it refers also to human, modern, and western projects to dominate the planet. *Dominion* intends to disrupt such projects.

The DLS, like all other mapping projects, is rife with anomalies. These are technical (due to the limitations of mapping technologies then and now), ecological (DLS-based land divisions are repeatedly undermined by the natural cycles of the prairies), and social (pre-existing patterns of land use -- aboriginal reserves, French river-lots, Métis settlements, and others -- survive as gaps in the grid). In other words, while the myth of the rational division of landsurvives in the prairie grid, it and its image are shot through with ruptures. A few of these can be identified in Fig. 5. Besides the mile-square sections of the DLS, we can identify numerous features which disrupt the grid, including the path of a river, seasonal sloughs and ponds, traces of larger-scale flooding, and the edges of satellite tiles composited from images at different times of the year.

We can easily recognize an affinity between the landscape depicted here, fragmented as it is by land use and ownership, and the images which represent it. It is no coincidence that the Google image of the North American prairie looks pixelated; it is a landscape reconstituted to serve processing by an industrial system, just as is the digital image. A native organic *thing* is cut up and turned into an assemblage of monocultural (or monochromatic) plots (or pixels), a process which would seem to impoverish it but for me, counterintuitively, enriches it.

The digital environment produced here reconstitutes the image of the human and technical landscape in the same terms that we have manipulated that landscape; this is a particular focus of *Dominion*. The project, which is now underway, will provide a critical visual meta-survey of the DLS grid and landscape, articulating the current state of the prairies, entangled in technologies old and new.

Conclusion

Stiegler's argument, and our use of these imaging systems, has implications for the contemporary subject. Our (growing) dependence on tools from organizations like Google is just one instance of how, in his terms, the *who* of the subject now extends out into the *what* of the technological matrix. Stiegler makes the case for a new subject, what he terms the *idiotext*, generated out of a process of *différentiation* provoked by that extension. The term suggests both the Greek sense of one without professional knowledge, illinformed, and also one in the paradoxical condition of being torn from context (idiosyncratic) and profoundly local (idiomatic). This subject's relationship to place is also a paradoxical one:

'The idiotext attempts to think place, the (re) constitution of place, and giving- place as such: the opening of a spatiality in the event's temporal having-place. This effort "has place" within the "context" of what I have characterized as decontextualization.' (Stiegler, 2009, p. 243)

If the image of the Earth is resonant with the torn up and reconstituted landscape, so are we. As we are renegotiated in new localities, through and within our supporting *whats*, we seem to be placed radically outside ourselves even as we take a place. The irony and contradiction in that condition is perhaps inescapable. We all take part in it; even our presence here at this conference is an example, as we all come from far away to discuss the significance of local territories and their relationship to media.



Figure 6. Courtesy Google Earth, © 2016 Digital Globe

We might elaborate slightly on an idea implied by Stiegler but explored in greater depth by another writer. That is the importance of stories. In *Time and Narrative* Ricoeur draws on St. Augustine to articulate how we

are torn apart by our impossible experience of time. (Ricoeur, 1984). In fact, Stiegler's deconstruction of the primary/secondary/tertiary memory distinction employs an analysis of the reading of poems which appears to intentionally recall St. Augustine's discussion of the memorization and recitation of song, employed in *Time and Narrative*. For Ricoeur, working from Aristotle, it is only narrative which sews together our being thus sundered. The intersection of database and archive expressed in these hybrid landscapes can be understood as a latent narrative in these terms, one which deterritorializes and reterritorializes space through a prosthetic both serving and failing memory.

In Fig. 6 we see again the product of two adjacent satellite tiles. The first, on the right, shows us a human settlement, two homesteads amidst fields plowed and marked by the hands and machinery of the farmer; a form of prosthetics proper to an earlier era. To its left is another field, a pixelated digital field generated by Google's Earth's processing of an older, lower-resolution image. In this second territory we can begin to identify a landscape belonging to the prosthetics of our own time, perhaps one to be inhabited by the *idiotext* of which Stiegler speaks. These two fields are linked by paths that might lead us between settlements, that make one field the umbilical source of the other. But which is which? If we cross the boundary from one these fields into the other, who will we find there? What might they become?

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Creation of Meaning in Processor-based Artefacts

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Abstract

Processor-based artefacts are often created following conventions inherited from analogue media forms, allowing the development of experiences that, in spite of the new platforms, are not fundamentally different from those that were already possible in the previous contexts. But contemporary media and arts often use processor-based artefacts focusing on conceptual and mechanical principles that do not attempt to simulate earlier forms but rather explore their computational nature. These systems bring about new modes of reading and new challenges, to both readers and artists or designers. In order to optimize the usage of processor-based media, creators need to understand how these artefacts are interpreted and how readers develop processes of creation of meaning in procedural contexts. This will allow authors to ground their practices on procedurality rather than only on surface contents, and to make a constructive use of contingent behaviour, learning, adaptation, selection, and other traits of these systems, not being limited to the emulation of well-established media forms. This paper outlines some of these challenges and proposes designing for the meaningful interpretation of computational artefacts.

Keywords

Processor-Based Media, Computational Art and Design, Artificial Aesthetics, Interaction, Creation of Meaning, Ergodic Experience, Virtuoso Interpretation.

Introduction

Our media landscape is dominated by processor-based systems. We often call these systems *digital*, a misnomer focused on their data encoding properties and that ultimately disregards their chief characteristics, a set of features that are synthesized by the four affordances identified by Janet Murray (1997, 2012): they are procedural, participatory, spatial, and encyclopaedic.

These media forms have become increasingly relevant in contemporary mass and personal communication, as well as in the arts, where we can find long-running events (such as Ars Electronica, ISEA, or Transmediale) that testify to their relevance for artists and academics, and

commercial enterprises (as e.g. Bitforms¹ or s[edition]²) demonstrating their market potential.

Procedural media are semiotically unique because they are built by software (Manovich, 2013) and have a very high potential for interaction, two characteristics that turn them into metacommunicational apparatuses (Engle, 2008, p. 15; Whitelaw, 2004). Computers are universal machines, able to simulate any process that can be precisely described. Processor-based media inherit this universality and are excellent at simulating and remediating other media. They are able to take over the roles of other media forms easily and cheaply, acting as a universal solvent (Hayles, 2005, p. 31), and being protean to the point of being better described by the collective noun *digital medium*, as Murray suggests (2012).

Being universal, processor-based media become more than mere extensions of the human, as they gain the capacity for autonomy, they acquire an increased agency, and therefore demonstrate a set of emergent properties.

Their high capability for simulation means that, despite replacing previous media forms, they do not necessarily transform their contents while doing so. Film created with digital tools and mediated by processor-based media can be (almost) indistinguishable from analogue film. Books written, edited, and published using computational platforms can retain a classical structure in spite of the drastic transformation in tools, infrastructure, and interfaces. We identify this phenomenon in many other media forms, with patterns in their contents, as e.g. narrative structures, not being necessarily altered too, not being affected by the transition of media between different distribution technologies (Jenkins, 2006, p. 13).

An example of this can be found with linear narrative structures, that originated in orality and somatic

1 www.bitforms.com

2 www.seditionart.com

technologies, were further developed in molar media, and inherited by processor-based systems, that still allow them to be experienced by audiences. Nothing in processor-based media primes narrative towards linearity, if anything, much on the contrary. But the same already happened with molar media forms, where the prevalence and dominance of linear narrative structures was not so much due to their structural characteristics but rather, as Aarseth proposes, either to ideological reasons or to a remote influence of the papyrus scroll (1997, p. 47), which was in fact a strictly linear-access device (Bolter, 1984, p. 137).

Molar media forms weren't always used to develop linear contents. If technologies as the codex are suitable for linearity, in reality, they are random access technologies, and therefore facilitate nonlinearity. Some of the media forms developed with the codex already explored those characteristics to breed nonlinear textuality, or proto-hypertextual structures as e.g. dictionaries, encyclopaedias, or *Choose Your Own Adventure*-type books (Aarseth, 1997, p. 48; Darnton, 2009). Beyond these, some authors have occasionally attempted to question linearity by exploring other forms of access, as Julio Cortázar did with *Hopscotch*, or authors of the Oulipo did in various works.

We can also speculate whether the prevalence of linearity across media may be related to the linear way how we humans experience and recall life, and how therefore we may prefer to codify our experiences, speaking of life in terms of physical motions or of a spatial travels (Hofstadter & Sander, 2013), and consequently thus translating experience into messages and media forms. Regardless of how non-linear, discontinuous, or sinuous our thought processes may be, the *narrative theory of the self* (Floridi, 2014, p. 68) points to the construction of a linear story as the basis for one's identity. Or perhaps this happens *in spite of how* non-linear, discontinuous, and sinuous our thought processes are, in an attempt to counter those characteristics.

The Oulipo's works, and other experiments in nonlinear textuality, have by and large remained curiosities and were often regarded as oddities. But they became increasingly relevant as case studies and inspiration when native processor-based media forms began to emerge. This was perhaps due to the fact that many of these works, although developed at a time when computational technologies were either non-existent or not easily accessible, were already deeply procedural.

They relied on algorithms or effective procedures as part of their mechanics (Carvalhois, 2016, p. 43), and were effectively developing artefacts comprised of both a surface and a *subface* (Nake, 2016). They were thus, as Aarseth also recognised, already *cybertexts*, and pointed to the increasing complexity that the media experience of native procedural forms would soon make possible.

Processor-based media have drawn from these early cybertexts and from the familiar experiences and conventions of classical forms, with an increasing number of native computational forms grounding their aesthetic experience in conceptual and mechanical principles that explored procedurality. Amongst these we can find games as *Façade*, that builds complex narrative experiences by using artificial intelligence to “move beyond traditional branching or hyper-linked narrative”³ in the creation of interactive drama. Games as *Spelunky* (2008) or *No Man's Sky* (2016) resort to procedurality to generate a potentially infinite number of game worlds or maps, while *Rogue Legacy* (2013) uses evolutionary processes to develop an assortment of playable characters. Interactive documentaries such as *Do Not Track* (2015) rely on resources drawn from big data, from the Web, and from social platforms to build the narrative experience. Artworks bring procedurality to the fore, centring the aesthetic experience in its (total or partial) understanding, as e.g. Karl Sim's *Galápagos* (1997), John F. Simon Jr.'s *Every Icon* (1997), Casey Reas's *Process* series (2004-), Pall Thayer's *Microcodes* (2009-2014), or Lia's *Monochromes* (2016).

Virtuosic Interpretation

As technology and media change, they transform human perception (McLuhan, 1964). If we regard perception as a system through which we build hypothesis about the world (Gregory, 1980) — or about the information being acquired from the world — it then follows that our contacts with any media form are informed by our previous knowledge of other media forms. Therefore, any new technologies, and any new media, breed new modes of reading. Some of these new modes of reading have been studied by e.g. Michael Joyce (1995), Espen Aarseth (1997), Jay David Bolter (2001), Florian Cramer (2001), Katja Kwastek (2013), or ourselves (2016), and they are not only related to the interpretation of signs, but also to other user functions, including what

³ www.interactivestory.net/#facade

we vaguely describe as *interaction*, which adds a new layer of complexity to the artefacts.

Another layer of complexity is brought by the increasing multimodality of processor-based media, which is again facilitated by the common coding of all digital media forms, and by their computational capability for simulation and remediation. Besides the most frequent modalities — visual, auditory, haptic, etc. — processor-based media often resort to what we may describe as a *mathematical* (Strickland, 2007) or *procedural* modality (Carvalhais, 2016, p. 257), whose workings we need to keep in close attention. The new experiences that are made possible by these multimodal *new media* — in the sense proposed by Manovich (2001, 2013) — may therefore lead audiences to experience a strong feeling of defamiliarization that may lead to a large number of divergent interpretations of their contents (Melo & Carvalhais, 2016). This is particularly important to keep in mind when we conclude that the creation of meaning in these media forms is not only dependent on the interpretation of signs but also on the procedural modality and, therefore, is not only dependent on logical and lexical semantics but also on *procedural semantics* and consequently on *procedural rhetorics* (Bogost, 2007).

By attempting to decode and understand the surface of these media forms, the reader makes an effort to develop mental simulations of them. For this, the reader creates hypotheses that are confronted with the surface of the artefact and confirmed, falsified, or refined during that experience (Carvalhais, 2011, 2012, 2013; 2015b). This effort is naturally dependent on the reader's capability to deduce the processes — or to remember previously known analogous processes that may accelerate this undertaking — but also on having the possibility to establish multiple contacts with the system, to evaluate the simulations.

If a system does not allow this contact with multiple instantiations — e.g. if the system's outputs are molar, such as prints, and the reader only has access to a single print — then this effort cannot be successfully developed unless the reader discovers recognizable patterns in the surface that may allow her to deduce a particular morphogenetic process. Even so, without the possibility to compare and contrast such process with alternative outputs of the processor-based form, the reader will never be able to attest the validity of the analogue process.

Depending on the complexity of the system, and on the reader's previous knowledge and capabilities, she may not attempt to develop a full simulation of the system but rather opt for developing several smaller partial simulations, focused on sub-systems or behaviours. In either case, simulations attempt to predict future behaviours and outputs of the system, thus informing the reader about it and about its horizons of action.

When a nonlinear, open, or generative (Galanter, 2006) artefact is impossible to access in its entirety — either because it is infinite, or because it may be too vast to become infinite-like at a human scale — a human simulation that is able to generate accurate predictions of the system's behaviours and outputs, can be seen as the culmination of its experience by the human reader (Carvalhais & Cardoso, 2015a) and one of the possible forms to achieve closure in the aesthetic experience.

This witnessing of multiple instantiations of a system, the comparing different samples of its outputs, the confronting of these with one's previous knowledge and the experience of comparable systems, is what we have termed the *virtuosic interpretation* of a system, a process of ergodic contemplation that allows the reader to develop a *theory of the system*. This is a process of reducing uncertainty about the system and of acquiring information about it, either through direct contact with its effusions or via indirect contact with the simulations that are developed.

An aesthetic system therefore becomes not only the coded process (or its *mechanics*, according to Hunnicke, Le-Blanc and Zubek (2004)), its runtime (or *dynamics*), and interpretation (the *aesthetics*), but also the dynamics and mechanics of the simulated systems, that are developed in parallel with the witnessed system and continuously compared with it.

Reader Challenges

The process of developing a theory of the system involves some risks for the reader. First and foremost, the risk identified by Aarseth as the *aporia*, the inaccessibility that is not “ambiguity but, rather, an absence of possibility” (1997, p. 3). This is also not, Aarseth notes, the same aporia that is experienced in classical media forms, where one may not be able to make sense of a part in spite of having access to the whole. This is an aporia that prevents making sense of the whole because a particular part may not be accessible (1997, p. 91).

We may identify another form of aporia in the risk of rejection created by an interpretation that is raised to intervention. As the reader becomes a player and a gambler within the system, she now faces the risk of arriving to inaccurate interpretations, and of deducing incomplete or inaccurate information about the system, and thus developing inaccurate (or dysfunctional) simulations that may ultimately lead to incorrect action. Although failure may of course lead the reader to reconsider the processes and to learn (Juul, 2013), this only happens when one is, by any means, made aware of the failure and of the discrepancies between the simulations being developed and the actual system the reader is interacting with. Therefore, if, in spite of the reader's efforts, failures persist, we may assume that they may be due to an inadequate understanding of the system one is communicating with (Wilden, 1987), but this doesn't necessarily mean that the responsibility should be placed on the reader's side.

Besides the aporia, we also have the risk of becoming *lost in the finite*, to resort to Søren Kierkegaard's terminology, that describes as such instances when one is bound by necessity, fate, and triviality. When this happens with a processor-based media form, the reader may end having a reduced agency and autonomy within the system, and being led to accept paradigms without questioning them, thus losing their individuality in the exchange.

Conversely, when confronted with a large number of possibilities, the reader may become *lost in the infinite*, with this corresponding to continuously sampling different paths and actions in the system without actually ever coming to understanding it. If the reader is focused in the *finite*, in the concrete status or configuration of a system at a given time, she won't do more than follow the systems cues and act according to them, thus not being able to probe the system and to discover its mechanics. If the reader's experience is, on the other hand, diluted by the *infinite*, too many inarticulate contacts with the system do not allow to turn potential into knowledge. In either case, the reader risks failing to understand the system.

The procedural modality needs inputs that may be acquired by both stances, sometimes following the system and conforming to finitude, other times diverging and following the infinite. The development of a theory of the system requires the dialectic balancing of these opposite tensions. The first is supported on the *system as encountered* (Upton, 2015), which in its turn is the framework

from which unfolds the *system as understood*, breeding the *system as experienced* from where finally narrative and meaning emerge. However, from this synthesis, and as a consequence of the ergodic weight of both the finite and the infinite, the reader also risks *anxiety*, to which Kierkegaard called the *dizziness of freedom*.

Traditional textual and aesthetic analyses are usually coupled with permanence and stability, usually of form or, if this is transient, at least of structure. Permanence and stability are attributes of the finite, with the infinite character of processor-based systems leading to continuous transformation and renovation, not only of surface but very often also of structure. This frequently inhibits (or at least limits the potential of) classical approaches to their study and usually favours analyses that are supported by procedurality and that lean towards artificial aesthetics.

Designing to Support Virtuoso Interpretation

Artists, designers, and content creators that want to use these new media to their fullest extent therefore need to understand how relevant their surface and subface become, not only in the process of creation (*allopoiesis*, mechanics), but also in their development (*autopoiesis*, dynamics), and in their effective communication with other systems, whether human or otherwise (aesthetics).

Creators need to be aware of at least three levels of semantics — logical, lexical, and procedural — that are involved in processor-based forms, because this is fundamental to understand how the process of interpretation of these media forms is developed. Understanding processor-based media as semiotic forms that continuously breed *algorithmic signs* (Nake & Grabowski, 2006) is vital if one intends to design to support *virtuoso interpretation*.

This is something that can be achieved by using code descriptions, procedural descriptions, or pseudocode (Berry, 2011, p. 52) in the surface of the works. Examples of this approach can be found in some of the previously mentioned works. On *Every Icon* (1997), John F. Simon Jr. describes the process developed by the artwork in a caption appended to the display running it:

Given: a 32 × 32 Grid; *Allowed:* any element of the grid to be black or white; *Shown:* Every Icon.

Similarly, Casey Reas offers procedural descriptions of the systems generating the artworks in the *Process* series. An example, from *Process 18*, reads as:

A rectangular surface filled with instances of Element

5, each with a different size and gray value. Draw a quadrilateral connecting the endpoints of each pair of Elements that are touching. Increase the opacity of the quadrilateral while the Elements are touching and decrease while they are not. (Reas, 2012)

Without presenting code in the surface, these works render reasonably detailed explanations of the morphogenetic processes, allowing the reader to more swiftly understand, and therefore simulate, their workings.

Explicit code can also be presented in the surface of the works, as Pall Thayer does in the *Microcodes* series of code poems:

```
Sleep
31. March 2009
#!/usr/bin/perl
sleep((8*60)*60);
(Thayer, 2009)
```

What this approach may gain in clarity and directness, it may of course compromise by forcing readers to actually read the programming language in which the code is written — Perl, in the case of *Microcodes* —, and to mentally interpret it, something that sometimes may be highly complex and other times impossible.

But the designer may perhaps be more likely to succeed if she considers the artificial aesthetic experience in all its complexity and recognizes that the code-level of a system's mechanics are but a starting point for the emergent phenomena of the dynamics and aesthetics. The designer may therefore opt to plant procedural clues in the surface structures of the system, or at the very least allow whatever procedural clues that may already be in place as a natural consequence of the system's operation to be understandable and as clearly readable as possible.

Designing for the procedural modality implies being aware of how a system's mechanics will generate a phase space, and how this will in its turn form horizons of action that may change during runtime and as a consequence of the interaction with the reader and other systems. These horizons of action will in their turn breed horizons of intent in the reader, and these are even more dynamic and fleeting. If the horizon of action is the set of all points in the phase space that are readily accessible to the reader, given the particular local constraints, the

horizon of intent is the set of those states that the reader *believes* can be “valid, attainable, and desirable in the near future” (Upton, 2015). They are not defined by the system's constraints but rather by the human's, and they are highly dependent on the context.

Still following Upton, we may think of the *system as encountered* defining horizons of action, and the *system as understood* spawning horizons of intent through semantics, interpretation, and the procedural modality. Keeping this in mind, carefully balancing repetition and novelty, entropy and information in the experiences that are being designed becomes crucial for the success of processor-based media forms, and for the emergence of meaningful experiences.

If lexical and logical interpretation of a system may of course vary between readers, the degree of variability of the procedural interpretation can be equally large. Reader interpretation is inevitable, and despite variable degrees of accuracy, there is hardly the possibility for incorrect interpretation, but rather a space for multiple, and concurrent, interpretations of a system.

To understand how vast this field of possibilities can be, and to minimize inaccurate interpretation, creators may perhaps take a cue from the iterative processes developed in interaction design and, when possible, field test prototypes with potential users. As we learn from human-centred design methodologies, creators should not rely solely on their own interpretation of a system and on their own interactions, as these are compromised by their personal histories, references, and biases. The theories of a system to which readers arrive are very personal and contextual. They emerge from the interactions between complex systems and therefore can only be discovered by enacting those interactions.

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The Demise of the Frame: A Media Archaeology of Motion Prediction

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Abstract

Prediction theory emerged during the WWII in order to improve anti-aircraft artillery and resulted in algorithms devised to statistically predict airplanes and missile paths. Although today prediction is the backbone of the video compression, the historical and technical connection between this mathematical theory and contemporary imaging technologies has not been sufficiently determined. Using a media archaeological approach this paper discusses how the implementation during the 1990s of prediction algorithms to video compression has generated an entirely new type of moving images. I argue that the consequence of turning each displayed picture into a rigid grid and its construction into the statistical prediction of the pixel's values is dramatic because it renders the temporal coincidence of all pixels within the frame unnecessary. On the surface there is no change. Yet, using prediction a video codec such as H.264/AVC has turned the frame into an address where chunks of pixels coming from different moments in time are put together. At the coding level, prediction has banished the frame. The elimination of that basic unit of all moving images, not only miniaturized video but it also has had ontological consequences for the image that are not yet fully understood.

Keywords

Motion Prediction, MPEG, Digital Video, Video Compression, Statistics, Ballistics.

Surface and Subface

As an algorithmic medium, digital video has two sides. On the surface and immediately before us, we perceive colours, shapes, and changes on the screen. A raster image. Underneath, on the *subface* (Nake, 2005, p. 50), occurs a complex series of operations. It is on the subface of digital video that one encounters some of the operations that reduced digital video so it could be packaged into a mobile phone. Such operations include de-constructing, quantizing, encoding, grouping, locating, predicting, compensating, transposing, decoding, and reconstructing. Since the last decade we have witnessed the sudden flood of online video, making

video something of the everyday and in need of a new set of conceptual tools to see its ontological transformation (Treske, 2015, p. 18). I argue that on the subface lies one possible answer to that question. Observing the subface of digital video leads into the history of the algorithms that are used today every time a digital video file is recorded or reproduced.

Subface is a concept that aligns with the epistemic aim of media archaeology to reveal the nature of media by observing and dealing with their inner micro-operations instead of their macro discursive effects (Ernst, 2012, p. 16). It is in that contact with the subface that media history is able to render the concrete time-axis operations and mathematical principles of media graspable.

This paper focuses on one time-axis operation of digital video that greatly affects the size of the file: motion prediction. One development in mathematics during the 1940s is key in making possible the implementation of prediction algorithms as means to transmit video over telephone networks since the end of 1980s. Among other techniques, digital video formats implement descendants of algorithms devised not for image processing but for statistically predicting airplanes and missiles paths during the WWII.

Prediction

Ballistics

During the WWII, the superiority of the *Luftwaffe*, combined with the Allies slow anti-aircraft fire control on the ground, made the calculations for ballistics a problem of tremendous military importance. The solution was straight-forward: the gunner, the firing table, and on-the-spot calculations had to be replaced with an apparatus that would follow an airplane, compute its distance, determine the length of time before a shell could reach it, and figure out where it would be at the end of that time.

It was during WWII that the U.S. NDRC engaged Nor-

bert Wiener, a Harvard PhD in mathematics at the age of nineteen, to tackle “the most difficult mathematical problem in fire control: prediction” (Mindell, 2002, p. 278). Wiener’s task was to formulate a method to trace the path of an airplane and estimate its future location at a given time. Wiener was able to contribute to the solution of this problem in part because of his previous work on the equations to solve situations in which two regions are separated by a given barrier and the data gathered on one region influences the behaviour in the other, but not vice versa. Wiener had observed that in such problems the ‘present’ acts as a buffer between the influencing ‘past’ and the indeterminate ‘future’ (Masani, 1990, p. 134). This continual elaboration of the new stems from Henri Bergson’s concept of temporal duration and proved important during Wiener’s work on the anti-aircraft fire control (Ernst, 2012, p. 275). His basic idea was “to use electrical networks to determine, several seconds in advance, where an attacking plane would be and use that knowledge to direct artillery fire” (Galison, 1994, p. 234).

After the war, Wiener generalised the principles governing his prediction system as mathematical formulations beyond the purpose of taking down airplanes. Text, speech, and pictures flowing through wires would soon be generalized as continuous signals, and later as discrete chains of numbers, that can be tracked and predicted. They’d become the statistical input data that constitutes a series in time, such as prices in the stock market, sounds in a mobile phone, and pixels in an online streaming video.

Statistics

A predictive operation has two pillars: time series and communication engineering. The first is a discrete or continuous sequence of “quantitative data assigned to specific moments in time and studied with respect to the statistics of their distribution in time” (Wiener, 1950, p. 1). The second component, communication engineering, treats a message as data and detached from its medium or physical carrier.

Speaking of communication engineering, Wiener considered that to be useful an apparatus should be designed to operate on a general set of messages and not exclusively on a single message (Wiener, 1950, p. 4). Thus, he designed and implemented an algorithm not to take down one particular airplane but any airplane in the set of airplanes. Furthermore, he later generalised it to

statistically predict the output of any message sampled on a time series, be it words, sounds, images or any signal. When motion and then vision became statistically analysed in time series a new type of imagery emerged, one that is the result of data processing techniques that continuously predict the next values on the numerical chain.

Based on the continuous storage and statistical accountability of past results, Wiener’s algorithm promised to predict a possible future result. The predicted position of an airplane g_h at time t thus became the infinite sum of all its past positions $f(t-\tau)$ and a derivative of the past errors af-

fecting it dWh :

$$g_h(t) = \int_0^{\infty} f(t-\tau) dW_h(\tau)$$

Similarly, the MPEG video decoder produces a *predicted picture* based solely on the statistical data gathered from a set of previous pictures. Future pictures are thus estimated by comparing the direction and distance of any motion between the present and past pictures. This decoder is able to make such calculation because each picture is a rigid raster grid whose points are addresses both in space and time as it was any airplane in the night sky over London in 1943.

Indexing

The substitution of videotapes with digital files marked a fundamental change in the reproduction of moving images. In order to go to one point in time to another, the former has to be wound or rewound, whereas the latter has indexes and addresses to jump directly to any particular frame. The new control thus gained over the reproduction of moving images, that is the ability to go from index to index and frame to frame without shuttling over the storage surface, abolishes the continuous and linear reading of film and videotape.

Indexing time and simultaneously targeting any of the frames echoe Friedrich Kittler’s argument that the Roman codex was more revolutionary in the genealogy of writing than the invention of the printing press because it granted non-linear access to specific content by fragmenting the scroll into a series of discrete leaves of papyrus fastened together (Kittler, 1993, p. 178). Centuries later, each *pagina* got a number, an address,

that allows the leaves to be compiled in the proper order and any detail in the text to be precisely referenced and accessed in a non-linear fashion. Similarly, a video player on a computer offers a timeline with a cursor to freely move the playback head to any point in time. This operation does not take the time-axis as a continuous line for strict sequential access from a beginning to an end, rather it treats it as a discrete series of binary addresses for instant non-linear retrieval.

Compression

MPEG: Interframe Prediction

MPEG is a data compression format whose main implementation has been in tapeless video. One of its core features is motion prediction, which is an application of predictive coding to estimate and interpolate the changes between successive frames.

Predictive coding has been part of video codes since their very beginning. The pioneering H.120 recommendation for *Codecs for Videoconferencing over Telephone Net-works* issued by the International Telecommunication Union (ITU) in 1988 already included the motion-compensation between two adjacent frames for a still or slowly moving area (ITU, 1988, p. 18). In a video sequence, objects tend to move in predictable patterns, changing little from frame to frame. Consequently, their motion trajectories can be traced over time and their future positions can be predicted frame-by-frame (Haskell & Puri, 2011, p. 7).

Predictive coding not only changed the way video is transmitted and processed but also affected the relation between the frame and the time-axis and redefined the inner structure of the frame itself.

Early versions of MPEG and H.26X converted the time-axis from the site for the mere succession of frames to the site for tracking and estimating motion in order to achieve higher compression rates. Frame references and predicted frames emerged from decoupling the synchronization between the encoded and the displayed image. In tapeless digital video, the order of the frame encoding and the order of the frame display do not correspond to each other. While frames are still fastened to a time-axis, the prediction of the location of pixels forces a H.26X/MPEG encoder to sequence and transmit the image stream by placing reference frames before predicted frames, i.e. future before present frames. This is a sequence that the decoder reorders to display a coherent video sequence.

The vast majority of video conferences, camera phone, and action camera videos are composed of one single shot with very little changes from frame to frame. In order to compress the amount of bits, a motion prediction algorithm takes advantage of such little change to track the positions of groups of pixels, called macroblocks, belonging to two adjacent frames, estimate their differences, and transmit that difference. When a cut occurs and the scene is replaced entirely, the algorithm establishes a new reference index and the process starts anew.

The H.262/MPEG-2 (1994) standard, used in DVDs, specifies three types of frames, Intra-coded (I), Predictive-coded (P), and Bidirectionally predictive-coded (B), each of which uses a different encoding method. I-frames are coded using only its own data. These are frames in the traditional sense and are used as reference for the motion prediction. P -frames are coded using motion compensated prediction from a past reference frame. And B-frames are coded using motion compensated prediction from a past and/or future reference frame (ITU, 1995, p. 13). A sequence of decoded frames might be: I_BB_P_BBB_P_ (ITU, 1995, p. v), where there are 7 predicted pictures from I to I.

Using a time series of two frames, the H.262/MPEG-2 encoder first searches for matches between successive frames, then, if found, it estimates the changes in position. If the differences are small, no prediction is transmitted. If there is sufficient change, then the encoder calculates the difference between both positions and transmits it as a motion vector. Such vectors describe the movement of macroblocks within the frame. As the data in the difference is smaller than in the macroblock, that difference can be represented with fewer bits. Motion vectors produce frames (P and B) that contain data about changes to be made with regard to other frames, but do not contain any data about light intensities and their locations. These frames have little to do with physically separated photographs or electronically scanned lines, since they are places for the granular analysis and assembly of motion.

A video encoder generates a series of motion vectors that the decoder reconstructs as predictive pictures that are not pictures at all but rather “a set of instructions to convert the previous picture into the current picture. If the previous picture is lost, decoding is impossible”(Watkinson, 2004, p. 256). The lack of picture references has been exploited by visual artists

like Takeshi Murata in works such as *Untitled (Pink dot)*, 2007, that result in the organic flow of video artifacts and glitches produced by the lack of reference frames (I) in a MPEG video file. Thus, the desire to hide the operations carried out on the surface of a homogeneous surface is countered by hacking the motion-prediction function. And the dirty guts of digital video lay there wide open.

Motion prediction made the frame, the old container of light intensities, into a specialised place for the machinic synthesis of movements, in which every block is tracked, computed, predicted, and coded. The detection and assemblage of vectors turned the moving image into an ever changing image, where the blocks that constitute it move within the frame forming new images until their changes are so dramatic that blocks with new luma and chroma data replace them and the morphing process begins anew. This produces smooth transitions between the frames of a moving image that, as Adrian Mackenzie observes, never flickers (Mackenzie, 2008, p. 53).

Sending only the motion data of macroblocks instead of their picture data allows any H.26X codec to produce pictures that can only exist as the sum of transformations that a past or future picture undergoes. Motion prediction redefined the frame and its relation to the time-axis, thus altering the material storage of moving images. In order to encode and decode each frame, predictive coding requires the non-linear access to the time-axis granted by the indexes and addresses of tapeless video. As a consequence, the magnetic tape, with its strict sequential writing and track-by-track manner of reading, was rendered an unsuitable storage medium for this new type of moving image.

Until H.262/MPEG-2 the frame was still the cohesive geometrical structure for one instant of time in digital video. More recent codecs like H.264/AVC (2003) and HEVC/H.265 (2013) changed this by creating patchwork-like frames made up of fragments of present data and fragments of data located elsewhere on the time-axis. A video frame, as shot with a camera phone or played via online streaming, is the site for the assemblage of macroblocks each of which originates at a different point in time.

Slices

One approach formed at the end of the 1990s, frame partitioning with multi-frame prediction, has, at least on the surface, rendered the frame obsolete as the cohesive unit for storing moving images.

Today, from the large HDTV screens in our drawing rooms to the small mobile phone displays in our pockets, H.264/AVC is a ubiquitous presence. Since around 2005, H.264/AVC has become one of the most frequently used codecs for recording, compressing, and distributing HD video files. It is behind DVB transmissions, HDV disk storage, and low and high resolution video streaming over the Internet. When a camera phone records a video it depends on a H.264/AVC encoder, implemented in C, to perform the cascade of operations that determine the outcome. Permanently connected to a network via the phone, the encoder produces a moving image that is immediately transmissible. Today, it is very common to get video footage of breaking news such as natural disasters or terrorist alerts coming first from a camera phone rather than from a TV camera.

Sean Cubitt pinpoints the rise of H.264/AVC as the dominant online video codec behind the decision of YouTube to drop a variation of the H.263 codec owned by Adobe in favour of H.264 (Cubitt, 2014, p. 246). Higher compression factors have allowed this codec to store HD videos in memory cards inside mobile phones, pocket digital camcorders, and action cameras. One of the reasons for the higher compression rate of H.264 is that, in contrast to H.262, it makes references to a time series composed of multiple frames in order to estimate the changes in the current video frame (Wiegand & Girod, 2001, p. 4).

Instead of using frames as geometrical containers for time, H.264/AVC partitions each video picture into slices of different sizes and types of coding. And although it assembles them into a frame for display, H.264/AVC's basic temporal container is the slice. Figure 1 illustrates the video bitstream of this codec. On the left side from top to bottom, it shows the hierarchical data structure from the smallest processing unit, the macroblock, up to the largest unit, the video sequence. On the upper right side, it shows macroblocks of 4×4 pixels for motion prediction on the time-axis. This small macroblock allows this codec to track subtle changes in areas with more detail. H.264 has no pictures in coding terms. Instead, it has an "imaginary Picture structure that is composed of one or more Slices," where 'imaginary' means "that there is no Picture layer in the bitstream structure, but a picture is generated through the Slice decoding process" (Lee & Kalva, 2008, p. 79). Pictures in the moving image sequence are only formed at the very moment of decoding, a formation that is signalled

in the bitstream by an indication of the types of slices that might assemble it.

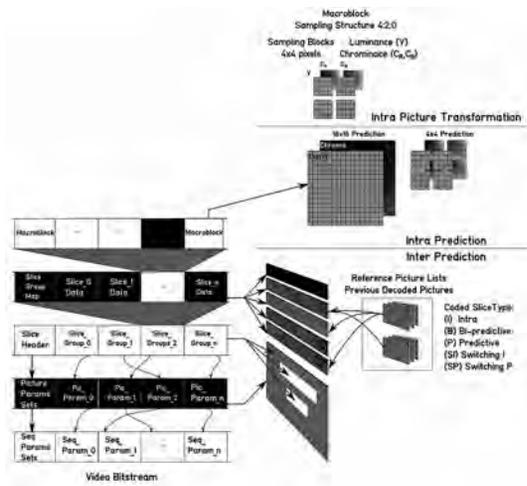


Figure 1. H.264/AVC (MPEG-4 part 10) Video Bitstream. Illustration based on data by (ITU, 2003) and (Lee & Kalva, 2008, p. 80)

H.264/AVC defines several types of slices according to their coding. There are slices without motion prediction (I), slices containing macroblocks with motion prediction based on multiple past frames (P and B), and Switching slices (SI and SP) that facilitate switching between high- and low-bit-rate streams on the decoder side by creating and storing an artificial picture. In previous codecs, “such switching would be impossible because of temporal coding” (Watkinson, 2004, p. 331). Using Switching slices, a H.264/AVC decoder adds decoded “data to the last decoded picture of the old bitstream and this converts the picture into what it would have been if the decoder had been decoding the new bitstream since the beginning” of the stored sequence (Watkinson, 2004, p. 331). A bunch of slices with their own temporal references and positions in the time-axis are enough to create a picture in the memory of the decoder. These ‘imaginary’ pictures are only ‘seen’ by the decoder in order to adapt the bitstream to this or that screen or to this or that resolution. Philip K. Dick’s androids might not dream of electric sheep but a digital video decoder might.

During the preparation phase for establishing this standard, time series greater than two references emerged in order to use long-term statistical data in digital video. This was the last step in order to banish the frame from

the surface of digital video. A long-term storage process for multiple frames was added to the codec to predict the motion of each 16×16 macroblock. Thus, from this codec on, “motion vectors are determined by *multi-frame motion estimation* which is conducted via block matching on each frame [in the] memory” (Wiegand & Girod, 2001, p. 38). Just as in Wiener’s problem about shooting down airplanes, H.264/AVC statistically estimates the present position of a macroblock on the screen based on a finite time series of its past positions.

Slicing the frame into regions with multiple references in the time-axis (time series > 2) had two effects on the moving images shot with any camera phone today. On the surface, this time-interwoven digital frame confirms Paul Virilio’s conclusion about speed that, “the delineation between past, present, and future, between here and there, is now meaningless except as a visual illusion” (Virilio, 1994, p. 31). On the surface, the absence of a synchronous frame enables the creation of pictures only for the machine. On the surface, the moving image has been restructured as a paradoxical object in which the number of time-axes is the same as the number of blocks it contains, with each axis starting at a different time and being of a different duration. On the surface, there are no frames.

Conclusion

In this paper, I have been suggesting that the ubiquitous linear predictive coding can be considered the key algorithm in the digital moving image. Predictive coding was used as the basis for early compression codecs for video-conferences, such as H.120 at the end of the 1980s. And although today it is hidden behind the smooth flow of HD video, prediction remains at the heart of digital video in codecs such as the H.264/AVC. Predictive coding, however, did not emerge out of any research into imaging techniques. As Wolfgang Schäffner has pointed out, the seemingly smooth relationship between images and computers is indeed more rocky than it appears on the surface, because the computer is not a technology for images but for mathematical operations with symbols (Schäffner, 2008, p. 127). It is in the surface, not on the surface, where every individual pixel is constructed out of several computations with endless strings of bits. Digital video is only possible due to algorithms that sample the incoming video signal and each pixel is located on the screen by algorithms that give them precise addresses.

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Author Biography

Ricardo Cedeño Montaña (Bogotá, Colombia, 1976). His background spans the fields of media history, media art, and design. His current research interest revolves around technical media and the history of knowledge with a particular focus on imaging techniques. He holds a PhD in Cultural History and Theory from the Humboldt-Universität zu Berlin, Germany (2016), an MSc in Digital Media from the Hochschule Bremerhaven, Germany (2009), a degree in Multimedia Creation from the Universidad de los Andes, Colombia (2003), and a degree in Industrial Designer from the Universidad Nacional de Colombia (1999).

Encoding Colours: From the Trichromatic Theory to the Electromagnetic Signals

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Abstract

Encoding schemes for producing, storing, and transmitting colour information in electronic media are based on a three-colour canon that originated in the 19th-century physiological studies of vision. During the 20th century this canon was first standardised and then implemented in technical media. Since then it has become ubiquitous for understanding and producing the sensation of colour. However, the precise technical operations to produce colours in electronic media has been usually overlooked in media history. This paper discusses how a certain interplay of scientific ideas, technical blueprints, and encoding specifications gave origin to the trichromatic theory and its implementation in electronic media. The first part of this paper happens in the scientific laboratories of the 18th and 19th centuries where the additive three-colour canon was set. The second part focuses on three implementations of this principle that have dominated electronic visual media ever since. These are: (i) the characterisation of a *standard observer* in the Colorimetric Resolution I by the Commission Internationale de l'Éclairage (CIE) in 1931, (ii) the implementation in of the NTSC color television during the 1940s and 1950s, and (iii) the ITU BT.601 recommendation for encoding digital video as a three-colour component signal from 1981.

Keywords

Colour, RGB, YCbCr, Colour Vision, Technical Media, Trichromatic Theory, Standard Observer

Rays of Light

In *Il Saggiatore*, in 1623, Galilei wrote, “to excite in us tastes, odors, and sounds [...] nothing is required in external bodies except shapes, numbers, and slow or rapid movements”. If we lose our ears, tongue and nose, he thought, these shapes, numbers, and movements would still exist, but not the tastes, odors, or sounds. According to him and other thinkers of the early modern science, tiny particles constantly strike our body that feels different sensations according to the place where it is touched. Thus he concluded, colours resided only in the consciousness. And reason or imagination only

arrive at such qualities thorough the senses (Galilei, 1957, pp. 277–8).

In order to understand sensations such as colour, Galileo directed all modern physics to the reading of those shapes, numbers, and movements first in the external bodies and later in our sensory apparatus. This classical dualism between mind and body—between the sensational act and the physical phenomena, has survived the centuries. Today many contemporary colour scientists still maintain that something like the colour red is actually a sensational property that we mistakenly take as a property of the object when in fact is a property of a region of our visual field (Byrne & Hilbert, 1997, pp. xix–xx).

In *Optiks*, 1704, Newton described the rays of light as not coloured. In them, he wrote,

“[...] there is nothing else that a certain Power and Disposition to stir up a Sensation of this or that Colour. [...] so Colours in the Object are nothing but a Disposition to reflect this or that sort of Rays more copiously than the rest; in the Rays there are nothing but their Dispositions to propagate this or that Motion into the Sensorium, and in the Sensorium there are Sensations of those Motions under the Forms of Colours” (Newton, 1952, bk. 1, part 2, prop II, theo II).

We experience the world as a continuum, it is our science and media that discretize it. Newton theorised that lights which differ in colour, also differ in their degree of refraction. In his famous experiment he concluded that the sun emits all sorts of rays at once, and together they produce the sensation of colour, illuminate, and paint an innumerable equal sorts of rays. Through a series of refractions, sunlight or white light was thus split, decomposed and projected as a continual series of clearly identifiable colours.

After separating the white light in a series of seven primaries, Newton explained the formation of colours

in the human sensory apparatus as the synchronization between the vibrations of the rays of light with vibrations in the retina and supposed that each colour arises from the proportions of vibrations propagated through the fibres of the optical nerve into the brain.

Three Discrete Sensations

One century later that explanation was not satisfactory for Thomas Young. On the problem of where the human sensory apparatus processes and orders the electromagnetic spectrum as colour sensations, he considered impossible that each fibre in the retina contains an infinite number of particles, “each capable of vibrating in perfect unison with every possible” vibration of light. In his Bakerian Lecture in 1801, Young suggested the fibres to be of a discrete number of types “for instance, to the three principal colours, red, yellow, and blue, of which the undulations are related in magnitude nearly as the numbers 8, 7, and 6” (Young, 1802, p. 21). Although Young did not explicitly described the sensation of white, after his theory, such a sensation has been generally understood as produced by the simultaneous stimulation of three fibres in the retina.

For over two hundred years now, it has been known that the sensation of colour produced by nearly any given light may be reproduced by the mixture in proper proportions of the light from three selected portions of the spectrum. More generally, all colour sensations produced by light may be described in terms of three properly chosen variables.

$$C=pM+qN+rO$$

in which C is the colour; M , N , and O are the chosen variables, usually spoken of as primaries; and p , q , and r , are the coefficients representing the respective amounts of the primaries required to match the sensation produced by the light. The particular specifications of these primaries may vary, and indeed may be quite arbitrarily assumed. Nevertheless, they are adequate as a formal description of the properties of colour vision insofar as they relate to colour mixing (Wright, 1929, p. 142).

Whereas Newton’s contribution to the science of colour was on the side of the transmitter, Young’s contribution was on the side of the receptor. His theory of three receptors became the basis for understanding the mechanism of colour vision. He called order from the endless chaos by virtue of explaining all the

phenomena described by Newton with a discrete number of receptors.

Building on Young’s trichromatic theory, during the 1850s, Hermann von Helmholtz empirically demonstrated that the three types of sensory receptors responsible for colour vision are primarily sensitive to one range of wave-lengths, with one sensitive to reds, one to greens, and one to violets. While Young succeeded in identifying the formation of human colour vision to the excitation of three receptors, Helmholtz gave a thorough mathematical description to the data stream of such sensual perception. Young only described theoretically this three receptors as being sensitive to the whole spectrum that at their maximum excitation were particularly sensitive to red, yellow, and blue. In contrast, with the assistance of a variety of new media technologies, particularly electric, photographic, and telegraphic inscription devices (Lenoir, 1994, p. 185), Helmholtz synthesised in a diagram three basic curves that illustrate the spectral properties of the three receptors.

Helmholtz’s use of media technologies in the laboratory was not only instrumental. In his analysis, the electrical telegraph served as a generalized model for the processes of sensation and perception. On 13 Dec 1850s, Helmholtz reported to the *Physikalisch-Ökonomische Gesellschaft zu Königsberg* (The Physical and Economical Society of Königsberg) his use of weak electric shocks to measure the reaction times of the human sensory apparatus. Throughout his report, he compared the processes of perception to the transmission of messages through the electrical telegraph. For instance, according to him, the nerve fibres were lines of transmission for messages from the outer borders to the governing centre just as were the wires of the electrical telegraph (Helmholtz, 1850, p. 181). Furthermore, he concluded that for any sensation in the human body there were three moments, first the reception of the signal by the senses (i.e. the stimulus), then its transmission to the brain, and finally the processing of the perception by the brain (Helmholtz, 1850, pp. 186-7). Helmholtz conceived human sensory organs as media apparatuses themselves. The eye was a sort of photometer that encoded light signals, red, green, and blue, as a multi-dimensional sensation. An image cast on the retina was thus as a set of discrete electrical impulses, symbolic data similar to the Morse code, and transmitted to the brain as a multiplexed signal along the optical nerve. The sensation of yellow would be per-

ceived by the combination of a strong excitation of red and green receptors with a weak excitation of the violet receptors, while a white colour would be perceived by combining the homogeneous excitation of all three receptors simultaneously (Helmholtz, 1867, pp. 291–2).

This quantification of sensual data using media technologies at the instrumental and epistemic level was important because it enabled theoretical problems of vision to be translated, externalized, and rendered concrete and manipulable. By rendering colour vision as the output of technological media, Helmholtz's work set the blueprint for the principle of colour mixing in electronic visual media. As Friedrich Kittler argues, after such “cold and inhuman” analysis “nothing stood in the way of the construction of real media that deceived and/or simulated visual perception” (Kittler, 2006, p. 42).

Implementations

Three implementations of the trichromatic theory of colour have dominated technical visual media ever since: the three light-sensitive emulsions of film, the cathode ray tube-layer coated with three phosphors, and the three colour components of digital images. In all of them a weighted combination of three different colour signals suffices to form a full colour space for the human visual system. Before dealing with the technical details of the last two implementations, I will discuss the standardisation of the sensation of colour during the 1930s. This old standard was a turning point in the history of technical media, because for the first time it framed colour into a system of parameters whose values provided precise information about how to represent and reproduce the sensation of colour. Since long time, the palettes of painters have stored empirical knowledge for the production and conservation of pigments, the mixing of colour tones, and the reproduction of coloured natural phenomena (Bredenkamp, Dünkel, Bruhn, & Werner, 2006, p. 7). The systematization of colour in a media technical standard rendered colour as objectively given thus overriding subjective tastes and preferences. This is why technical media, following Kittler's argument, are no simple tools or machines, but cultural technologies that process, store, and transmit information not natural energy (Kittler, 2006, p. 48).

The Standard Observer: 1931

During the 1920s William David Wright and John

Guild conducted experiments and measurements with 17 different observers in order to determine colour-matching relations to physical stimuli. Their output data constituted the basis to standardise a trichromatic system that fixed the proportions in which “three definite but arbitrarily chosen stimuli measured in certain units must be mixed to” produce a particular colour (Smith & Guild, 1931, p. 74). In 1931, the International Commission of Illumination (CIE) in its Colorimetric Resolution (I) characterises the *standard observer's* visibility values as the mixture of three homogeneous monochromatic “stimuli of wave-lengths 700 μm , 546.1 μm , and 435.8 μm ” (Smith & Guild, 1931, p. 75).

The value for each stimulus is “so chosen that a mixture of one unit of each of the three matches the” white colour defined by the National Physical Laboratory in London, where Guild had conducted his measurements. The CIE resolution denotes these wavelengths as R, G, and B, respectively (Smith & Guild, 1931, p. 81). The white colour Wright and Guild used as reference is a standard illuminant provided by a gasfilled lamp at a temperature of approximately 4800 °K, that is above 4500 °C. White light thus defined became the basic stimulus for the standard observer.

The amount of luminosity of the reference stimuli, R, G and B, required to match this basic stimulus are in the ratio 1.0000:4.5907:0.0601 when expressed in photometric units. White light is matched by a weighted sum of the luminosities of the three stimuli, where the luminosity of the green stimuli contributes with the largest part.

With this collection of a standard observer, a standard white, and the homogeneous stimulus, the RGB colour space became the de facto norm in electronic visual media. The Helmholtz-Young model was thus transferred over to a technical specification that would determine the mixing of colours and how such a mix would reach the human eyes.

Brilliance and Chromaticity 1939

Throughout the 1930s in order to achieve a coloured television signal it was proposed having red, green, and blue filter sectors revolving in front of the receiver of a cathode-ray tube. Such a filter would successively scan a scene in fields corresponding to one of the three primary colours following in the order red, green, blue, red, green, blue, and so on (Goldmark, 1942).

The rate of scanning needed to be quick that the

sensation produced by one field would persist in the mind of the observer during the scanning of the next two fields. As a result, the image would appear as if the three colours were present simultaneously and the sensations added, producing mixtures of the primaries and reproducing the colours in the scene. Such a field sequential system however was technically incompatible with the monochrome TV sets already deployed in millions across the US. This was a major issue.

In the same period of time, in France, Georges Valensi had devised an encoding system to enable B/W TV sets to receive colour signals (Valensi, 1945, p. 1). His invention was an apparatus for the transmission of TV images in colour through two channels, one providing a signal dependent upon the colour of the image scanned, and the other providing a second signal dependent on the luminance, that is the perceived brightness, of the image. The principle is as follows, the three-magnitude signal, RGB or HSV, picked up by the camera, would be coded in two electrical signals and transmitted over two channels. At the receiver side, a decoding device would restore the three-magnitude signal out of the two for the display of colours or use only the first signal for the display of a monochromatic image.

His apparatus included three coloured filters associated with the scanning device, a differential to compare the voltages of the incoming signals and a filter to automatically locate in a Maxwell-like colour triangle the luminous point which represents the actual colour of one particular point of a scene at a given instant.

Valensi's patent was not implemented in actual TV systems, however his principle of reducing a trichromatic signal into two electrical signals for TV and video transmission was taken up by the committee that standardised colour TV in the USA in the early 1950s. In that recommendation colour was added to the broadcast service by using the B/W signal to transmit all the information concerning luminance with the higher resolution and using almost all the bandwidth. The chromatic information was then added and cornered in the higher frequencies with a narrower bandwidth. With Valensi's machinic production of colour based on two coded signals instead of three, the human lost just another anthropomorphic monopoly. This old compression technique would have profound ontological consequences for the electronic image with its digitisation during the 1980s.

BT.601 1981

In the early 1980s, the analogue video signal was completely transposed to the digital domain. There the question concerning the minimum amount of data that can be broadcast while still preserving the image quality after the transmission became critical. To answer that question, models based on the higher sensibility to luminance than to colour of the human photoreceptors were used and the colour space of video was shifted to a more efficient representation.

In 1982, led by the EBU, an agreement between several international bodies of telecommunication engineers on the transposition of analogue video signals to digitally encoded data brought to life the first standard for the transposition of analogue video signals into digital form that determined their use in TV studios and professional applications, the ITU-recommendation BT.601.

BT.601 shifts the incoming video signal from the simpler but more redundant trichromatic representation of the RGB colour space to the more complex but more efficient colour representation of the YCbCr component video (Baron & Wood, 2005, p. 329). As any other colour space in technical media, YCbCr has three components. The RGB colour space requires equal bandwidths for each of its three colour components, which results in three equal sampling frequencies. As illustrated in figure 1, RGB requires 3 bytes per pixel, 8 bits for each component. By exploiting the human eye's lower sensitivity to colour than to luminance, the YCbCr colour space decomposes the signal into a grey-scale signal sent at full bandwidth, Y, and two colour-difference signals Cb and Cr, sent at lower band-width, using 2 bytes per pixel. "Each pixel is made up of 8 bits for luminance and 4 bits for each of the colour-difference signals, [...] a total of 16 bits" (Strachan, 1996, p. 69).

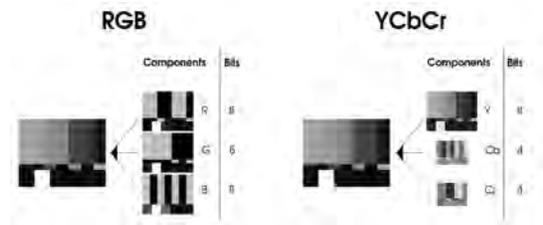


Figure 1. Comparison between the RGB and the YCbCr colour encoding systems.

In the luminance-chrominance encoding of colour, the luma signal contains the added intensity (brightness or darkness) values of all the colour signals in the video image. The weighted sum that defined the standard observer reflects the larger influence green wavelengths have in the composition of luminance. To obtain the Y signal, BT.601 adds the R, G, and B signals in a weighted sum based on the ratio set by the CIE in 1931, in which the middle spectral range, or green signals, produce a larger stimulus than red and blue signals of the same brightness. As a result, in BT.601 and subsequent digital colour encoding schemes the green frequency contributes the highest value to the luma function, while the blue frequency contributes the lowest. When sent at full bandwidth, Y already takes up one signal, leaving the two remaining slots to colour-difference signals, the red-luma and blue-luma (C R and CB). As the *panchromatic* Y signal already contains the necessary detail, a CG signal would only add noise (Watkinson, 1990, p. 89).

Conclusion

At the scientific level, the production of colour sensations was located inside the human eye and cold-blooded understood as a process of sampling the incoming luminous signal in three dimensions. At the machinic level the production of colour sensations became an encoding operation of voltages happening far far away from the human senses.

In this paper, I have been suggesting that it is precisely on this detail of the technical history of colour were media operations can be best appreciated. While in analogue television the separation of luminance and chromaticity was only used for the transmission to the television set, when bits and bytes infiltrated video that separation reached the human eye receptors closing a circuit initiated by the CIE during the 1930s. This marked an important shift in the creation of media machines that write sensual data directly into the human visual apparatus.

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Avoid Setup

Insights and Implications of Generative Cinema

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Abstract

Generative artists have started to engage the poetic and expressive potentials of film playfully and efficiently, with explicit or implicit critique of cinema in a broader cultural context. This paper looks at the incentives, insights and implications of generative cinema by discussing the successful and thought-provoking art projects that exemplify the complex connections between the creativity in cinematography and the procedural fluency which is essential in generative art. It states that the algorithmic essence of generative cinema significantly expands the creative realm for the artists working with film, but also incites critical assessment of the business-oriented algorithmic strategies in contemporary film industry. These strategies of commercial film seem logical but they are creatively counter-effective and generative cinema is becoming the supreme art of the moving image in the early 21st century.

Keywords

Algorithm, Cinema, Creative Coding, Digital Art, Film, Generative Art, Generative Cinema, New Media Art.

Introduction

This paper is part of the extensive artistic and theoretical research in generative art and its broader context. It is motivated by the observation that there exist complex connections between the creativity in cinematography and the procedural (algorithmic) fluency which is essential in generative art. These connections have been targeted implicitly or explicitly by the artists of generative cinema but remain virtually untouched in theoretical discourse. The film studies are traditionally focused on the historical, narrative, formal, aesthetical and political aspects of the relations between cinema, technology, culture, media and other art forms. The theoretical studies in new media art primarily address these relations on the conceptual, material and phenomenological level, investigating and comparing how the different references of information are captured, stored, manipulated, retrieved and perceived

in film and in digital media. In *Cinema and the Code* (1989), Gene Youngblood anticipates the creative potentials of the algorithmic foundation of code-based processing of the formal elements in film, but never explicates them.

This paper explores generative cinema by discussing the successful and thought-provoking art projects which represent the relevant approaches toward cinema in generative art and exemplify the artists' abilities to transcend the conceptual, expressive and aesthetic limits of code-based art. The theme is observed primarily from the aspect of the artists' creative thinking and critical evaluation, with the aim to show that the cognitive tensions between film and generative art have significant expressive, intellectual and ethical implications which could benefit both fields. The aim of the paper is also to encourage and open up the possibilities for further theoretical and practical research in generative cinema.

The statements in this paper are based on a combination of the literature review (which includes theoretical texts, media art histories, catalogues, articles and web sites in relevant areas) and the author's experience working as an artist, curator and educator in the field of new media. The concrete knowledge of methodologies, procedures, requirements and limitations of the actual artistic practice is rarely reflected and/or utilized in theoretical texts which are predominantly based on the analysis of other texts. This practical knowledge is an invaluable asset that sharpens the critical edge, improves the efficiency of reasoning and the depth of understanding in theoretical work. This special viewpoint both enables and requires the author to try and bring the theory and the practice together in a more comprehensive way.

Generative Cinema

The immense poetic and expressive potentials of film have been barely realized within the cinematic cultural legacy, mainly due to industrialization, commercialization, politicization and consequent adherence to the pop-cultural paradigms (Benjamin, 2008). Unrestrained by the commercial imperatives, motivated by the unconventional views to film, animation and art in general, generative artists have started to engage these potentials playfully and efficiently, with explicit or implicit critique of cinema in a broader cultural, economic and political context.

The conceptions of generative art in contemporary discourse differ by inclusiveness (Galanter, 2003; Arns, 2004; Quaranta, 2006; Boden and Edmonds, 2009; Watz, 2010; Person, 2011). In this paper, generative art is perceived broadly, as a heterogeneous realm of artistic approaches based upon combining the predefined elements with different factors of unpredictability in conceptualizing, producing and presenting the artwork, thus formalizing the uncontrollability of the creative process, underlining and aestheticizing the contextual nature of art (Dorin et al., 2015; Grba, 2015). Consequently, generative cinema is understood as the development and application of generative art methodologies in working with film both as a medium and as the source material.

Generative cinema has been one of the emerging fields of digital art in the past twenty years. Before that, generative techniques had been seldom explored in both conventional and experimental film (Hansen, 2015; Leggett, 2007; Youngblood, 1989). As a logical extension of generative animation (Monfort, 2012), generative cinema in digital art became feasible with the introduction of affordable tools for digital recording and editing of video and film. It expanded technically, methodologically and conceptually with the development of computational techniques for manipulating large number of images, audio samples, indexes and other types of relevant film data. Diverging beyond purely computation-based generativity—which drew considerable and well deserved criticism (Arns, 2004; Watz, 2010)—the production of generative cinema unfolds into a number of practices with different poetics and incentives. Here are some examples.

Supercut

Cristian Marclay's *Telephones* (1995) used supercut as

a generative mixer of conventional cinematic situations involving phone calls. Supercut is an edited set of short video and/or film sequences selected and extracted from their sources according to at least one recognizable criterion. It inherited the looped editing technique from Structural film which was popular in the US during the 1960's and developed into the Structural/Materialist film in the UK in the 1970's. Focusing on specific words, phrases, scene blockings, visual compositions, camera dynamics, etc., supercuts often accentuate the repetitiveness of narrative and technical clichés in film and television.

With the explosion of online video sharing, supercut became a pop-cultural genre but remained a potent artistic device, for example in the installations *Every Shot, Every Episode* (2001) and *Every Anvil* (2002) by Jennifer & Kevin McCoy, in Tracey Moffatt's pop-cultural thematic explorations such as *Lip* (1999), *Artist* (2000) and *Love* (2003 with Gary Hillber), and in Marco Brambilla's *Sync* (2005). It was added a witty existential flavor in Kelly Mark's post-conceptual, post-digital works *REM* (2007) and *Horroridor* (2008).

It was charged with political and meta-political critique in R. Luke DuBois' brilliant projects *Acceptance* (2012) and *Acceptance 2016* (2016) (Figure 1), the two-channel video installations in which the acceptance speeches given by the two major-party presidential candidates (Obama and Romney in 2012, Clinton and Trump in 2016) are continuously synchronized to the words and phrases each of them speaks, which are 75-80% identical but distributed differently.



Figure 1. R. Luke DuBois, *Acceptance 2016* (2016)

The conceptual and technical logic of supercut received a fundamental critical assessment with Sam Lavigne's Python applications *Videogrep* (2014), which generates supercuts by using the semantic analysis of

video subtitles to match the segments with selected words, and *Audiogrep* (2015), which transcribes audio files and creates audio supercuts based on the input search phrases.

Statistical

Classification, indexing and systematic quantification of formal qualities in time-based media allow for building databases which can be handled and manipulated with statistical tools. This enables the artists to make alternative visualizations and temporal mappings that reveal the overall visual and structural logic of popular films.

The idea of unconventional editing and presentation of film has been explored in a number of projects. *Soft Cinema: Navigating the Database* (2002-2003) by Lev Manovich and Andreas Kratky demonstrates Manovich's view of the cinema as a digital (discrete) medium and of the film as a database. The project was based on classifying and tagging a set of stored video clips, algorithmically creating the editing scenarios in real-time, and on devising a user interface for arranging, navigating and playing the material (Manovich and Kratky, 2005).

Daniel Shiffman's video wall *Filament* (2008) continuously animates and shifts the sequence of 1400 frames (50 seconds) from Tom Tykwer's *Run Lola Run* (1998). Programmed manipulation of digitized film also enables the artists to statistically process the films frame by frame, for example in Ben Fry's *Disgrand* (1998), in Ryland Wharton's *Palette Reduction* (2009), and in Jim Campbell's *Illuminated Average Series* (2000-2009) which averages and merges all the frames from Orson Welles' *Citizen Kane* (1941) and Hitchcock's *Psycho* (1960) (Campbell, 2000; 2009).

In *Portrait* (2013), Shinseungback Kimyonghun used computer vision in the statistical style of Jim Campbell and Jason Salavon (Figure 2). The software detects faces in every 24th frame of a selected movie, averages and blends them into one composite with the dominant facial identity of a movie, stressing the figurative paradigm in mainstream cinema (Shinseungback, 2013).



Figure 2. Shinseungback Kimyonghun, *Portrait (Taxi Driver and Bourne Identity)* (2013)

The classic conceptual, formal and experiential form of infographic processing of film was achieved in Frederic Brodbeck's graduation project *Cinematics* (2011). The core of the project is a Python-based online application for interactive visualization and analysis of the loaded films according to a number of criteria such as duration, average luminance and chromatic values, number of cuts, dynamics of movement in sequences, comparisons between different genres, original film versions vs. remakes, films by the same director, films by different directors, etc. (Brodbeck, 2011).

Crowdsourced

As an old method for outsourcing complex, iterative or otherwise demanding projects to many participants who are expected to make relatively small contributions, crowdsourcing has significantly evolved with the Internet (and has often been skillfully exploited), from the SETI@home screen-saver in the early WWW, to FoldIt, Kickstarter, Wikipedia, CAPTCHA, social networking and social media platforms.



Figure 3. Nicolas Maigret, *The Pirate Cinema* (2012-2014)

In *Man with a Movie Camera: The Global Remake* (2008) Perry Bard combines online participation with automatic selection of crowdsourced video clips to make a properly ordered shot-by-shot interpretation of Dziga Vertov's eponymous seminal film *Человек с киноаппаратом* (1929). A similar idea, the surrealist 'exquisite corpse' method for sequential collaging of found video clips, is behind João Henrique Wilbert's *Exquisite Clock* (2009) which constructs the digital clock with six screens showing the uploaded users' free-style photographic interpretations of decimal digits.

With *The Pirate Cinema* (2012-2014) Nicolas Maigret brings the real-time robotic sampling of film to the world of peer-to-peer exchange (Figure 3). The installation uses a computer that constantly downloads the 100 most viewed torrents on a tracker website, intercepts the currently downloading video/audio snippets, projects/plays them on the screen with the information on their origin and destination, discards them and repeats the process with the next stream in the download queue (Cox, 2015).

The idea of expanding the conventional film structure with crowdsourced, programmatically arranged and interactively manipulable contents was polished up and designed to consequently reflect the logic of online video sharing in Jono Brandell and George Michael Brower's *Life in a Day Touchscreen Gallery* (2011). It is a highly configurable platform for organizing, sorting and screening the clip sets of all the 80,000 short video submissions to a traditionally scripted and edited crowdsourcing film *Life in a Day* (dir. Kevin Macdonald, 2010) which used around 10,000 selected video clips. The fact that *Touchscreen Gallery* was a sideshow instead of being central to the *Life in a Day* project reflects the dominant ideology of mainstream cinema.

Deanimated

One of the most impressive critical deconstructions of the structural and audiovisual conventions in cinema was achieved by Martin Arnold with *Deanimated* (2002) (Figure 4).



Figure 4. Martin Arnold, *Deanimated* (2002): corresponding stills *Invisible Ghost* (left) and *Deanimated* (right)

Arnold successively removed both visual and sonic manifestations of the actors in the 1941 Joseph H. Lewis's B thriller *The Invisible Ghost*, and then consistently retouched the image and sound so that the final minutes of the film show only the empty interior/exteriors accompanied by the crackling of the soundtrack (Matt and Miessgang, 2002; Cahil, 2007).

Similarly motivated to overcome the figurative and narrative dictates in film tradition, Vladimir Todorović combines generative animations with voice-over narration and ambient soundtrack in *The Snail on the Slope* (2009), *Silica-esc* (2010) and *1985* (2013) (Figure 5). The *1985* is an abstract rendition of the fictional activities of the ministries of Peace, Love, Plenty and Truth that govern Oceania one year after the events in George Orwell's *1984* (1949). Its uncanny ambience relies on the sudden changes of sound and image, triggered by the random walk algorithm which was modified with cosine function, accelerated and decelerated (Todorović, 2013)

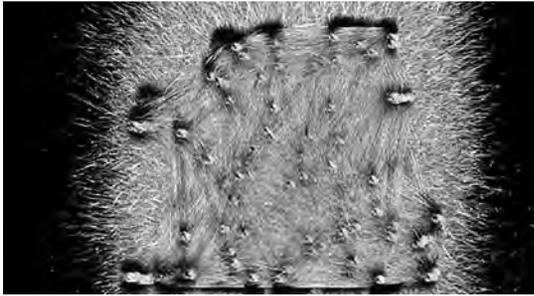


Figure 5. Vladimir Todorović, *1985* (2013)

Documentary narrative structure can also be transcended, for example in Jonathan Minard and James George's computer film *CLOUDS* (2015) which dynamically links real-time generative animations and sound with pre-recorded documentary footage.

Condensed

In *Fast Film* (2003), Virgil Widrich intelligently expanded the possibilities for reproducing and interpreting the film snippets in order to accentuate the fascinations, obsessions and stereotypes of conventional cinema (Figure 6).



Figure 6. Virgil Widrich, *Fast Film* (2003). animated effect, visually resembling Arcimboldo's grotesque pareidolic compositions (Pagden, 2007)

Fast Film was created by paper-printing the frames from selected film sequences, reshaping, warping and tearing them up into new animated compositions. In its exciting 14 minutes of runtime, *Fast Film* provides an elegant and engaging critical condensation of the key cinematic themes such as romance, abduction, chase, fight and deliverance.

Nine years later, György Pálfi exploits this formal and

narrative methodology, along with the achievements of super-cut art and culture, to produce a feature-length movie *Final Cut: Ladies and Gentlemen* (2012) out of the short sequences from 450 popular films and cartoons. Although it proved to be barely watchable as a whole due to the fundamental incompatibility between rapid editing of incoherent imagery and long running time, the film critics praised it as 'an ode to cinema' (Q.P., 2012).

Synthesized

The concept of real-time procedural audiovisual synthesis from the arbitrary sample pool, in contrast, elevates the film structure by following the essential logic of cinema. It was achieved by Sven König in *sCrAmBIEd?HaCkZ!* (2006) which uses the psychoacoustic techniques to calculate the spectrum signatures of the sound snippets from the stored video materials and saves them in a multidimensional database that is searched in real-time to mimic any input sound by playing the matching audio snippets and their corresponding videos (König, 2006). Perhaps this innovative software project was largely overlooked because König used *sCrAmBIEd?HaCkZ!* mainly for VJ-ing rather than for developing complex artworks by establishing the specific relations between the sources of stored and input materials.

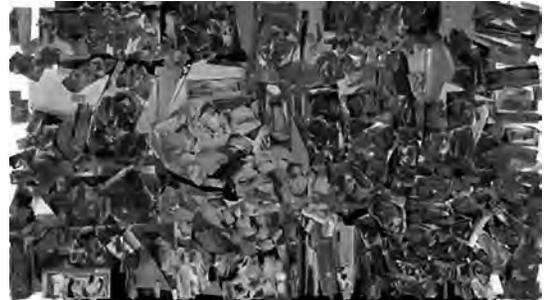


Figure 7. Parag Kumar Mital, *YouTube Smash Up: Emotional Baby! Too Cute!* (from 2012)

Procedural audiovisual synthesis was advanced through the application of neural networking and machine learning by Parag Kumar Mital in *YouTube Smash Up* (from 2012) (Figure 7). Each week, this online software takes the #1 YouTube video of the week and resynthesizes it using algorithm that collages the appropriate fragments of sonic and visual material

coming only from the remaining Top 10 YouTube videos (Mital, 2012; 2014). It produces a surreal

The more demanding, machine-based synthesis of coherent film structure and plausible narrative was tackled by Oscar Sharp and Ross Goodwin in *Sunspring* (2016) (Figure 8). It was their entry to the 48-Hour Film Challenge of the Sci-Fi London film festival. Experienced in language hacking (natural language processing) and neural networks, Goodwin programmed a long short-term memory recurrent neural network and, for the learning stage, supplied it with a number of the 1980s and 1990s sci-fi movie screenplays found on the Internet. The software, which appropriately ‘named’ it-self Benjamin, generated the screenplay as well as the screen directions around the given prompts, and Sharp produced *Sunspring* accordingly.



Figure 8. Oscar Sharp and Ross Goodwin, *Sunspring* (2016)

The film brims with awkward lines and plot inconsistencies, but it qualified with the top ten festival entries, and inspired one of the judges to say “I’ll give them top marks if they promise never to do this again (Newitz, 2016).” *Sunspring* playfully reverses the ‘Deep Content’ technology of What is My Movie web service, which analyzes transcripts, audio-visual patterns and any form of data-feed that describes the video content itself, automatically converts it into advanced metadata which is then processed by a machine learning system that matches the metadata with the natural language queries (Valossa, 2016).

A Void Setup

All these approaches in generative cinema point to the powerful algorithmic concepts for freely, parametrically and/or analytically generating the cinematic structure, narrative, composition, editing, presentation and interaction. One such concept proposes a flexible system for automatic arrangement of the manually tagged film clips, or their arrangement according to input parameters

(Berga, 2016). A more complex one would be able to combine the computer vision, semantic analysis and machine learning to recognize various categories and reconstruct plots from a set of arbitrarily collected shots, sequences or entire films, and to transform and reconfigure these elements according to a wide range of artist-defined criteria that substantially surpass those in conventional film.

The algorithmic tools of generative cinema significantly expand the realm of creative methodologies for the artists working with film and animation. They empower the artists to gain insight into conceptual, formal and expressive elements of film and animation, and to enhance them through experimentation. Furthermore, the algorithmic principles of the successful generative cinema artworks, regardless of their technical transparency, can be inferred, repurposed and developed into new projects with radically different poetic identities and outcomes. These creative capacities also provide a specific context for the critical assessment of conventional film.

Like with the earlier trendy ideas that it had clumsily borrowed or re-purposed from the avant-garde, mainstream cinema has been systematically exploiting some aesthetic effects and themes of digital generative art, with little understanding of the intellectual values behind generative methodologies. This superficial exploitation is revealed in the goofs spotted by the adequately informed members of the audience. When the commercial film tries to utilize algorithms as creative tools, it does so ineptly and ineffectually, reflecting its rigid ideology as exemplified in this paper by Macdonald’s *Life in a Day* and Pálfi’s *Final Cut*.

The algorithmic strategies that film industry applies successfully are those for conceptualization, script evaluation, box-office assessment and other business-related aspects of production, distribution and marketing. Major production companies, such as Relativity Media in Hollywood, use statistical processing of screenplay drafts, while consulting services, such as Epagogix, offer their clients the big-data-based predictions of their films’ market performance (Jones, 2009; Barnes, 2013; Smith, 2013). The outcries over the ultimate loss of creativity, provoked by the media disclosures on these practices are, however, either naive or cynical because business-related algorithms have always been integral to the big-budget filmmaking.

This might have become more obvious since

Hollywood's funding shifted towards investment banks, stock-brokerage firms and hedge funds, but algorithmization is a logical consequence of the business strategies, hierarchies and conservatism of film industry. The formulaic screenplay design that uses variables such as genre, theme, narrative elements, and principal actors was already prevalent in Hollywood in the 1930's. It was illustrated by Luis Buñuel's predictive algorithm—a synoptic table of the American cinema:

There were several movable columns [...]; the first for 'ambience' (Parisian, western, gangster, war, tropical, comic, medieval, etc.), the second for 'epochs,' the third for 'main characters,' and so on. Altogether, there were four or five [tabbed] categories. [...] I wanted to [...] show that the American cinema was composed along such precise and standardized lines that [...] anyone could predict the basic plot of a film simply by lining up a given setting with a particular era, ambience, and character. (Buñuel, 1985).

Contemporary film industry shares much of the dogmatism with the 1930's Hollywood. It is evident in the unquestionable dominance of storytelling over event, figuration over abstraction, explanation over ambience and certitude over ambiguity, in recycling motifs and themes, in exploiting the aesthetics of comics, videogames, music videos, television and visual arts, in remaking, serialization and franchising, in reducing the technical innovations to the routine tools for streamlining production, etc. This dogmatism shapes the agendas of commercial film and forces it to employ the algorithms in simplistic, mechanical and unimaginative ways. Struggling with competitive new media and art forms, the film industry today is unable to transcend and unwilling to hide its fundamentally commercial motivation which relies on communicating a subset of human universals (See Brown, 1991). Therefore, it runs its business more consciously and rationally, focusing the algorithms on market analysis, target group research, risk-assessment, and screen-play design, all the way to the test-screening evaluations corresponding to the debugging procedures in computer coding. While this pragmatic algorithmization seems logical, it is creatively counterproductive and a global mass-market film industry could benefit from generative cinema only if it takes certain commercial

risks and opens up for the experimental incentives of its creative talents.

Unrestrained by the commercial imperatives, motivated by the unconventional views on film, animation and art in general, generative artists develop new approaches and methodologies which can be advanced and repurposed by other artists, stir our amazement with the moving image, and at the same time broaden our critical understanding of the cinema as cultural product. In this regard, the poetic divergence, the technical fluency and the conceptual cogency of generative cinema successfully demonstrate that the authorship evolves toward ever more abstract reflection and cognition which equally treat the existing creative achievements as inspirations, sources of knowledge and tools.

Images

All the images in the paper provided courtesy of the artists.

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Digital Material and Creative Practice

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Abstract

Digital Material explores fluctuant dynamics between artistic creation and digital systems by projecting a theoretical model to analyze variable methodologies implemented in creative processes. The proposed model is articulated through levels and layers of information representing abstraction barriers where the information changes and assumes particular identities. Through these strata creative thought is filtered informing the material, manipulating its information and becoming art.

Keywords

Digital Material, Theoretical Model, Creation, Code, Information, Art Practice.

Digital Material and Creative Practice

This essay projects the model for a *digital material* used by creators when they implement digital systems in their creative processes. The model is structured by a series of information layers and establishes the possible relations within the material and with the rest of the creative system. The configuration and relations between these layers can be used to analyze the creative strategies exercised on digital information as well as the resulting outcomes. Likewise, the strata are constituted as abstraction barriers that: on one hand signal changes in the identity of the information, and on the other may indicate the depth of manipulation on data the artist seeks. These indicators can be of great help and interest for the analysis of artistic methodologies and the particularities of specific practices.

The work with digital systems is usually performed on several levels of depth simultaneously or involves multiple strategies in parallel that define divergent identities for a singular digital entity. That is to say, within the same project the creator can adopt strategies that use a given block of material as a predefined element or use it as a dynamic process, in which case the informational dynamics changes at any given time. Therefore, it is presumed that the structure of digital material explored

in the case study does not represent a fix entity but rather a particular example for implementing the model and can be multiplied by analyzing new sets of creative processes.

The basic framework for the concept defines four points of approach and a specific context. Thus, the problematic system is the artistic practice within digital production and is defined by the following guidelines:

A) The *digital material* only exists within digital systems. Once the information acquires body outside of the system it loses some of the features inherent to the concept. Such is the case of a printed image from a digital archive. When printed it loses its update variability and closes all the paths of communication with the system.

B) An artist works with compounds or blocks of *digital material*. A block can be a digital entity or can be composed by several nested or interconnected entities. An entity includes any digital file that contains in itself all the strata necessary for its own predefined actualization, for example a digital image. A second option is to use a database, in this case the compound includes the database as structure and its elements. Another possible format of compound can include an algorithm that meets a specific task required by a database or its elements. In short, a compound is defined by all digital elements to which the artist has access at a given time.

C) The artist works within a digital system. This system can have different levels of complexity and therefore the concept of *digital material* acts as an accordion that expands and contracts with the configuration of the system and the extension of the manipulation carried out by the creator. For example, if an artist works on a small scale system, such as an *Arduino*¹, in which he programs all the control software, creative substance comprises the totality of that system.

¹ Arduino is a platform of open hardware designed to facilitate the use of electronic means in multidisciplinary projects.

On the contrary, when the work is done on a complex system there is usually a computing framework which the creator does not transform, e.g. the operating system of a computer. It acts as the environment in which the manipulation of the material is performed, but it will not be considered part of the *digital material* because there is no creative force exercised on it.

D) The user interfaces are configured by the creative work and constitute communication channels that feed new data into the compound. Therefore, interfaces are constituting its outer layer.

These basic parameters define *digital material* as: the compound of entities on which a creator exerts a creative force within a digital system. In this general framework different methodologies may appear and the implementation of diverse strategies for separate instances of digital production are common. Even so, it is possible to identify the raw material in a given state of the process and establishing both: the layers of information in action and its internal and external relationships with the system. The strata configuration and the relationships may vary through the process given the dynamic nature of digitality, but in general the model is proposed over the most recognizable abstraction barriers.

Model [digital material]

The proposed model is formed by five layers of information and four separate levels. Each stratum represents a particular type of information or a specific manifestation of the identity of the information. Each level represents an access path and an observation scale in relation to information.

Level 1	-----	Data block
Stratum 1	-----	Binary Information
Stratum 2	-----	Structural information
Stratum 3	-----	Metadata
↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓		
Level 2	-----	Programs: opaque/transparent
Stratum 4	-----	Programmatic Information
↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓		
Level 3	-----	System Software
↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓		
Level 4	-----	Human Interfaces
Stratum 5	-----	Sensual information. Updates to the <i>digital material</i>

Table 1. Digital Material layers

First Level (Sratum [1, 2, 3]) // Data

The first stratum of *digital material* is the binary code. Namely, the moment in which information is binary, encoded in a numeric string of zeros and ones that can be transmitted quickly and effectively by means of an electrical signal. Given that a binary string of characters is not in itself structured it needs a second layer of information that defines the organizational parameters. This second layer defines the structure that organizes the binary information and projects the reading system for the binary data, consequently it is the first step towards information actualization. The third stratum defines a set of data useful to manage this information. That is to say, it consists of

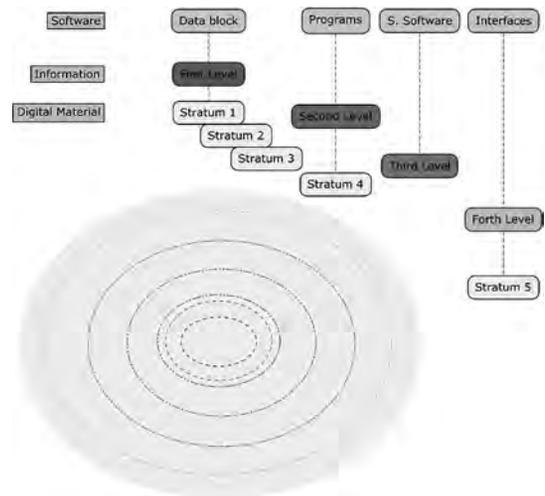


Figure 1. Digital Material Model. Metadata associated with the package or data flow that informs the exterior layers. These three layers form the first level and can be treated as a unit. This level forms a packet referring to a set of data with intrinsic structure which the creator can access.

Data packets may have at least two states: predefined stored information or variable streams of data. The first one defines information stored in a specific location that can be accessed at any time (e.g. an image, a text or a sound stored on a hard disk). This packages are relatively stable and its actualization is replicable since the data does not change. The second state of information packages flow through a digital system without being stored and therefore are ephemeral (e.g. the information current from a microphone, data retrieved in real time

from the Internet, the video stream of a webcam, etc.). They are elastic, do not have dimensions nor default parameters since these will depend on the volume of data flowing. Finally, their sensual actualization is not replicable because of its variability.

Second Level (Stratum [4]) // Programming

The fourth layer of *digital material* is constituted by computer programs which determine when and how the information on the first level is used. They allow access to independent strata of the data package and set the mapping scales for information. Here are defined the algorithms used for handling the underlying strata and the processes used to format the resulting updates. This stratum also determines the interaction between masses, including the ways of human interaction. This programmatic text is structured in computer programs limited to the parameters of a particular programming language, which defines its structural information and metadata that allows communication with the system. The fourth layer of data provides the second level of access to information.

It is characterized by an attribute of opacity that determines the level of control for the artist. This opacity is proportionally direct to the degree of programmability that it possesses, i.e. the possibility of defining the program processes and the data identities. Opacity defines the manipulation potential over the digital mass, the higher the opacity less control, the greater the transparency more control. However, in general it is presumed that a higher opacity faster and stronger data processing. A common example of opacity is the difference between image manipulation with a graphic editor or by means of graphical programming. A graphical editor is opaque because the actions exercised over the image are preset and cannot be changed outside the programmed parameters. The creator usually does not understand the underlying processes because they are hidden under a graphic abstraction which aims to simplify use². In compensation for the concealment of their processes these programs have a wide range of specialized procedures to be performed quickly and easily. On the other hand, through graphical

programming this layer acquires transparency. This is, the programmer defines and controls processes; determines and maps parameters; and establishes the paths of formalization for the information. In this way the creator gains greater control over the material.

In conclusion, this fourth layer structures the *digital material* by defining the general shape of its actualization. The programmatic text found in this stratum details the update path by which the information becomes sensitive to humans. In other words, the fourth layer generates the information that will be used and filtered by the software system and the hardware infrastructure to complete the visualization process.

Third Level () // System

The computational system is the third level of information acting as the environment for the *digital material*. It includes the operating system, the device drivers and other predefined software. It is in direct contact with the hardware and it defines the possibilities and limitations of the system. Therefore, although theoretically digital data has an undefined potential for actualization, this potential is confined to the bounds of its computational system. It is through this environment that the basic structure molded with the material acquires details, resolution and other specific attributes.

Fourth Level (Stratum [5]) // User Interfaces and Sensual Actualizations

Finally, the data packets handled through the processes and filtered by the system is updated in sensitive forms for humans in the so-called user interfaces. This is the outermost layer of the system where the *digital material* is projected and accordingly its peripheral layer. Through the user interfaces the information enters the human sensory spectrum and simultaneously, through them, external information enters and nourishes the material. That being the case, the user interfaces are the last level of informational mutation where, for a moment, the dynamic exchange of forces update on the interfaces.

The proposed model is articulated through levels and layers of information representing abstraction barriers where the information changes and assumes particular identities. Each level is a point of access to digital materiality which favors certain methodologies and practices. The implementation of the model has shown that the creative work with digital systems changes according to the stratum manipulated. Through these

² The graphic menu of these applications is composed by symbols representing actions to be performed: a brush, a pencil, a draft, etc. These symbols are used to represent the expected outcome of their use but not the algorithmic process performed on the digital data.

strata creative thought is filtered informing the material, manipulating its information and becoming art. This dynamic information flow is key in the constitution of the work of art and the aesthetic experience, as it is here where the informational entities absorb thought. Each stratum of information, which operates as an open variable in the model, receives new data generated in the creative process. Therefore, after *digital material* accumulates information in its multiple levels it acquires shape, volume and image. Digital information ceases to be a structured collection of data assuming the role of a specific creation entity. It becomes artistic material.

Actualization [Paisaje desmembrado]

The particular artistic practice of an artist and the way in which the digital systems are inserted in a project constitute the framework within which different configurations of *digital material* are projected. These formations are variations of the model, derived from the work of the artists, that express their qualities, characteristics, powers and possible appropriations.

The project *Dismembered Landscape (Paisaje desmembrado, Vergara, 2009)* allows to explore the way in which video as a practice and as a medium, acquires a very particular expressive potential when it leaves the traditional limits of audiovisual language and explores its digital characteristics. This case study is interesting because of Nelson Vergara's practice and ideas have profound roots in traditional painting which emerge in his interest of using code to remodel and stretch the boundaries of videographic representation.

In this work the video emerges as a record, it has symbolic and discursive value as a trace of the human action over nature. However, the digital identity of this videos allows Vergara to extend the documentary nature of the register and reshape the information, redefine its structure and thus investigate the relationship between time and space in videographic representation. As digital files, the videos are just part of the configuration of a *digital material* through which the artist acquires data. Specifically packages of data in the first level of information containing the video's own data: its metadata, the digital structure and the actual audiovisual data. They constitute the third, second and first data stratum adding the first level the proposed model.

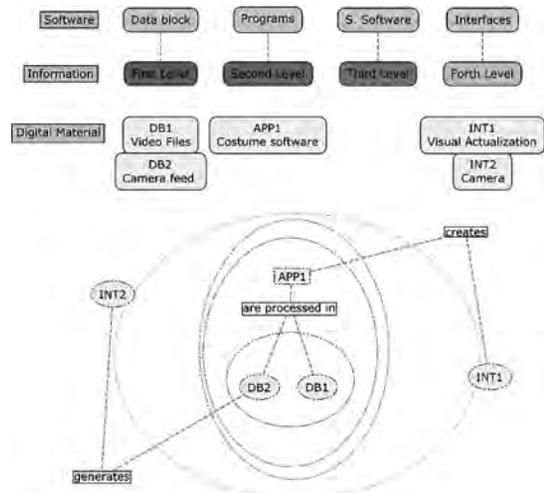


Figure 2. Digital Material projected on Vergara's Dismembered Landscape

However, in *Dismembered Landscape* there are other first-level data packets with their respective strata. The data flow coming from the video camera that registers in real time the exhibition space, the projection and public interaction. This information package is dynamic, since its data is not stored in the system and is constantly emerging from the camera feed. The images from this video stream are analyzed in the fourth layer of information in order to detect motion in the space and define openings and modifications for the figurative planes in the screen. In this way a dynamic relationship between the data packets, the documental image and the motion feed, is defined and the visual update of the work arise.

On the one hand, the video file provides graphical information and spatiotemporal sequentially storing its representational potential. On the other hand, the video feed defines the location, duration and dimension of the dynamic plane apertures in these spatiotemporal sequentially updating and modifying that discursive power. It can be concluded from this interactive relation that the projected visual update on screen cannot be considered a conventional video, since it is constructed dynamically from multiple sources of asynchronous and delocalized information. On screen, local and global times collide, external data is nested on videographic information, and the formal elements of the image cannot be attributed exclusively to any of these sources, since their structure is defined by a programmatic

module outside the first information level, the video and camera files.

This programmatic module controlling the described relationship is a costume made program specifically designed for the piece. It occupies the fourth stratum - second level - of the material on which the data packets converge. It is also concerned with collecting, transforming and reshaping these packages into a new stream of dynamic visual information that is injected into the system for display.

Specifically, the program performs a series of transformations on the data to build the visual dynamic object on screen. The process can be described as follows: First, it abstracts the video frame information into vertical lines organized from left to right as a function of the video temporal space. This converts the time vector into a spatial vector - the horizontal - in the visual object. Second, the program analyzes the changes on the camera flow to identify the presence of bodies in the exhibition space. This is achieved by comparing a reference image with the image flow such that the difference is interpreted as values defining a transformational behavior related with the presence of people in the space. Behavior that defines apertures of the symbolic accordion constructed by the continuous lines. Third, it draws a visual construct made up of color lines and rectangular apertures, moving from right to left of the screen as the video file runs again and again inside each one. As a whole, the programmatic behaviors reintroduce the video-image into the dynamic visual object. Allowing the viewer to discover that the on-screen abstraction represents a visualization of the internal structure of the digital video file, which register the action of the artist's gaze on the natural territory. Simultaneously, it activates the audience own look over the installation territory.



Figure 3. Dismembered Landscape. Up: Installation view. Down: Image processing interface

Following the information transmutation, the program generated data circulates through the computer system. On this third level it is updated according to the particular characteristics of the informational system. Finally, it is updated on screen, the communication interface and fifth layer of this artistic material. Both the screen and the camera act as a communication interfaces, giving access to external information thus allowing the interaction between public and work. *Dismembered Landscape* exemplifies a syncretic balance between data packets (first level), the designed application (second level) and the human communication interfaces (fourth level), instances of the creative material character of digital information.

To conclude, the particular configuration for the *digital material* on Vergara's practice produces a highly variable work which expresses differently to each observer. Although it uses video files as resource it is much more because the visual construct does not follow a video logic, rather it expresses the informational

structure and the variability of data.

While its medial content is virtualized, its digital structure is visualized, remixed and reconstructed into an experience (Manovich, 2005, p. 203). The experiential and performative character of this work is a direct reflection of the artist 's actions over territory. The piece becomes a metaphor for the action of transforming the territory into landscape through the view. For the audience, when traversing the territory of the digital archive, their actions modify the installation territory thus becoming landscape and aesthetic experience.

The implementation of the model in the study of *Dismembered Landscape* shows that the creative work with the digital systems changes according to the stratum from which it is accessed. Even so, regardless of the methodology of work, through these strata the creative thought is filtered, the material is transformed, the information within is manipulated and it becomes art. This dynamic flow of information is decisive in the constitution of the work of art and in its experience, since it is in this stream of information that the *digital material* is formed and informed.

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Design Process for Wearable Technologies and Urban Ecology, AirQ Jacket

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Abstract

This paper reports the creation and research process of the AirQ jacket, a wearable device that conveys temperature and air quality data through embedded electronic devices emitting light and sound. The project is oriented to enhance environmental awareness to the local passerby, since the proximity of Manizales (Colombia) to an active volcano brings the topic of air contamination to the everyday life city concerns. While the research process is introduced, some topics will be discussed such as the policies and actions taken by governmental institutions in monitoring air pollution or some wearable technology projects and approaches facing similar challenges. The paper will also describe in detail the prototyping process, on the one hand, by discussing high-level topics such as the perceptualization of scientific data. On the other, by addressing low-level topics related to the assemblage and electronic components embedding, such as portability or washability. Our systematic method of design research will be presented, outlining the dilemmas we faced and solutions we followed in the four stages of the research process.

Keywords

Wearable Technology, Urban Ecology, Soft Computing, Sonic Interaction Design, Environmental Awareness

Introduction

A challenging topic for creators and designers in Manizales, the place we live and work, is air contamination, since the city is exposed to continuous toxic gas emissions due to its proximity to a volcanic region. Beyond the discussion triggered by the pollutants, the factors, the policies and the actions we can take, we would like start thinking about air as a mixture of gases that forms the atmosphere. Beyond the discussion it triggers around pollutants, factors, policies and actions, we would like start thinking about air as a mixture of gases that forms the atmosphere. The surrounding air retains the gravity force of our body allowing us to breathe and move with stability. That is why air is so important in the permanence of human

beings. Accordingly, an ecological perception principle suggests that the “loco-motion” of the body is molded by the environment. (Gibson, 1986, p. 130). In our design process, we incorporate this insight in the local context, taking as a premise that the environmental conditions affect the passerby mobility in the urban space.

On the other hand, the pedestrian perspective of the city is another inspiring topic in our creative process. According with Michel de Certeau there is an opposition between a city view from “up there” that is totalizing and allows, “seeing the whole”, and another view from “down below” where live “the ordinary practitioners of the city” (Certeau, 1984, p. 93). Likewise, we could think that the urban environment can be twofold. It has both, a physical and an electronic layer. Meanwhile, Lemos suggests that urban spaces have “informational territories”, “zones of control of emission and reception of digital information for individuals who are circulating in the public space...” (Lemos, 2007, p.129).

In this paper, we will discuss about how wearable technology can enhance environmental awareness by allowing its user to confront the experience in the physical space with electronically retrieved data about the surrounding contamination. The design process took into account global perspectives in the fields of environmentalism and wearable technology, trying to adopt them as variables in our proposal. The design purpose seeks to empower the city passerby with portable devices and garments allowing him/her to face the local environmental conditions.

The first section will address air quality, by determining not only, the factors and consequences of air pollution, but also by discussing public policies and actions taken by governmental institutions. We will state here that wearable technology can provide new perspectives in the interpretation of scientific environmental data, bringing to the sphere of the everyday life concerns about air contamination. The second section will go into

the wearable technology practice, confronting recent projects and examining their designer's assumptions and purposes. While some of these creators propose different solutions to similar problems and similar solutions to different problems, they raise relevant topics on our design research, such as the developing of new materials, the relation with the urban space and the particular circumstances faced by wearable technology designers from peripheral places. The third section will deepen on the research process that gave rise to the AirQ jacket device. The design problem was addressed from different perspectives that led us to take into account topics such as perceptualization, portability or washability. Informed by theoretical resources in the field of design methodology, we opted to follow a systematic as well as creative-based approach to design research. Accordingly, analysis, synthesis, prototyping and assemblage stages will be reported. Last section will discuss some conclusions and final remarks.

Public Policies and Actions on Air Quality

Air Care and the widespread concern about climate change require from both, designers and engineers, plausible solutions around the world. In order to improve the urban life conditions, governmental institutions have been taking actions. They have created local policies, air pollution monitoring programmes and advertising strategies to make the community aware about climate phenomena according to the exploitation of economic and environmental resources. One remarkable example of that is the Canadian Ministry of Environment and Sustainable Development (MDDLECC, 2016). It takes actions through a platform that warns the population about contamination levels and the polluting factors according to each zone. The institution provides real-time scientific data about the environment to Internet users according to their location. Air Quality is determined by an Index (AQI) established in the Clean Air Act considering a number of pollutant gases such as O₃ (ozone), PP (polystyrene particles), CO (carbon monoxide), SO₂ (sulfur dioxide) and NO₂ (nitrogen dioxide) (AQI, 2017).

Both, air quality and climate change, suggest ecological challenges while they depend, on the one hand, on large natural cycles and, on the other, on human production and consumption activity. In a city such as Manizales, there are some governmental agencies working to mitigate the impact of natural phenomena

in the urban environment, warning the population about contamination levels and smog. Manizales is located near an active volcanic zone, due to this fact; there are constant emissions of toxic gases that are invisible to the passerby. In addition, the vehicular fleet and industrial park growth have recently become important factors in the local air quality.

Corpocaldas, as the highest environmental authority in our region, is responsible for monitoring air quality in Manizales. They have placed air quality monitoring stations at different points in the city, focusing on SO₂ and NO₂ levels (CORPOCALDAS, 2016). Moreover, they warn about acidic precipitation, which contains high level of SO₂ and silicon particles, producing an effect in the sky how Ballantyne called "scattering" (2007): the landscape becomes visually contaminated and the sunbeam produces light effects caused by volcanic gas emissions. The Colombian Geological Service (CGS) manages a risk plan by monitoring in real time the regular activity of the Nevado del Ruiz volcano. The 2015 "volcanic tremor" (VRM, 2015) produced an ash layer in the atmosphere that was more intense than the ones seen in past years. It increased the acidic rain as well as the levels of silicon particles and SO₂ in the air. CGS risk plan faces unexpected meteorological events that can affect the community, while it is known that human exposure to air contamination weakens the cardiorespiratory system and produces eyes and skin irritation among others consequences.

Despite the actions taken by these Colombian institutions, there is little clarity about the impact of warning environmental and climate change information in the local community's everyday life. According to the World Health Organization (2016) societies with meteorological and atmospheric imbalances have great impact in the displacements, the migrations, the malnutrition, the intensification of conflicts of gender, changes in habits and the alternate use of the soil in agricultural production.

While the WHO recommendations head towards environmental awareness, the wide spread of scientific information about air quality still remains as a challenging task. In this regard, wearable technologies can be helpful since they can introduce technological processes, such as, monitoring air quality, to the sphere of the community everyday life. By regularly interpreting pollutant levels the pedestrians will have informed criteria to take better decisions and personal

actions related to the environmental conditions. This should improve habitability and convivial in the urban space. Furthermore, by providing a portable air quality monitoring system to “ordinary practitioners of the city” (Certeau, 1984, p. 93), wearable technology solutions can contribute to the above mentioned institutional endeavours, offering alternative ways to retrieve environmental information.

The Practice of Wearable Technology

Fashion and costume design has been strengthened by a new generation of clothing technology based on informatics. Computer’s mobility and portability have fostered a new conception of the human body and have encouraged major fashion corporations to develop new materials. Wearable computing design practices have been growing in the past decades and today there is a significant number of studies and specialized laboratories. The research on wearable technology has diversified in directions that we have been identifying, such as art, performance and activism, urban practices, dance, athletic performance, surveillance and security systems, medical care or environmental awareness among others. Electronic- empowered experimental garments go from very simple DIY electronic devices (Mellis, 2014) to sophisticated cyborg-like garments.

It is worth mentioning that, since the first microprocessor launched in the 1950’s, the industry has been developing novel materials with chemical and physical properties that have been placed in the enduser personal computer models. Today, some of these technological innovations are near to appear in the fashion mass market with wearable technology initiatives supported by agencies such as Google or Levis. It is the case of the “Jacquard” project (Project Jacquard, 2016), a denim jacket made with an interactive textile allowing its wearer to control smartphone applications from the garment.

Wearable technologies have been eliciting new conceptions about the urban space and contemporary citizenship. They can provide ubiquitous access to electronic and online services to pedestrians and people in transit through the city. While smartphone interaction is usually restricted to a deeply focused user, electronic garments and accessories promote alternative ways of dealing with computer technology in public places. With the help of sensors and actuators, wearable interaction systems expand the human body by enhancing its

physical and mental capabilities.

Many of these experiments could not be carried out without the Internet, while most information on wearable technology is available as online tutorials (Instructables, 2016) or downloadable code (Github, 2016). From this perspective, wearable technology practices are very open and accessible to designers and artists, even for those that are not familiar with electronic prototyping and programming. However, one of the challenges we faced in our design process was finding materials. Some components, microcontrollers, sensors, and, most important, specific wearable technology parts are not easy to find in a peripheral online marketplace such as the Manizales one. In our design process we have tried to deal with this restriction following the premise: “more construction, less parts” (Hannah, 2011). We have opted to work with locally available materials and components, leading us to insights and prototypes that have risen by exploration and serendipity.

Inspiring Cases

In this section we will gather a group of creators coming from design, art and technology, equating their different approaches in the practice of wearable technology. Although, for many reasons, their projects differ from ours in the purposes and goals, discussing them will reveal different solutions and proposals facing common problems and shared challenges. In some way, they express the “future of clothes” (Tilbury, 2014), by unveiling a shift of thinking about the body in fashion design practices. While the human body expands its both, physical and mental capabilities, these projects take advantage of the portability of electronic items (Gershenfeld, 2013) to propose new ways of embodiment without losing attention to environmental and ecological awareness. By adapting shared design knowledge about electronic prototyping (Banzi, 2011), they enclose global problems in a single piece of cloth.

From a fashion design global perspective, Paulina Van Donger’s Wearable Solar integrates different procedures in a single “scientific creation” (2015). The project consists of a jacket with an embedded solar panel acting as a power bank to recharge smartphone and other equipment. The garment is intended to the Wadden Sea workers, since this Netherland’s natural reserve is away from electrical energy sources. As a “worn on” (Van Donger, 2015) project, it allows the workers to keep the circuit running (e.g. charging the jacket) while

doing their regular activities. When one considers the distinction between “internal and external stimuli” placed by wearable technology designer and theorist Barbara Layne (2007), Van Donger’s creative proposal suggests a rewarding example of the latter. According to Layne: “the most interesting advances in smart textiles are being made by a new generation of artists, engineers, designers and programmers: people who have a strong expertise in an area and also learn skills in fields that complement each other...” (Layne, 2007).

On the other hand, chinese-born designer Ying Gao explores embedding motors and other physical actuators in *haute couture* fashion design. Her “code couture” (Gao, 2016) work settles closer to Hussein Chalayan’s approach (2000), however Gao includes wearable robotics in fashion shows, performances and artistic installations suggesting an original contribution to the field. In Gao’s work, wearable technology is the result of a convergence between engineering and dressmaking labs. As a result, new fabrics, textiles, materials and garments are produced. However, there are some other designers adopting a sort of ready-made processes, taking advantage of obsolete artifacts and second-hand clothing in their experiments and testing stages. CO2 Corset by Kristine O’Friel could be an example of this. She embeds a set of servomotors in an existing female corset. The motors tighten or release the adjusting strap mechanism according to the CO2 levels in the environment reported in real time by an embedded sensor. The dress hacking process suggests alternative ways to capture and make perceptible information that the human senses are not aware of. (O’Friel, 2008).

On one side, there are industrial processes and the production of new fabrics and material for wearable technology, such as Van Donger’s or even the Gao’s one. On the other, there are homemade processes supported by DIY and online tutorials, such as the CO2 Corset. Whether, the former or the latter, the new generation of “reactive fashion” (Berzowska, 2005) and “soft computation” (High-Low Tech, 2016) is immersed in a multidisciplinary collaboration context where engineering, design and art rediscover each other. They share the challenge of finding out new ways of creating wearable and interactive artifacts (Dunne, 2005).

The AirQ Jacket Device

The AirQ Jacket is a wearable device that conveys temperature and air quality data through embedded

electronic devices emitting light and sound. Jacket reacts to environmental conditions and notifies them to its user in a symbolic way. The AirQ Jacket (2016) is the MA degree project of fashion designer Maria Paulina Gutierrez, in the Universidad de Caldas, Design and Creation Program in Manizales. It was carried out under a funded research project entitled, Sound Design for Urban Space, coordinated by program member and PhD Julián Jaramillo Arango (Sonology, 2016).

While the Manizales contamination is originated by im-ponderable factors, such as the natural volcanic activity, the industrial production or vehicle CO2 emissions, the jacket electronically retrieve environmental data providing a meaningful context to interpret scientific information about the urban space. Although air quality is not always detectable by the human’s senses, it does affect the population health producing a number of associated diseases. In this regard, environmental awareness is an urgent task in our region. The jacket intend to bring to the sphere of the Manizalian population daily life, the question and concern about air quality.

AirQ Jacket invites the passerby to interact with the environment in a reciprocal loop. This criterion comes from Sonic Interaction Design (SID) theorists (Rocchesso et al, 2008, p. 3969). They propose that in the phenomenon of Sonic interaction, humans get immersed in a “feedback loop” where actions govern sound and, reciprocally, sound become the main criterion in deciding what will be the next action.

Perceptualization

The AirQ jacket creation process also looked into the field of perceptualization (Barras&Vickers, 2011, p. 153), in this case, the mapping of scientific data to visual and auditory stimuli. On the one hand, temperature and air quality data are visualized by two arrays of colored leds attached to the upper and lower sides of the jacket. The circuit maps the information in a traditional symbolic way: blue-to-red to show temperature in the upper side, and green-to-red to show pollution in the lower side. This changing color symbolism is also associated to the scattering effect. On the other, the sonification system runs in a custom-made artifact attached to the jacket that was built with a piezo-electric device located inside a plastic cabinet that totally kills the sound, unless you approach the ear, such as telephonic equipment. Our sonification strategy demands an exploratory analysis process from the user and adopts a “reference” or

contextual sound (Walker&Ness, 2011, p. 26). The user hears a couple of regular metronomic ticks. The first one displays the temperature data changing the pitch. It also lets hear the pollution data changing the velocity. The second tick acts as a grid of reference, it represents “normal” state. When the pedestrian compares the two ticks he/she can appreciate the environmental conditions.



Figure 1. AirQ Jacket prototype. ©Maria Paulina Gutierrez & Julián Jaramillo Arango

Portability and Washability

A challenging task in the AirQ Jacket design process was embedding the electronic circuit (power source, sensors, microcontroller, leds, speaker, chords). The distribution of such components in the jacket leads us to a rewarding interchange between electronic prototyping and dressmaking. While portability became a goal in the AirQ jacket design, the patternmaking and the choice of materials adopted the criterion of lightness.

It is worth mentioning that, in the field of fashion design, lightness is a sign of modernization. In fact, when Barthes discusses the “real dress” (as opposed to the photographed one) he addresses the fashion system changes according to social processes such as the democratization and homogenization of design and the rise of a set of new citizens’ needs:

“The displacement from heavy to light is evidenced by the evolution of the real dress; the sales of the coats has decreased in profit of the most light garments (water-proof, raincoats), perhaps because of the urbanization of the population and the development of the automobile”. (Barthes. R. 1978, p.115)

Not only the growth, but also the modernization of the urban space has made fashion design to evolve.

Wearable technology requests a layer of electronic devices implanted in the “real dress” and intended to inhabitants of the digital city. In terms of patternmaking, Rudofsky argue that a piece of traditional clothing “...is equipped with about seventy or more buttons and about two dozen of pockets, most of them useless.”, and “... thanks to mechanized cleaning methods, they come loose” (Rudofsky. B. 1971, p. 170). Washing machines have influenced modern pattern making. In our days, sustainable design suggests additional demands since they argue that “the sense of community pay attention to the important thing of life” (Manzini, 2008). Accordingly, “post-growth, local wisdom” and “craft of use” notions research aims to create “garments that link you with the natural world”, “garments that catch your attention each time you wear it” and “garments that are made up of separate pieces that can be interchanged” (Fletcher, K. 2010, p. 1412). With these concepts in mind, the AirQ jacket was created with two layers: on the one hand, an uncomplicated washable layer with strategically located pockets in order to attach electronics. On the other, an electronic layer that distributes the circuit in a way that it can be detached when the piece is going to be washed.

Design methodology

The AirQ Jacket has been the result of a research process. It enclosure different stages in our insights about wearable technology and environmental awareness. Since we didn’t find a shared methodology for such an undertaking, we adopted design methodological resources that allow us to create a prototype as the main research result. We took into account theories such as project-based-research (Findeli, 2008), active practice through design (Archer, 1976), social design (Manzini, 2008) and the systematized method of design research proposed by Jones (1984). As a result the research was segmented in four main stages or phases, each one with its own purposes and challenges: (1) analysis, (2) synthesis, (3), prototyping and (4) assemblage. While theoretically the research findings were expected to emerge during the construction of the device, in reality the research focused the last two phases. There is not enough space here to describe the whole research process, but we will mention some aspects in each of their stages.

1. Analisis The analysis resulted from a gathering of wearable technology proposals developed in the past ten years. We pay special attention to both, the available

allowed us to test different configurations and links between input and output, and led us about musical composition and visual design concepts. They were useful in the finally adopted solutions that were discussed in the perceptualization section.

Dispersing Light Panels The light dispersion is one of the acid rain collateral effects. The solid particles present in the atmosphere turn in various colors making visible the contamination through the sunbeam when one views the horizon. This effect, called as “scattering”, was translated to the jacket through dispersing light panels we made with four textile material layers (see Figure 4): the first one is the plastic bag material developed to cover the jacket, the second one is a dark surface with holes dispersing the led light, in the third one the leds are sewed and the last one is the inner lining.

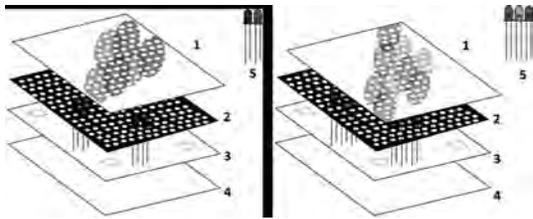


Figure 4. AirQ Jacket layered led panel. ©Maria Paulina Gutierrez & Julián Jaramillo Arango.

Plastic Bag Material In addition to the dispersing panel, we searched other strategies to smooth the effect of the led's light. Our approach was creating a sort of reactive material that could cover the outer layer of the whole garment. We inspected in some materials dealing with biological waste and toxic agents, such as DuPont's Tyvek, which inspired us to propose a recyclable solution. The outer layer of the jacket was made with shopping plastic bags, that were printed in the jacket's outer layer with a double-sided thermal-adhesive film (see Figure 5). This solution helps to protect the components from the rain and provided translucency, giving the appearance that the jacket changes its color.



Figure 5. AirQ Jacket plastic bag material. ©Maria Paulina Gutierrez & Julián Jaramillo Arango.

DIY Pattern Making We adapted standard jacket patterns from models found online in DIY tutorials with different sizes and cuts. We made some changes in one of them, in order to distribute the electronic components and embed them in the patterns. In a L size model, we included some pockets for the sensors, the arduino and the actuators, as well as some covering films for the wires and jumpers (see Figure 6). The final patterns were cute according to cover-ability with the plastic bag material, size, weight and the number of components to be attached in the jacket.

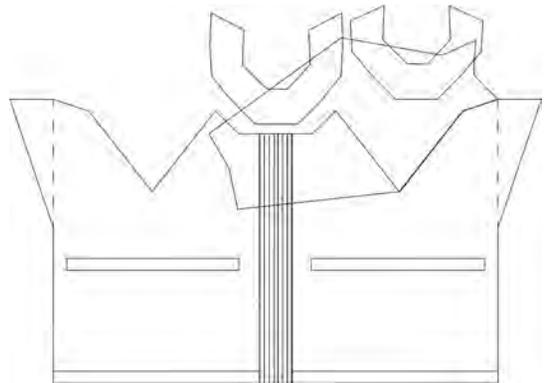


Figure 6. AirQ Jacket pattern making model. ©Maria Paulina Gutierrez & Julián Jaramillo Arango.

Zipppers, Claps and Pockets Electronic components, at least those that we could find in Colombia, are not washable. In this regard, the AirQ jacket design took into account a mechanism able to mount and remove the whole circuit from the jacket. We designed some lockable with zippers and clasps covering pockets that easily allow unmounting the components, such as the

one covering the AirQ sensor that shows the Figure 7. It allows the jacket's wearer to wash the garment separately from the circuit, since electronic materials require a very different maintenance from the textile ones.



Figure 7. AirQ Jacket gadget solution. ©Maria Paulina Gutierrez & Julián Jaramillo Arango

Anti-pollution Mask The anti-pollution mask is a supplementary resource attached to the jacket allowing the wearer to protect himself when there are low levels of air quality, such as “Moderate”, “Unhealthy for Sensitive Groups”, “Unhealthy” or worse (AQI, 2017). The mask filters pollutant particles and was sewed to the jacket's hood. The mask filter can be easily changeable, allowing the user to choose his/her own degree of protection.



Figure 8. AirQ Jacket gadget solution 1. ©Maria Paulina Gutierrez & Julián Jaramillo Arango

Remarks and Future Work

Wearable technology is relevant to the particular context of design, art and technology that is concerned with sustainability and environmental awareness, since the research on physical computing has raised new possibilities and challenges to envision applications, systems and prototypes.

The AirQ jacket does not compete with the current institutional actions and programs dealing with pollution monitoring, instead the device is complementary to them. Although the AirQ jacket retrieved data are not so reliable than those provided by, Corpocaldas, for example, our garment does provides dynamic data in the current pedestrian place.

One challenge to wearable technology is embedding (relatively) heavy and rigid electronic components to light and flexible textile fabrics. In this regard, some DIY and DWO tutorials focused on particular projects propose original solutions in dealing with the balance and the articulation of electronic and dressmaking materials.

While the AirQ jacket provides dynamic and emplaced data to its wearer, it is envisioned that the garment could also share this information with others. In this regard, including Internet access to the circuit is a future goal for us as designers, since IoT (Internet of Things) applications and services matches with wearable technology aims and technical possibilities.

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Julián Jaramillo Arango is composer and researcher working in the field of new media design and focusing on experimental sound practices, multimodal communication and in the development of interactive applications and services. Jaramillo Arango's works bridge the gap among science, arts, technology, creativity, society, community and sustainability through works that explore different modes of sonic interaction. He holds a PhD in Sonology advised by Dr Fernando Iazzetta, São Paulo University. Currently Julián conducts a postdoctoral research in the Caldas University Design and Creation program where he develops novel interfaces for the local urban space. Julián lives and works in Manizales, Colombia.

Interactive Art Based on Musical Genealogy: Nam June Paik's Random Access Byeongwon Ha

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Abstract

Random Access (1963) is one of the earliest interactive art pieces, which incorporates an electronic interface in art. Compared to Paik's fame in video art, his originality in interactive art was hardly examined in the history of new media art. This paper explores *Random Access* as a pioneering project in interactive art. Paik was educated in West Germany from 1956 to 1963. Based on his academia in the center of music, Paik published several music articles for Korean and Japanese readers as a foreign correspondent. According to his articles about progressive music in Europe, Paik was inspired by Karlheinz Stockhausen, Pierre Schaeffer and John Cage when he started to create his own interactive project. His specific articles about these experimental composers reveal that *Random Access* shows a long-time development of a diligent academic artist. As a history of interactive art, this study traces Paik's unprecedented creation, which made a significant transition from music to interactive art.

Keywords

Interactive Art, Nam June Paik, Random Access, Karlheinz Stockhausen, Pierre Schaeffer, John Cage

Introduction

Random Access encourages visitors to make collage music in their active participation. With a mobile head of a tape recorder, visitors are directly able to play music with many strings of graphical magnetic audiotapes on a white wall. Their action converts the visual montages into sound collages in real time. Through *Random Access*, Paik literally utilized the original meaning of "random access," nonlinear access to database for the interactive environment. To study the musical interactive device, Paik's musical background is the fundamental material.

After completing his thesis on Arnold Schoenberg's serialism, or twelve-tone music, at the University of Tokyo in Japan in 1956, Paik went to West Germany in the same year to continue his study of this

progressive music technique in a musicology PhD program at the Ludwig-Maximilian University of Munich. The following year, he transferred to Freiburg Music Academy to be a composer. He also attended several music conferences and festivals in Darmstadt, Strasbourg, and Donaueschingen to directly experience contemporary music. Paik practiced music as well as studied it, just as an art-practice based PhD student nowadays. In particular, when Paik attended the Yearly International Holiday Courses for New Music in Darmstadt, he encountered the most influential composers, Karlheinz Stockhausen and John Cage, and found after serialism¹ experiments in their progressive compositions and performances. His interest in purist music, or serialism naturally reached to a new type of purist music, or electronic music. Stockhausen's electronic music encouraged Paik to study Pierre Schaeffer's *musique concrète* as the origin of electronic music. Paik witnessed Cage's music performance as spatial collage in real time. The critical mixture of three composers encouraged Paik to create interactive art as a new type of progressive music. However, Paik's articles about them in the late 1950s and the early 1960s are hardly examined in the history of interactive art. This research scrutinizes this unexplored literature to trace Paik's idea while he gradually developed his own interactive art.

From Progressive Music to Interactive Art

After his successful debut, *Hommage à John Cage*, in 1959, Paik became a famous performer for action music. Paik's action music incorporates spatiality in music and sounds from his provocative performances as a significant element for music. It aimed to break static

¹ Nam June Paik published two articles, "Après Serie," about subversive music breaking from serialism. The title means after serialism. For this reason, this paper uses after serialism instead of post serialism.

bourgeois art with aggressive actions. For example, Paik performed the text-based composition written by La Monte Young's *Composition 1960 #10 to Bob Morris* (1960), which consists of a simple text, "Draw a straight line and follow it." Paik reinterpreted it as a subversive performance, *Zen for Head* (1961). Using his head dipped in ink as a brush, Paik slowly dragged himself along a piece of paper laid on the floor (Ahn, 2014). The text became a performance. The performance was left on a long paper as a painting.

This performance seems to inspire the development of *Random Access*. Similar to a pun in Dada works, Paik replaced his head with a head for a tape recorder. Visitors followed the strings that Paik attached on the white wall (Broeckmann, 2006). This articulates Paik's transition from composition to action music to interactive art. Finally, his gradual endeavors of breaking high art emancipated audiences from one-way communication, and invited them to two-way communication. This paper bridges the gap between Paik's study of experimental music and his interactive art.

In studying the relationship between Paik's musical education and his artworks, the academic community has been neglecting his interactive art. That is the reason *Random Access* has not been scrutinized in the study of Nam June Paik. His article, "About the Exposition of Music (Paik, 1962)," clearly mentions the idea of his interactive art, which provides visitors with real freedom as not audiences but participants. Another of his articles, "New Ontology of Music (Paik, 1963)," also reviews the trajectory of his experimental music from action music to interactive musical project. They show the culminating period for his interactive art. However, these English articles are too short to articulate how Paik develop the idea of interactive art. Therefore, this study explores Paik's Korean and Japanese literature during his creation of interactive art. He wrote diverse texts about new music from the Korean newspaper *Chayushinmun* and Japanese music magazine *Ongaku Geijutsu*. They contribute readers to revisiting the critical transition from action music to interactive art in the artistic world of Nam June Paik. In particular, his Korean and Japanese articles deal with significant issues from three experimental composers, Stockhausen, Schaeffer, and Cage. In this regard, they are essential literature to study the relationship between Paik's new music and interactive art. This research examines each of these artists as significant contributors to *Random Access*.

Karlheinz Stockhausen's Random, Electronic, and Spatial Music

In *Ongaku Geijutsu* on October of 1957, Paik (1957) published "The Bauhaus of Music," which deals with the Darmstadt music conference in the same year. In the music magazine, he first mentions "random access," which allows data to be approached in a nonlinear way. He (1958a) also mentioned the same topic in "The Music of 20's Century²," which consists of eight serial music articles from the Korean newspaper *Chayushinmun*. He (1958a) used the computer term, random access, to explain Stockhausen's *Klavierstück XI* (1953), which a pianist is able to start and play randomly based on the composition's algorithm: when the same patterns are repeated three times, the pianist ceases to play. Paik (1958b) focused on Stockhausen's *Zeitmass* (1956) with the dialectic combination between random access and a whole organization in music. They are well-organized pieces based on the algorithms with randomness, which is common in computer-generated art today. Paik (1958a, 1958b, 1958c, 1958d) mentioned the talented composer Stockhausen four times among the total eight articles. In random access, each space has the equal access to be used. Paik thought that this was the advanced music style of serialism, which composers use each tone equally regardless of their chord. By unrolling strings of audiotapes, Paik's interactive project, *Random Access*, realized "random access" for audiences. This new approach is a primary element of *Random Access*, which inspired by Stockhausen.

Next, Stockhausen developed spatiality of music. Paik (1959b) mainly dealt with the issue in his article, "Serie, Chance, Space," in *Ongaku Geijutsu* on December of 1959. Paik explained that Stockhausen's piece *Gruppen* (1955-57), which allows three conductors to randomly conduct three different orchestras with a basic rule at the same time. Stockhausen turned a time-based medium, music, into a space-based medium by employing three orchestra teams, which surrounded the audience in a horseshoe curve (Paik, 1959b). This description is also included in Paik's Korean article, "The Music of 20's Century (Paik, 1958d)." This reveals that Paik was impressed by Stockhausen's new experiment, which provides audiences with unfolded environment for music. Paik also adopted the new possibility of music for *Random Access*. It was not well known that

² Its original Korean title can be translated into "The Music in the Second Half of the 20th Century." It seems that Paik used a pun for the title.

Random Access was a spatial music project beyond a white wall since the white wall part in the project only remains in exhibitions. As proved in the documentation pictures of *Random Access* in the exhibition catalogue of *Exposition of Music Electronic Television Revisited* (Neuburger, 2009), *Random Access* has a three-directional environment for music like *Gruppen*. On the both left and right lower sides of the white wall, there were several parallel tape strings on the top of the clothes, which could be rotated with a ratchet lever like a mechanic music box. In other words, Paik's original idea on *Random Access* is based on a three-dimensional interactive medium. He encouraged visitors to be active performers to create spatial music. In other words, with the spatial interactions, *Random Access* converted passive audiences to active conductors, and allowed audiences to make collage music in real time.

Finally, Stockhausen's contribution to *Random Access* is electronic music. In "The Music of 20's Century," Paik (1958e) suggests that Korean musicians need to learn twelve tone technique and electronic music to catch up with the contemporary music in Europe. He also stresses that he would make electronic music, which was mainly developed by Stockhausen in the Cologne electronic music studio.

Electronic music at that time consisted of two main elements, music collages like *musique concrète* and sine wave sounds from electronic sound generators including an oscillator. In particular, collage music significantly changed Paik's style away from his early focus on serialism, a type of purity music style. This encouraged him to study *musique concrète* as the origin of electronic music. *Random Access* basically employs this collage method to compose an ephemeral music.

Stockhausen's contributions to random access in music, spatiality in music, and electronic music are foundational theories for making *Random Access*. After meeting Cage in the 1958 Darmstadt music conference, Paik (1961) equally dealt with Cage and Stockhausen as the main after-serialism composers in his Japanese article, "Après Serie." After leaving West Germany for New York, Paik mentioned much more Cage than Stockhausen. However, without Stockhausen's legacy, it is impossible to study Paik's interactive art projects in West Germany.

Pierre Schaeffer's Musique Concrète

As Paik got interested in electronic music, he researched

musique concrète as the origin of electronic music. In particular, he visited Schaeffer's *musique concrète* studio in Paris on April 16, 1958 (Paik & Steinecke, 1999). The main purpose of the visit was to use the studio for his *musique concrète* composition under Professor Wolfgang Fortner in Freiburg. This event was well described in Paik's unpublished article, "The Paris Studio of Pierre Schaeffer and *Musique Concrète*," for Korean readers in *Chayushinmun* in 1958 (Paik, 1973).

Musique concrète is a progressive music style developed in Paris during the late 1940s. Pierre Schaeffer created this new composition style with *objets sonores*, or sound objects. The sound objects are 0.5 to 5 second-long sound fragments from any sound databases (Godøy, 2009). By extracting a specific sound from diverse sound sources, sonic objects are converted from objective to subjective sounds. This is a fundamental unit for *musique concrète*, and one of the most remarkable achievements in Schaeffer's *musique concrète*, which is based on the subjective perceptual listening experience, *acousmatic listening* (Godøy, 2009). *Acousmatic* refers to a noise that one hears without seeing what causes it. Schaeffer mentioned an anecdote about Pythagoras regarding *acousmatic* from the Larousse dictionary, which he taught his lectures behind a curtain and his disciples could only listen to him without seeing him. Like the curtain, Schaeffer thought that today the radios and tape recorders can play a similar role with an invisible voice. In other words, he insisted that the tape recorder had the virtue of Pythagoras' curtain, which created new phenomena to experience, such as audio independent of visual sources (Schaeffer, 2004). By discovering the instinctive paths that lead from the purely "sonorous" to the purely "musical," this type of environment denies the instrument and cultural conditioning, and puts the sonorous and its musical possibilities in front of audiences (Schaeffer, 2004). This is a very phenomenological experiment due to direct sound experiences without visual and contextual references. Schaeffer experimented with a large archive of sound effects records, which consisted of more than 500 records in 1950 (Schaeffer, 2004). Ultimately, he dreamed of a huge cybernetic-like machine that could achieve millions of combinations (Schaeffer, 2012). By using sound objects, Schaeffer created a musical database with recordings of everyday sounds like bells ringing, trains, and humming tops. These sounds were manipulated using various sound editing techniques,

including reverse playback, changes of speed and adjustment of the attack and decay, and loops of these sounds were recorded onto discs (Meigh-Andrews, 2006). This experimental music incorporated noises and every day sounds as well as a manipulated sound database in the blurred boundary between art and life. He believed that these techniques were able to provide new notes or pseudo-instruments without normal musical instruments (Schaeffer, 2012).

In his article “Time Collage,” Paik recollects the conversation with art critic Yoshiaki Higashino in the WDR studio in Cologne. When the critic visited the studio, he saw more than one hundred audio strings hung on the ceiling. He was surprised that the cutting-edge electronic music came from a handcraft workshop that looked similar to a workplace in the medieval age (Paik, 1984). Likewise, according to his colleagues, Paik only used simple sound devices³ and accumulated a bunch of abandoned audiotape strings for his project (Rennert, 2010). In other words, as an aspiring composer at the University of Cologne, he had a hard time accessing the expensive electronic music devices including the high-end oscillators and amplifiers at the Cologne studio. He mainly used the concrete music editing system in the studio. Paik used a huge number of audio strings to make his music by his hands. He utilized the practical element of musique concrète, a wide range of haptic databases to make recorded collage music, for the database environment of *Random Access*. Nevertheless, the relatively out-of-date musique concrète experiences became an important event, which changed Paik’s musical idea from serialism to collage. His haptic experiences in the musique concrète studio in Paris and the electronic music studio in Cologne were reflected in his musical interactive art. The process of making musique concrète was not based on the graphic-user interface in the computer, which contemporary composers use. By unrolling the sound database at the gallery, Paik gave audiences a chance to be a musique concrète composer. His physical experiences from audiotape led him to create *Random Access* with his musique concrète experiences. In other words, the basic environments of *Random Access* came from the process of making musique concrète. Audiences in *Random Access*

³ In particular, Hans G. Helms recollected that Paik used only an electrical studio. He incorrectly distinguished electric from electronic music devices. It seems that he wanted to emphasize that Paik had the only access to common music mixers instead of the cutting-edge electronic music equipment.

visited in a quasi-musique concrète studio with tons of strings of audiotapes, and experienced the sound database making their haptic music in real time (Ha, 2015).

John Cage’s Prepared Piano, Theater Music, and Cartridge Music

Paik was not interested in Cage prior to meeting him. Paik confessed that he went to see Cage’s Oriental music with a very cynical mind (Decker- Philips, 1998), but Paik (1959c) became a strong supporter of Cage’s music after his first performance at the Darmstadt music conference in 1958. Paik became a member of the small audience fascinated by Cage’s performances in Darmstadt (Iddon, 2013b). Paik introduced Korean and Japanese readers to these exciting events. Paik’s articles, “Chance Music – the yearly International Holiday Courses for New Music in Darmstadt Festival” and “Serie, Chace, Space” are critical materials that reveal which courses Paik took and what he thought during the Darmstadt music conference. First, his Korean article, “Chance Music” was published as small articles on January 6 and 7, 1959 in *Chayushinmun* (Paik, 1959a). In comparison, Paik (1959c) published the Japanese article, “Serie, Chance, Space” about the same event for *Ongaku Geijutsu* in December of 1959, which is a twenty-page article for the music magazine. In these articles, Paik concentrated on “chance music” from Cage first. After the meeting with Cage, Paik’s interest in electronic music and musique concrète were dramatically shrunk. Instead, he focused on three properties of Cage’s music: chance operation, music performance, and appropriation of musical devices. First, Cage’s chance operation thoroughly changed Paik’s philosophy of music. Paik (1959a) explains that Cage’s chance operation follows a number of throwing coins based on *I-Ching*, which is an ancient Chinese divination text. Cage darkened natural stains on paper with his pencil, and based on the paper’s materiality, he chose some of these stains, then, he overlaid the stained paper with his transparent sheet of blank music notation, and the intersection between both papers would become tones in addition to sharp or flat by chance operation (Paik, 1959a). In fact, Cage experimented with diverse chance operations by overlaying transparent graphical papers. His score was decided by the materiality of paper and coins rather than his artistic creations.

In “Chance Music,” Paik (1959a) asks Cage, “If a composer would make more than twenty scores a day

by using this simple rule, how could the composer choose a single composition for a performance among them?” Cage answers that it did not matter which one was chosen. (1959a) Paik was impressed by his answer not because of irresponsibility but because of its conformation to Nature by removing a fixed thought. (1959a) This chance operation makes music with no priority. Paik thought that this method was a subversive technique as a-composition against Schoenberg’s a-tonal music (Paik & Steinecke, 1999).

Paik utilized Cage’s chance music to undermine a huge gap between double meanings of quality, or value and character. Before Cage’s music, Paik interpreted quality as value, concentrated on elitist music from a few great composers, and was disappointed by the popularity of serialism. Paik thought that there were few quality serialism composers were overwhelmed by a majority of so-so serialism composers (1958f). However, after Cage’s chance music, Paik (Paik, 1973) thought of quality as character. With Cage’s philosophical approach, Paik acknowledged differences rather than superiority in music. He left purism and elitism in music, and then was able to break all authorities in that field. Cage’s chance operation allowed him to quit the authoritative position of composer, and explore to compose 70% and remain 30% for audiences (Makoto, 1963). Similarly, on the poster of Exposition of Music – Electronic Television, Paik wrote a sub-topic “How to be satisfied with 70%.” In this regard, Cage’s chance operation inspired Paik to make interactive art as an unfinished project, or an open work. This idea helped Paik escape from the classical definition of music. This became a fundamental idea for his interactive art.

Second, Paik stressed that he was not fascinated by Cage’s theories but his performances (Decker-Philips, 1998). Paik (1959a) discussed another aspect of chance music, which some durations and timbres were freely decided by a pianist. Cage’s chance operation score was based on simple graphics like lines or rectangles. Because some parameters are missing in this score, musicians can interpret them in their own way. Musicologist David W. Bernstein (2014) divides Cage’s chance music into two different kinds: chance operation is pre-compositional random procedures used to determine a fixed musical score, whereas indeterminacy provides far more freedom for the performer with a set of unlimited possibilities. In fact, these two qualities are mixed together in Cage’s indeterminate music. His

indeterminate music was mostly created by his chance operation and pianists have, in some degrees, their own choices. Whereas Stockhausen’s random access music, *Klavierstück XI*, in the Darmstadt music courses of the previous year was able to be altered by performers’ decisions, Cage’s music could be manipulated by both the composer’s decisions based on the materiality of chance generators such as a coin and paper and performers’ reinterpretations based on the compositions. In other words, Cage’s action performance was different from Stockhausen’s musical spatiality. Stockhausen stuck to the classical structure of music even though he experimented with music by using extremely progressive methods such as surrounding music with several loud speakers, audiences surrounded by multiple orchestras, random access algorithmic music, music theater, and electronic music. Compared to Stockhausen’s music, Paik described that Cage’s busy performances reminded Paik of an exciting pro wrestling match (Paik, 1961a). His performance involved a variety of noises as essential fragments of music. He broke the clear boundary between music and noise. Paik thought Cage’s music as the earlier and better version of musique concrete, which deals with the same approach. In particular, Paik emphasized later in the United States that Cage’s *Imaginary Landscape* was the origin of media art as “some kind of quantum leap (Daniels, 2011).” Paik insisted that unlike Schaeffer, Stockhausen, and Hindemith, Cage not only made montage sounds but also recognized and used the existence of ubiquitous radio waves, hardware audio, and software ephemeral waves (Daniels, 2011). Paik admired the development of Cage’s chance music from chance operation to musician’s indeterminate music, and then to indeterminate music with ephemeral signals from electronic music devices.

However, Cage used a timer to follow his fixed composition. Paik wanted to create more flexible music than Cage’s chance music. Even though Paik (Paik, 1962) respected Cage and his colleagues, he did not follow Cage’s chance or indeterminate music at all since it did not allow audiences to experience real chance and freedom in art. In other words, freedom of Cage’s music still remained in himself and few performers. Paik planned to trespass the last authoritative property in Cage’s performance environment by providing audiences with roles of creators such as composers, conductors, and musicians.

Finally, it is essential to draw attention to Cage’s

appropriation of musical instruments and devices for the study of Paik's interactive art. Cage's prepared piano was developed to make an African pitch set when he composed *Bacchandle* (1940). After experimenting with the strings of his piano with newspapers, magazines, ashtrays, books and a pie plate, he fixed the thread of a wood-screw, wound between two strings of a single note (Revill, 1992). In "Chance Music," Paik (1959a) stressed that Cage's prepared piano is not a classical instrument, but still a young one as a new musical instrument. Cage's piano's strings, its lid and body itself were able to be beat, hit, and scratched in Darmstadt in 1958. In *Music for Amplified Toy Pianos* (1960), Cage's pianos made a sort of string instrument sound by flicking the plastic rod between the key and the hammer, which in turn strikes the metal bar which produces sound (Iddon, 2013a). In other words, Cage skipped "the key", a key element for piano, to make the sound of a different musical instrument. Inspired by several Cage's appropriations of musical objects, Paik himself continued to develop the interactive piece, *Klavier Integral* (1958-63), which incorporates the significant transition from Cage's prepared piano to interactive art. It started as a simple prepared piano, but finally became a multimedia instrument with diverse inputs and outputs such as ointment, toys, a light bulb, a hair dryer, a motor, barbed wires, etc. Whereas Cage often omitted the key of his prepared piano to make sound, Paik actively utilized the key as an important interactive interface for his *Klavier Integral*. Visitors were able to enjoy the transition from touch to other senses when they played the manipulated piano.

In *Cartridge Music* (1960), Cage manipulated electronic music devices such as turntables and contact microphones. By replacing a stylus in the cartridge with different daily materials such as a feather and a leaf, Cage created experimental music, which could not be expected (Paik, 1961a). Without records, performers played music by carefully touching these materials. Paik made the cartridge of turntable a movable interface for random access to a variety of 78-rpm records in *Record Shashlik* (1963). Paik threaded several records in two different axes on a table. This is similar to a hard disk drive, which has several layers in an axis. Audiences were able to choose any points to play these sounds databases in two rotating axes. They were spatially able to have random access as computer users can nonlinearly use any files on a hard disc drive. In *Random Access*,

similar to *Record Shashlik*, the cartridge was switched into the head of a cassette recorder. The mobile interface interacts with chaotic magnetic audiotape montages on a white wall.

In *Cartridge Music*, Cage also made a new sound approach by attaching contact microphones on tables or furniture. Unlike normal microphones, contact microphones can only detect sounds very near them, like tapping on the surface they are attached to. In other words, they mainly receive the sound from the attached objects. With loud speakers, audiences can listen to daily sounds that they hardly recognized before due to their small volumes. Cage showed that any materials can be musical instruments or music contributors. In other words, Cage broke the clear boundary between musical instrument and readymade objects in his performance. He played with daily-life objects and incorporated ignored sounds for his performance. Whereas Cage fixed the sound detectors, cartridges and contact microphones in his music, Paik liberated heads for turntables and audiotape recorders from their fixed positions. Paik found that musical devices could be manipulated as a creative interface for interactive music projects. Paik went one step more toward progressive music. Whereas Cage only gave these new interfaces for playing music himself and his talented musicians, Paik provided normal audiences with his appropriated musical devices in *Random Access*. He pointed out that his creativity in interactive art did not follow Cagean idea (Makoto, 1963b). Finally, Paik had his own original position in interactive art beyond his influential composers.

Conclusion

Paik mentioned "Do It Your..." as one of the subtitles for the poster of his first solo show, *Exposition of Music – Electronic Television*. This reminds us of "Do It Yourself," nowadays prevailing in the art-and-technology field. In fact, Paik never learned how to make visual art in the academic field. In the same way, he never learned electronic engineering or computer science in that field. To make his unprecedented interactive pieces more than a half of a century ago, Paik mainly studied and practiced this progressive art by himself. However, Paik did not create his own interactive art as *Tabula Rasa*. Paik actively reinterpreted his musical knowledge and experiences to create interactive art based on active interaction with creative composers Stockhausen, Schaeffer, and Cage. His inspirations from

those composers were able to be articulated by the study on Paik's Korean and Japanese music articles from 1957 to 1963. In this regard, the study of *Random Access* depicts an early part of the history of interactive art from progressive music to interactive art.

Some artists in interactive art use visual language computer programming, Max/MSP Jitter, to create interactive projects. Max/MSP was originally created for electronic music. However, later it incorporated the visual component, Jitter, beyond sound. Currently, it became a multimedia tool for interactive art by connecting with the technology of physical computing. The natural transition of Max/MSP Jitter from music to interactive art coincides with Paik's trajectory from music to interactive art. Interactive art has plural origins including Marcel Duchamp's kinetic 'sculpture' and Roy Ascott's changing 'painting.' Likewise, Paik's *Random Access* reveals the musical genealogy of interactive art. He was a creative composer, an active musician, a musical instrument inventor, and ultimately an important pioneer of interactive art. In particular, *Random Access* contributes to verifying his pioneering musical approach to interactive art.

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Author Biography

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Diligent Operator: The Resurrection of Musique Concrète with Max/MSP Jitter and Arduino Byeongwon Ha

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Abstract

Nam June Paik (1932-2006) exhibited the progressive music environment for audiences, *Random Access* (1963) in his first solo show. It allowed audiences to make their own sound collages by interacting with visual audiotapes on a white wall. This unusual music project was based on Paik's musique concrète composing experiences. Studying the practical relationship between *Random Access* and musique concrète, *Diligent Operator* (2016) develops Paik's idea of interactive collage music by employing Internet system to access a wide range of sound data all the world over. This new version of musique concrète was created with computer programming including Max/MSP Jitter and Arduino.

Keywords

Interactive Art, Nam June Paik, Musique Concrète, Random Access, Max/MSP Jitter, Arduino

Introduction

Diligent Operator encourages visitors to make sound collage music in real time by connecting black Ethernet cables as if visitors become 'diligent operators' in the operating switchboard system. *Diligent Operator* creatively reinterprets Paik's *Random Access*, which was exhibited in his first solo exhibition *Exposition of Music – Electronic Television* in Wuppertal, West Germany in 1963. *Random Access* allowed visitors to make sound collages by rubbing the strings of graphical audiotapes on a white wall with a mobile head of a tape recorder in a nonlinear way. This project is considered one of the most significant pioneering interactive art works (Paul, 2015).¹ Based on his research on musique concrète compositions, Paik employed the composing environment of musique concrète to make the interactive system for *Random Access*. Likewise, *Diligent Operator* is an academic creation that was developed from the study of *Random Access*.

¹ In particular, art curator Christian Paul (2015) focuses on Paik's reinterpretation of nonlinearity in art. She insists that *Random Access* predicted two-way communications between artwork and visitors.

Musique Concrète

Musique concrète is a pioneering style of mixing music developed in Paris during the late 1940s by French composer Pierre Schaeffer. This mainly emphasizes two intertwined elements, or a sound fragment and an acousmatic. A sound fragment is considered a discrete and complete sound object for compositions beyond our preconception (Schaeffer, 2012). Schaeffer pointed out sound fragments, which are 0.5 to 5 second-long fragmentary sounds from any sound data-base (Godøy, 2009) including recordings of everyday sounds like bells ringing, trains, and humming tops (Meigh-Andrews, 2006). By extracting specific sound from diverse sound sources, sound fragments are converted from objective to subjective sounds. The sound fragment is a fundamental unit for musique concrète, and one of the most remarkable achievements in Schaeffer's musique concrète (Godøy, 2009).

As conceptual artist Marcel Duchamp disconnected the fixed relationship between signifier and its signified, and created a new meaning in his 'readymades,' Schaeffer explored unlinking the preconceived relationship between sound and its original function, and listening to sound itself. In this regard, Schaeffer emphasized the subjective perceptual listening experience, acousmatic listening from sound fragments (Godøy, 2009). Acousmatic refers to a noise that one hears without seeing what causes it. Schaeffer high-lighted acousmatic from the Larousse dictionary, using Pythagoras who taught his lectures behind a curtain so that his disciples could only listen to him without seeing him. Like the curtain, Schaeffer thought that today the radios and tape recorders can play a similar role with an invisible voice. In other words, he insisted that the tape recorder had the virtue of Pythagoras' curtain, which created new phenomena to experience, such as audio independent of visual sources (Schaeffer, 2004). By discovering the instinctive paths that lead from the purely "sonorous"

to the purely “musical,” this type of environment denies the instrument and cultural conditioning, and puts the sonorous and its musical possibilities in front of audiences (Schaeffer, 2004). Sound fragments based on acousmatic listening make musique concrète very phenomenological music due to direct sound experiences without visual and contextual references. To expand the phenomenological sound experience, Schaeffer’s piles of records were decomposed, compressed, stretched, de-ossified, inverted, shattered and pulverized as if a child aggressively played with his toy (Schaeffer, 2012).

Nam June Paik’s Musique Concrète

When Paik studied musicology in Munich in 1956, he was obsessed with new music in Europe. In particular, he focused on serialism, or twelve-tone music, which was developed by Austrian-born composer Arnold Schoenberg. The following year, he transferred to Freiburg Music Academy to be an avant-garde composer. It is not surprising that he was interested in a new form of music, electronic music. At the same time, he focused on musique concrète as the origin of electronic music. Paik visited Schaeffer’s musique concrète studio in Paris on April 16, 1958. The main purpose of the visit was to use the studio for his musique concrète project under Professor Wolfgang Fortner in Freiburg (Paik and Steinecke, 1999). After coming back to West Germany, he wrote an article about musique concrète, “A report on the Paris Studio of Pierre Schaeffer and Musique Concrete.” Paik thoroughly explored the history of musique concrète as a musique concrète composing researcher, as he mentioned in the end of the article. Paik concentrated on three qualities of musique concrète, composition with sound data, noise in music and the studio system for music. First, Paik mentions Paul Hindemith and Ernst Toch as precursors of musique concrète. In *Trickaufnahmen* (1930), Hindemith used several turntables to change the pitch of recorded sounds and mixed them to create new interactive rhythmic sequences, and Toch experimented with voices by manipulating volume and pace of the sound data (Holmes, 2012). In other words, they created a method to make meta-record music. Another quality of musique concrète, noise, is stressed by Paik: Italian futurist Luigi Russolo had already experimented with noise as a main element for music in the 1920s-30s in this article. In fact, Russolo presented his statement “The Art of Noises” in 1913. He highlighted that noise sound as the revolution

of music is paralleled by the increasing proliferation of machinery sharing in human labor (Russolo, 2011). Russolo did not reject noise as an obstacle for music. Instead, he stressed that composers would utilize this inevitable element for new music. Paik explained how Schaeffer mixed these two experimental methods, or noise and meta-music, to make musique concrète. Paik insisted that his contributions to experimental music became a critical seed for studio music and growing electronic music studios around the world. Paik emphasized that without Schaeffer, scholars could not write a history of contemporary music. Accordingly, Paik thought of Schaeffer as a very important pioneer in progressive music as a precursor of electronic music, which Paik had just become interested in.

Nam June Paik’s Random Access

Random Access was exhibited in the basement of the Galerie Parnass during *Exposition of Music – Electronic Television*. *Random Access* consists of fundamental materials for musique concrète, or a tape recorder and its audiotape strings. It shows a visual collage of audiotapes on a white wall. Audiences were able to access sound fragments with a mobile head of a tape recorder in a nonlinear way. By rubbing the tape strings with the extended musical interface, visitors were actively able to compose collage music. Even though Paik used the electronic music studio in Cologne when he enrolled in the PhD program at the University of Cologne, he mainly used normal audio editing systems, which are similar to the Paris studio of musique concrète instead of expensive electronic music devices (Rennert, 2010). In Paik’s article “Time Collage,” he recollected the conversation with art critic Yoshiaki Higashino in the WDR studio in Cologne. When the critic visited the studio, he saw more than hundreds of audio strings hung on the ceiling. He was surprised that the cutting-edge electronic music came from a handcraft workshop that was reminiscent of a workplace in the medieval age (Paik, 1984). Along with this montage experience, Paik also installed a twin project of *Random Access* by switching audiotapes into another medium for musique concrète, 78-rpm records. In *Record Shashlik*, Paik threaded several records in two axes on a table. The appearance and function of it is similar to a hard drive. Just as with *Random Access*, audiences were able to access music data bases in a nonlinear way. *Record Shashlik* and *Random Access* showed two different

editing environments of Schaeffer's musique concrète studio. Paik invited visitors to virtual music studios of musique concrète. These installations were based on Paik's new idea. He quit the authoritative position of composer, and explored a new way to compose 70% of a score and leave 30% for audiences (Paik, 1963). Similarly, on the poster of *Exposition of Music – Electronic Television*, Paik wrote a sub-topic "How to be satisfied with 70%." It explains that Paik explored how to be satisfied with his unfinished projects or interactive art as a progressive artist.

His new idea allowed audiences more freedom to change the speed of reading the tape strings as if an artist paints abstract images on a huge canvas. In other words, Paik did not provide viewers with a final work, but made them take part in the process of creating collage music. This open work gave viewers active interactions. By providing audiences with diverse choices of sound databases, Paik created his own interactive pieces. In this regard, these projects can be considered one of the pioneering interactive art projects with electronic devices, which mix and manipulate different sounds in real time.

Dissatisfaction with Interactive Art

When Paik exclusively developed his interactive art *Random Access*, he published a two-page manifesto "About the Exposition of Music" to reveal his philosophical idea about interactive art. Even though Paik respected Cage and his colleagues, he did not like their music since their chance and indeterminate music were still fixed, at best a little open to performers (Paik, 1962). Unlike them, Paik explored to provide audiences with real freedom to engage in his project. In this regard, his interactive art started with how to escape a one-way communication in art and performance.

Currently, a lot of artists in the art-and-technology field have been using visitors' bodies as a critical interface to participate in their interactive projects. This popularity gains momentum with the release of *Kinect* as an interactive interface. Even though this was originally designed for users to physically interact with the video games of the *X-Box* console, artists appropriate the affordable interface in their interactive art. Some collaborative open sources simply allow *Kinect* and their programming to communicate with each other. Since the popular interactive interface has been released, the body has been popularly used for

interactive art with a low budget and simple coding. With the infrared technology from *Kinect*, visitors' bodies disappear on the screen. Without their image, they can be immersed into the virtual reality designed by artists. The visitors' bodies often become invisible in current interactive works. Even though their hidden bodies are included in the project, in most cases, audiences just need to be immersed into its environment. In this regard, interactive art provides them with restricted freedom, or some limited interactions without a recognition of their identity. For this reason, their bodies tend to become a passive agent in current interactive art.



Figure 1. Diligent Operator ©Respect Copyright

Similar to participants in interactive art, common computer users are isolated in their own filter bubble on the Internet (Pariser, 2011). For example, video service websites such as *YouTube* and *Netflix* have the algorithms to accumulate the information about users. And then, they recommend specific video clips and movies based on each customer's searching and viewing data. After all, they control users' activities online by analyzing their web surfing data. Due to this closed-circuit algorithm, users are getting more and more trapped in their previous data online. As data is getting bigger and bigger, costumers are paradoxically getting more passive with the regional and closed-circuit experiences in Internet environment, which people call World Wide Web. In 1984, although Paik broadcasted a worldwide satellite performance *Good Morning, Mr. Orwell* (1984) with diverse artists in both the East and the West, passive viewers are still limited in our regional and autocomplete boundaries.

Visitors in interactive art usually try to find the description for it, and follow the creator's description

to view their own contributions to predictably changing the creator's limited world without any reflections about their identities. Does interactive art really give visitors the freedom to choose? Or, does interactive art itself employ passive volunteers to activate it? Based on these questions, *Diligent Operator* suggests a negotiation boundary between a passive environment in interactive art and an active space in progressive music. Even though musicians practice musical instruments following the rigid rules, they can be creative performers while they master the instruments.



Figure 2. The input part of *Diligent Operator* ©Respect Copyright

Diligent Operator

Diligent Operator outstandingly makes an interactive acousmatic environment for visitors. It identifies passive recipients submitting to their filter bubbles on the Internet with conformists following the instructions in interactive art. In *Diligent Operator*, visitors become diligent switchboard operators in a hierarchical workplace in order to rethink their role as an interactive subject. In a recognizable similarity to Paik's *Random Access*, *Diligent Operator* uses the same strategy of Paik's interactive art, visual collage on a white wall with a movable interface. Instead of audiotapes, in *Diligent Operator*, 12 Ethernet cables are attached to the white wall. The end of each cable has a different changing four-digit random number image every 30 seconds. These 12 random numbers are generated in 12 sections of 833 or 834, which are equally split numbers from 0000 to 9999 into 12 regions to indiscriminately be selected. Each number represents a four-digit number for video camera data, or DSC four-digit number. If uploaders on YouTube do not type any titles for their video clips, the system automatically assigns the identical file names to

their video titles. Since they do not have a real title and few information, most of them are could not be searched with any keywords except for the combination of DSC and the specific numbers. However, they are public videos, which every user can have access to. In other words, most of the video clips do not deal with secret or confidential messages, but show everyday life. For this reason, titles with DSC and four digit numbers are mainly documentations of their activities to share their videos with their family, relatives or small communities.

The computer commands visitors to connect a specific four-digit number among 12 random numbers in order to play sound fragments from the specific DSC video files on YouTube. However, audiences' shadows from the projector discourages viewers from finding the number. Their bodies make viewers uninvited guests in interactive art. To complete the computer's mission, they need to hide their bodies so as not to make any shadows on the numbers as much as possible. If visitors do not successfully follow the instruction by connecting the specific Ethernet cable on the white wall with an interactive interface, or a long Ethernet cable on the ceiling in 30 seconds, the random numbers and the instruction number change. If the visitors made it, the computer finds 32 YouTube video clips from a list of the search results based on the DSC number that the computer said, and randomly plays six of them without visual images.² The sound becomes a sound fragment liberated from its original function as musique concrète's collage sound. This is global collage music without our preferences. Each sound clip plays for ten seconds, and the following sound starts in the middle of the previous sound clip. In other words, visitors listen to overlapping sounds except the starting and ending five seconds. In addition, if uploaders for the video clips allowed to show commercials before them, visitors listen to commercials instead of their amateur videos. This collage between amateurish and professional sounds makes comparison sound, and underscores the home-movie-like sounds.

As opposed to the autocomplete function, following the computer's rule discourages visitors from interacting with their preferences. Following the computer's command makes visitors passive operators,

2 When the computer does not find enough DSC four-digit number titles on YouTube, it automatically includes similar titles based on its specific algorithm. As the four-digital number gets higher, the accuracy of the title gets lower.

but their interactions demolish their filter bubbles of autocomplete with the double random algorithm between a random number on the wall and randomly chosen video links on the collected list from the number. This provides visitors with random access to peripheral video clips, as compared to popular videos that users mainly visit. In other words, with physical computing and programming, visitors perform as a passive operator who navigates diverse video clips without their biased key-words. Their passive interactions paradoxically contribute to breaking their filter bubble, and allow them to listen to peripheral sound collages with random access. In the end, they become active musicians in the restricted world.

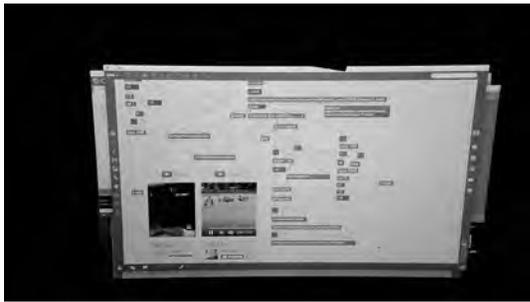


Fig 3. The Max patch of *Diligent Operator* ©Respect Copyright.

Technology of Diligent Operator

The physical computing part of *Diligent Operator* includes Arduino and Adafruit 12 Key Capacitive Touch Sensor Breakout - MPR121. This breakout board communicates with Arduino via I2C communication protocol, which uses only two pins, SDA and SCL pins, to interact with serial signals from diverse devices. This board allows users to use 12 capacitive touch sensors without building any parts with resistors, capacities, and pull-up or pull-down wires. To communicate Arduino with Max/MSP Jitter, this project simply uses the serial communication. Since Max/MSP Jitter is only required to recognize basic signals from the capacitive sensor, the program does not need an external patch like Maxuino. Each pin is attached to each Ethernet cable on the wall. Max/MSP Jitter simply generates 12 different four-digit random numbers, which are projected onto the wall. These numbers dim up and down, and change every 30 seconds. Their positions are adjusted to the end of each Ethernet cable by using the `jit.gl.videoplane` objects based on the OpenGL technology. When a

mobile Ethernet cable on the ceiling, acting as an input interface, is connected with any of these 12 Ethernet cables, the touch sensor board recognizes which cable is connected.

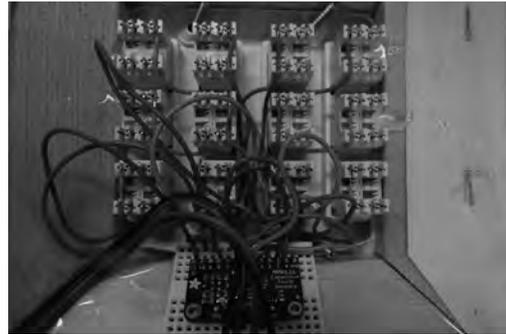


Figure 4. The capacitive sensor for Ethernet cables ©Respect Copyright

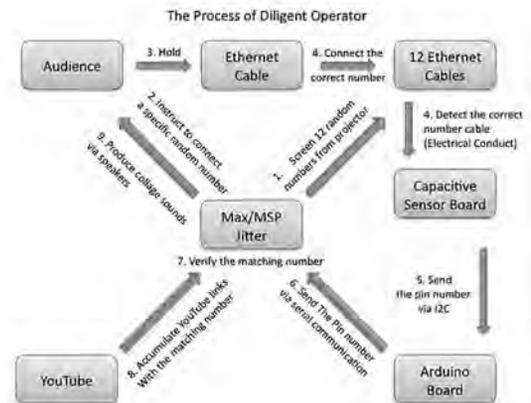


Figure 5. The diagram of the process of Diligent Operator ©Respect Copyright

The computer commands visitors to connect a specific Ethernet cable, which has a specific number among these 12 random numbers. If visitors connect the right number cable with the mobile Ethernet cable hung in the ceiling after the instructions, the computer collects the addresses of 32 video clips with the title of DSC and the specific number on YouTube by using the coll object, and randomly selects six video links among them. By using the `jweb` object, which allows creators to incorporate Internet websites in their Max/MSP Jitter patches, participants can listen to collage music from the video clips. In other words, selecting the right four -digit number on the wall automatically leads the computer

to enter the DSC and the number on the search bar on YouTube, and randomly plays six of the videos on the list of the search results. However, their correct connection impacts the random order of collage music in *Diligent Operator*. Visitors' access moment decides the list and order of the final six video clips because Max/MSP Jitter generates random numbers based on the moment when users execute the random object.³ The random number from the computer is intertwined with the random order of search results by participants.

Result

Interactive art mainly employs participants as the source of the unpredictability, which random processes have a similar role as a complexity generator in computer art (Kwastek, 2013). *Diligent Operator* mixes both strategies to make an unpredictable complexity in sound art. This project provides visitors with a chance to make the order of sound fragments as if they become musique concrète composers. In other words, connecting Ethernet cables in this project generates the chance order of diverse sounds. Mixing randomly amateurs' sounds from YouTube literally makes real time musique concrète via the Internet all the world over. In this regard, they are not passive conformists, but active musicians in interactive art.

The result of *Diligent Operator* is simple sound collages. The original sources from video clips are not manipulated except for trimming their length. Furthermore, its limited selections can make monotonous interactions. Even though *Diligent Operator* intends to encourage visitors to concentrate on sounds from diverse ordinary users, these could discourage them from actively taking part in making sound collages due to its restricted sounds intact. This would still be an unfinished project, and need some modifications to encourage visitors to actively participate.

³The reference for Random in Max/MSP Jitter describes that "A second argument is used to set a "seed" value for the random generator. If no argument is specified, the time value will be used to initialize the seed." *Diligent Operator* does not use a specific argument for the random object so that it generates a random number based on the time elapsed since system startup as the seed. In other words, six YouTube addresses among 32 ones are randomly selected and ordered for the list of sound clips by using this unpredictable seed when visitors connect the Ethernet cable. Visitors' reaction time will contribute to making a specific random order for playing the six video clips.

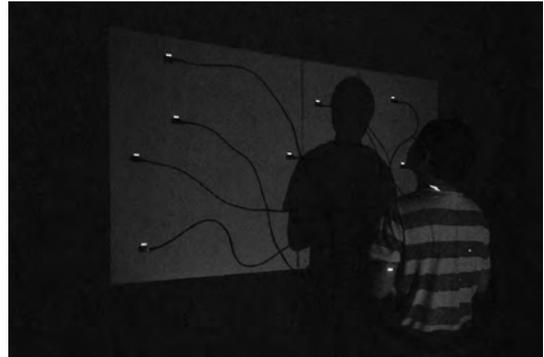


Figure 6. The input part of *Diligent Operator* ©Respect Copyright

Future Development

Diligent Operator can be developed with the basic sound manipulation techniques of musique concrète. First, the collage music can be edited by modifying speed, envelop, direction, and volume in the original sound sources. These sound manipulations like DJing techniques are the main legacy of musique concrète. However, *Diligent Operator* does not intend to eradicate the original quality of sound because sound from amateurish videos in diverse cultures can contribute to breaking our filter bubbles, and give audiences authentic acousmatic sound experiences in a whole new world. The auditory environment from *Diligent Operator* will balance between original sound sources and their modified objects. In other words, this will be intertwined original sound with its manipulated sound just as in musique concrète. This complex editing method will revive a real musique concrète project, but as a real-time performance.

Next, this project can be more complex with more inputs. *Diligent Operator* uses only 12 Ethernet connections. For the future, it would incorporate around 100 inputs just as a real operator switchboard. This environment will provide visitors with more active participations to find "the random number." This will make participants real diligent operators.

Conclusion

Diligent Operator has the same origin, musique concrète, with Paik's *Random Access*. In this virtual environment for musique concrète, visitors become diligent switchboard operators as silent conformists. However, as interactive subjects, visitors can be active musical performers by composing the order of sound fragments with random algorithm based on their

reaction moments. As opposed to normal interactive art, following the rule does not lead to a clear narrative result. Instead, visitors become collage musicians with unexpected daily life sounds. In this regard, *Diligent Operator* contributes to retrieving the active roles of both composers in musique concrète and participants in interactive art.

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This project developed from my previous proceeding, “A Pioneer of Interactive Art: Nam June Paik as Musique Concrète Composing Researcher” at the ISEA 2015.

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idMirror

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Abstract

idMirror is an interactive installation which was previously demonstrated at Ars Electronica 2015 and at the ACM CHI 2016 and is part of the Critical Device Art series. In this paper, we describe the idMirror installation from four viewpoints: Conceptual (introduction), development (section 2), technical (section 3) and the collected data analysis (section 4). The paper also presents our study of the idMirror installation participants' emotional reactions on the idMirror installation. Artists can certainly play a role in educating the public in the sense of encourage critical thinking about the access and use of their data. The idMirror project can serve as an example of how we can use social media data to create aesthetic representations and experiences. This paper elaborates upon our earlier work, published as an extended abstract as part of the ACM CHI 2016 proceedings [1].

Keywords

Identity, Virtual World, Interactivity, Physical Reality, Mobile Technologies, Device Art

Introduction

The idMirror project opens the possibilities of how to redefine classic art with the help of new technologies. New technologies in computer systems and artificial intelligence make new directions in art possible. One of those directions is a creation of highly-interactive works based on computation. From artistic point of view, interactive art is not a new phenomenon. The questioning of the role of the artist, the work and the audience, the relationship between art and society can be traced back to the 1960s when the movements of Fluxus, happenings art, participatory art and cybernetic art already provided many ingredients for interactive art. The spectator turns into the user that provides the meanings, and in a sense creates the work at the moment of the interaction. Interactivity plays an important role in new media art as described by Turkle [2].

We are not merely viewers but also participants in the environment that the idMirror installation

creates for us. The real investigation is of the life and the being itself, the virtual medium is just a tool in this investigation. This process is rather seen as the knowing of how a present action will be transformed into the future one. With the introduction of new agents in technologies, and gadgets such as the mobile phone, the hand held computers, GPS navigators, portable media players or iPads, etc. the borders between the real and the virtual world are becoming unstable and more and more indistinct. We have still not abandoned our bodies and our physical reality to set out on a never-ending spiritual wandering across virtual worlds, as it was foreseen when intelligent technology was at its opening stage – on the contrary, it was the virtual that came to us; it is here in the actual real world, surrounding and changing our physical bodies. Deleuze stated that *“The actual and the virtual coexist, and enter into a right circuit which we are actually retracing from one to the other. [...]*

Pure virtuality no longer has to actualize itself since it is a strict correlative of the actual with which it forms the tightest circuit. It is not so much that one cannot assign the terms ‘actual’ and ‘virtual’ to distinct objects, but rather that the two are indistinguishable.” [3]



Figure 1. idMirror effect in the mirror

From Device Art to Critical Device Art

Device Art is a concept derived from the Japanese approach to media art. It has been proposed by a group of artists, researchers, and engineers. Works of Device Art involve hardware specifically designed to realize a particular concept [4]. The functional and visual design of such hardware, or a device, is an essential part of the Device Art modality. Technologies and materials are re-explored and used as an original and innovative form which stems from the Japanese tradition of respecting the tools. Device art have also an enlightening side, to make people interested in the nature of technology. Japanese Device Artists are quite often criticized for their positive attitude toward technology. That is also one of the reasons for bringing out the new term Critical Device Art.

idMirror installation is one of the first projects in the series of Critical Device Art. We have to be aware that being critical is important in art and it does not mean being negative. Artists visualize what technology means and does to us as units and to the society as a whole. Being engaged in contemporary visual practice carries along also the need for social responsibility, which at the same time is also the subject of Critical Device Art approaches. This is another form of being critical which is the key point of the idMirror device.

idMirror Design and Meaning of the idMirror Effect

Nowadays we are using our mobile devices such as smartphones and tablet computers as mirrors. By observing ourselves and others we noticed that the first thing we do in the morning is that we check our devices and the last thing we do before going to bed is again checking our mobile devices. We can say that nowadays we are using all these mobile devices as mirrors. That is the reason why we chose to design the idMirror devices in the shape of a handle mirror. Mirrors are also used to study how the brain decides what is self and what is other, how it judges distances and trajectories of objects. When a participant takes idMirror in their hands he/she can see his/her own face as in the regular mirror. But after a few seconds they realize that their face is changing. They can observe how their reflection in the mirror is getting distorted and falling apart into small fragments. This effect makes us question ourselves what is happening with us when entering in to the

virtual worlds. Our identity gets spread all over social networks and other virtual environments. We noticed that the participants reacted differently to their own image/appearance in the idMirror device, which we will discuss later in this paper.



Figure 2. idMirror installation setting at ACM CHI conference 2016

Conceptual Design

The research is about how a human is constructed; how one perceives things in the world, how one interacts with the world, and how one is part of the larger whole. That includes not only our own position in the world, but also the mental states that we experience when we are confronted with things that we don't exactly understand e.g. self-knowledge and self-awareness. Transformation becomes a part of a future occurrence – both real and virtual must exist at the same moment.

The image is not considered to be a frozen moment or/and arrested action, or an effect of light, or anything like that. It is really conceived as existing within the spectator. In the case of the idMirror project the viewer no longer remains a passive observer, standing in front of an artwork that is not materially changed by the act of observation; rather, in the case of an interactive work of art, the viewer becomes a user whose act of observation produces material changes in the artwork.

Related Works

As a reference to the idMirror research we would like to propose the projects Wooden Mirror by Daniel Rozin

[5] and the spatial installation *Desire of Codes* by Seiko Mikami [6]. Both projects were inspirational to us because the authors of these projects are also dealing with information technology, image transformation and they confront us with the essential questions of 'how we retain ourselves as individuals and what brings us together in communication'.

They also claim that it is through images that our identity/we are changed into manipulative objects in virtual worlds; from real, tangible entities into coded virtual images. The very same strategy is used in the *idMirror* installation. The difference that we would like to expose when comparing those projects with the *idMirror* project is, that we have also put on the test the participants' emotional response while using the *idMirror* device. We have tested the *idMirror* device in three culturally different continents: Europe, the U.S.A. and Asia (Japan). The results will be discussed further on in this paper.

Prototyping Process

We built *idMirror* iteratively using a prototyping process. We developed various versions of the handle mirrors designs and visual effects. After several tests with the *Future Lab* collaborators we decided to use the design and effects as described in this study.

Prototype 1: Handheld Mirror

We developed various prototypes of the encasing and also experimented with the effect. In this prototype the effect would be continuous, only ending when the user left the installation. The effect would divide the face into small particles and spread around and return them back together using a pulsating animation. The feedback from the first user participants when testing this version of the installation was that it was too complex, both in terms of the design of the encasing as well as the effect.

Prototype 2: Simplified Handheld Mirror with External Projection

For the second prototype we simplified the design of the encasing and made some changes to the effect. The interaction with the device would now be more controlled, having a clear beginning and ending by having the effect fade in when first being used and fade out after a short time period. This matches more strongly with how we use our devices, checking them multiple times a day for short time periods. We also added the

external projection, which represents the longer-term concept of being a user within a larger system. This is the version which we eventually showed at *Ars Electronica Festival 2015* and later at the *ACM CHI conference 2016*.



Figure 3. The *idMirror* device consists of a wooden case and a half mirror. A tablet computer is inserted into the case

Technical Specification

The installation consists of two major components (Figure 2): the *idMirror* devices and the *idMirror* projection. The *idMirror* devices are tablets embedded in a handle mirror shell. The *idMirror* projection is a processing application running on a computer which is connected to a projector. The *idMirror* devices are connected to a wireless router using Wi-Fi. The computer running the *idMirror* grid is connected to the wireless router using a LAN cable.

idMirror Devices

The *idMirror* devices (Figure 3) contain a Google Nexus 9 tablet, which has a powerful CPU and GPU. We have developed an application for the tablet using the Android SDK and OpenGL ES 3.0 [7]. The application uses face detection to react to a person looking at his or her reflection.

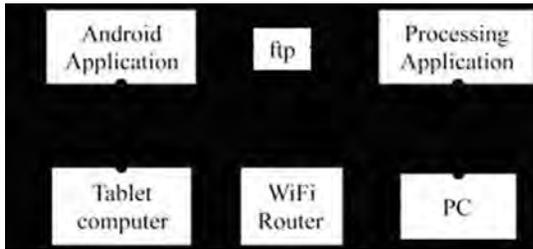


Figure 4. System overview

When users interact with the device the application renders an effect (Figure 1). When starting the idMirror application, it divides the screen into a 40*40 grid of polygons. The application disables all the polygons which do not overlap with the visible area using some basic trigonometric operations. During the startup we also enable the camera, start the face detection algorithm and add a listener for the face detected occurrence. We used the face detection algorithm supplied in the Google Android's Camera API, which proved to be robust enough for our use. During the interaction the application randomly moves the corners of each cell. Because each corner is randomly moved, the shape of the cells changes individually, forming random four-corner polygons. When a face is detected, the appearance occurs, starting the animation. We take the x, y, (width, height parameters) of the face location the image in the picture frame returned by the face detection algorithm and use this to extract a picture of the detected face. We then stretch this picture to fill the entire screen. The picture is divided among the grid polygons. For each polygon the application loops through the eight parameters specifying the location of the edges and randomly increases or decreases these by 2 pixels per second on average. This is demonstrated by the following pseudocode:

```

params = {top_left_x, top_left_y, top_right_x,
top_right_y, bottom_left_x, bottom_left_y,
bottom_right_x, bottom_right_y}
face_time = time_now - start_time

```

```

for parameter in params:
if rand_bool():
parameter = parameter + 2 * face_time else:
parameter = parameter - 2 * face_time

```

The total duration of the effect is 20 seconds, including a 5-second fade-in time and a 5-second fade-out time. After two seconds a picture of the user is taken and transmitted using an FTP connection to the idMirror projection running on a PC. The source code for the idMirror Android application and idMirror grid can be found under the MIT license on GitHub [8].

idMirror Projection

The idMirror projection is a collage of participants' faces which are metaphorically presenting their traces that we all leave when entering virtual worlds.

The idMirror projection (Figure 5) runs on a PC on which we also installed an FTP server to allow file transfer from the idMirror devices. In the grid, we show the latest 20

pictures transferred, and we show one picture in which we overlay the recent faces using transparency.

Data Analysis

The idMirror project was presented in Europe (Ars Electronica Festival in Linz, Austria, 2015), in Japan (Tsukuba Media Art Festival, Empowerment Informatics studio opening, 2015) and in the USA (CHI conference exhibition, San Jose, CA, 2016). At those exhibitions we collected thousands of participants' face images. As previously described in this paper, the idMirror installation takes facial photos of the participants. The image of the participant's face is taken 2 seconds after they see themselves in the idMirror mirror. In those 2 seconds we captured and measured the participant's emotional reaction on seeing themselves in the idMirror device.



Figure 5. Projection showing total number of participants and pictures of recent participants

Problems Encountered

One challenge in implementing the idMirror device has been to reduce the power consumption of the backlight. We managed to reduce the power consumption without negatively affecting the usage by dynamically changing the backlight based on whether the device was in use (100% brightness) or idle (0% brightness). We also added a wireless Qi charging to the tablet, using an external charging receiver and transmitter.

The implementation of the face detection API returned 2D location of the person's face, but did not return any parameters regarding the orientation (i.e. yaw, roll and pitch). For the current implementation we did not need to use any face orientation parameters, however these parameters could be useful for future improvements. After developing the idMirror application using Google's Camera API, we have tested the Google's new Face API and noticed that this does offer functionality for detecting head orientation and landmark positions such as mouth, eye and nose. To improve positioning of the idMirror devices with respect to the chargers we were considering various options. The simplest option we came up with would be to draw the outlines of the idMirror device on the surfaces on which they are placed. Another option would be to place the idMirror devices in an alcove.

Many participants tried to use the idMirror devices in small groups of people (e.g. in pairs). Because we only selected the most prominently available face using face detection, the idMirror devices could not be used to make group pictures. We have not yet come up with a good solution to allow participants to interact with the idMirror in this way.

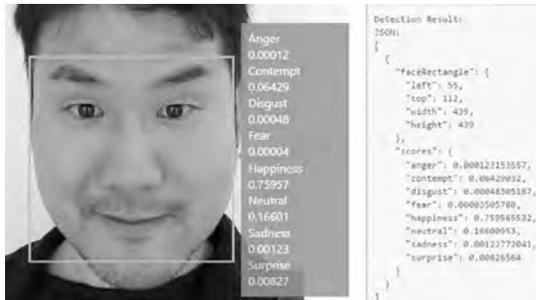


Figure 6. The data referring to the default analyzed types of emotions, stated in the figure above generated by the Microsoft emotions API

For this study, we have analyzed face images of 150 participants, aged between 18 and 75; among them 50 (25 females and 25 males) participants' face images collected in Europe, 50 (25 females and 25 males) participants' face images collected in the USA and 50 (25 females and 25 males) participants' face images collected in Japan.

Cultural Differences in Facial Expressions

Psychologists have long debated whether emotions are universal, versus whether they vary by culture. When analyzing idMirror we were aware of Hofstede's dimensions that can be used to generate specific hypotheses with respect to cultural differences in the perception of facial expressions. That is, there are cultural differences in the prevalent, modal and normative emotional responses. Emotions are biological as well as socio-cultural in nature.

Culture regulates emotions by elaborating on subjective experience. Cultures affect the relative intensity of emotional experiences. Cultures also facilitate the emergence of cultural emotions, which are unique to human cultures and require cultural knowledge for elicitation. These emotions may be universal, but not necessarily biologically innate and may be somewhat different in different cultures.

Facial Analysis Procedure

When choosing the suitable system for face analysis, we were considering the following conditions for facial expression classification in general. The following requirements were; the system should be capable of analyzing any subject, male or female of any age and ethnicity. After having tested several facial analysis systems we decided to use Microsoft emotions API. The Microsoft Emotion API takes a facial expression in an image as an input, and returns the confidence across a set of emotions for detected face. The emotions detected are anger, contempt, disgust, fear, happiness, neutral, sadness, and surprise. These emotions are understood to be cross-culturally and universally communicated with particular facial expressions [7]. These expressions are muscularly defined, and have been linked to specific and differentiable affective states by people in cultures around the world. In our study we focused on emotions that express happy or sad reaction on the idMirror device.

We have inserted 150 participants' photos into the Microsoft Emotion API. After the presence of a face

is detected in the observed scene, the next step was to extract the information about the shown facial expression. For the analysis, we chose to collect the emotions of happiness and sadness of the participants' faces.

In general, the intensity of the emotional response of happiness is much higher than the intensity of the emotional response of sadness in the case of all participants from all the three analyzed continents.

When we compare the participants from all the three continents it is quite evident that in the analysis of happy emotions the Japanese (females and males) react substantially less intensely than their peers from both, Europe and the States.

When comparing the participants from all the three continents with regards to sad emotions we can see that the differences exist, but they are lesser than in case of happy emotions. We should, however, point out that the European participants (both; females and males, react sad emotions to a much lesser extent than the participants from the other two continents.

In general, there is the smallest amount of sad emotional response with the European population, with hardly any difference between the European females and males.

The neutral response of the participants accounts for the difference to the 100% in the analyses.

The participants from all the three countries/continents are very uniform and low (about 1 person) in their reactions of sad emotions.

In the case of happy emotions, we find that the European and American women react quite similarly (12 women in both countries), whereas the number of Japanese women who would react to idMirror with happy emotions is only a third in comparison to their European and American peers.

The difference in the male population from all the three countries is rather different in their happy reaction to idMirror. The Japanese do not express their happy feelings much (only 1 person out of 25), and when comparing the Europeans and Americans, we find that the European men react happily to almost twice the extent of their American peers; 8 Europeans to 5 Americans.

Discussion

Dealing with intermedia art practice carries an important responsibility, which itself is a subject of exploration of contemporary society. In the idMirror project we tested the working principles of intermedia

artistic practice which with social responsibility. We have analyzed relations among the responses of the statistical population from different parts of the world to see whether the differences in their cultural background affect their responses to idMirror. idMirror represents Critical Device Art production. These same relations among different scientific practices present new dilemmas and questions to people today from which new knowledge and new disciplines are born.

The central part of the idMirror project is showing how variable are human identities in the age of information societies and what humans reactions to these issues are. Artists can certainly play a significant role in enlightening the broader society in the sense to trigger their critical thinking about the access and use of their own personal data in the internet. Art should not become just an ornamental style used for making data more pleasing or consumable but a powerful statement about the world we live in. The idMirror project can serve as an example of how we can use social media data to create aesthetic representations and experiences while also provoking a critical thought about the world we live in.

Conclusion

By turning the participant's face into the object of manipulation and observation, the idMirror project aims to redefine the human position in the contemporary world when all kinds of environments – including those of everyday life – are particularly information-oriented in a society. The analysis of collected facial images of the participants who interacted with the idMirror device provided us with the information how humans of different gender and originating from different continents react to the metamorphosis of their own face. The idMirror project can give us the background to understand and to become aware of all these transformations, and to understand the complexity of the contemporary world around us.

Future work

In the further development of Critical Device Art series we would like to continue exposing the importance of the interaction between art and new technologies on the one hand and art's critical reflection of science and technology on the other hand for the beneficial development of "information societies" that we live in.

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Authors Biographies

Maša Jazbec, after finished the study of Fine Arts at the Faculty of Education Maribor (Slovenia) continues her study at the post-graduate department of Interface Culture, at the University of Arts and Design Linz (Austria). During her study, she completes a residence at the Institute of Advanced Media Arts and Sciences IAMAS (Japan). Her projects, exhibited as artworks, have always shown her understanding of new media as a research artistic practice, stemming from the tradition of the video and the new artistic thought, linked to the current situation in the contemporary society. She is currently a Ph.D. candidate at Empowerment Informatics, University of Tsukuba, Japan and a visiting researcher at ATR (Hiroshi Ishiguro Laboratories).

Floris Erich is a Special Fellow in the Empowerment Informatics program at the University of Tsukuba in

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Hiroo Iwata has been conducting research on virtual reality. His research interests include haptic interface, locomotion interface and spatially immersive display. He exhibited his work at the Emerging Technologies venue of the SIGGRAPH every year from 1994 to 2007. He also got honorary mentions at Prix Ars Electronica 96 and 2001. He launched Device Art project in 2004. He has been leading Ph.D. program in Empowerment Informatics at the University of Tsukuba since 2013

Compositional Approaches to Spatialisation with the speaker.motion Mechatronic Loudspeaker System

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Abstract

This paper describes compositional approaches to working with the new speaker.motion mechatronic loudspeaker system. The spatial affordances that come with the new loudspeaker system require new compositional ideas to explore the dynamic use of spatial attributes in electronic music. The speaker.motion system is first introduced and the communication protocols that composer use to control the system are discussed. The paper then continues with two case studies describing site-specific compositions that have been developed for the speaker.motion system each of which uses the spatial affordances of the system at the fore-front of their creative output. In assessing the compositional strategies of the system the paper also includes discussion provided by other composers who have utilized the speaker.motion system and their thoughts on the new ways it affords spatial performance and composition approaches. The paper then concludes with the future directions of both the system and the development of compositions for it.

Keywords

Mechatronic Instruments, Spatial Performance, Interface Design, New Loudspeaker Systems.

Introduction

The speaker.motion system allows dynamic directionality changes of four loudspeakers. The new approaches and affordances of the speaker.motion have been explored through the composition of new musical works with dynamic spatialisation as a key aspect of the piece, as well as through a user study completed by composers utilizing the system. The new spatial affordances of the speaker.motion system have catalyzed new compositional approaches to dynamic spatialisation in particular in regards to the composer/performers active engagement with the physical properties of the performance space.

The concept behind this new instrument is the development of a tool to further allow composers and performers to actively manipulate the way sound travels

through a performance space as a part of their piece. speaker.motion is a mechatronic instrument that has been designed to allow real-time manipulation of the sound projection vector of a loudspeaker. By dynamically manipulating the directionality of the loudspeaker, the composer/performer is able to use the way sound travels through and reflects around the physical area of the performance space, which affects the way that the audience perceives it.

Spatial Composition

Spatial composition has a long tradition within the development of electronic art music. Composers such as Schaeffer, Stockhausen, Cage, Xenakis and Tudor have embraced spatial relationships in their works. Throughout these early spatial experiments in electroacoustic music, a number of avenues for spatial expression can be identified. These avenues continue to be the basis for contemporary spatial explorations.

Spatialisation has also been considered by many scholars as a way to further add layers of structure, emotion and meaning in electronic music. Denis Smalley, Natasha Barrett, and others make a clear distinction between the intrinsic and extrinsic qualities of a sound (Smalley, 1997), (Barrett, 2002), (Kendall & Ardila, 2008). They argue that the intrinsic qualities of sound are those that are inherent within the sound itself, such as, its timbre, dynamic qualities, or spectrum. Similarly, the extrinsic qualities are the sound's ability or tendency to point the listener's mind towards a real-world equivalent to the sound. This might be something with which the listener is familiar that could possibly produce the particular sound, or a sound similar enough for the listener to immediately create an association in his or her mind. Composers are often aware of both the intrinsic and extrinsic qualities of sounds in their pieces, and they exploit and manipulate these associations for aesthetic or structural reasons (or sometimes both). These same

intrinsic and extrinsic properties are also evident in the spatial domain. The intrinsic spatial aspects of a sound are the individual resonant properties of a sound source as well as the compositional creation of a spatial illusion. The extrinsic spatial aspects would then be a spatial allusion where the intention is not to have the listener believe that they are physically in the space being alluded to, but to have a tendency to point the listener's mind in that direction. In the same way, composers can use the knowledge of the effect of spatial intrinsic and extrinsic qualities of sound in order to create friction (by specifically rejecting what is expected spatially) or resolution (by adhering to the listener's expectation of a spatial quality).

Many scholars of spatial theory have focused on distinct spatial locations in sound spatialisation practice. In 'On Sonic Art', Trevor Wishart extends this to the idea of spatial motion in composition, arguing that, in fact, many sound sources are in need of some spatial motion in order to be recognised (Wishart, 1996). A static bee humming, for instance, will often not make the listener think of a bee, but when it appears to be moving around a space, the listener is more likely to associate it with the image of a bee. The spatial metaphor of frequency (high frequencies come from above, and low frequencies come from below) often gives composers the ability to either compliment or contradict what can be expected, and therefore can be used to create conflict and resolution within a piece. The tenth chapter of 'On Sonic Art', 'Spatial Motion', proposes many possible potential sonic trajectories and discusses how they may be used to deepen the portrayal of meaning and emotion in music. However, in practice, many of these potential spatial trajectories are difficult to achieve. One of the major motivations for the research presented in this paper is therefore to create ways for composers to more easily generate advanced spatial trajectories, particularly in real time. With the *speaker.motion* system affording the added element of dynamic manipulation of the directionality of loudspeakers, composers can add a further layer of decipherable intention to their work, as conceptualized by the scholars mentioned above.

A number of extensions to traditional loudspeakers have been made over time. For Kontakte, Stockhausen placed a loudspeaker on a turntable and recorded the sound of the speaker whilst it was in motion (Maconie, 1990). More recently, Dan Trueman and colleagues developed hemispherical loudspeaker arrays as a

way of simulating, in electronic instruments, the complex acoustic radiation patterns created by acoustic instruments (Trueman, Bahn, & Cook, 2000). These hemispherical loudspeakers also allow electronic musicians to create the same point source localisation when collaborating on stage that would be experienced through localising sounds to specific instruments in an acoustic orchestra. The hemispherical arrays have been used extensively in laptop orchestras and robotic music ensembles. While not necessarily the original intention, the shape of these loudspeakers does allow musicians to conceive of spatial trajectories by creating specific panning patterns throughout the individual cones of the loudspeaker unit.

The spatial elements of hemispherical loudspeakers have been explored in more depth by Gerriet Sharma and colleagues, who have used their icosahedral loudspeaker system as a way of spatialising sound (Sharma, Zotter, & Frank, 2014). This is accomplished through the creation of complex spatial trajectories with the individual cones of the icosahedral loudspeaker as well as by positioning the speaker array in the room in particular ways to allow the composer to manipulate room reflections.

Speaker.motion System Design

speaker.motion is a system of four mechatronic loudspeakers (Johnson, Norris, & Kapur, 2016). Each loudspeaker can rotate in either direction infinitely and can also simultaneously tilt. The *speaker.motion* system includes four identical units that can be used individually or daisy-chained together.



Figure 1. The speaker.motion mechatronic loudspeaker

Each unit features a Genelec 8010A loudspeaker mounted in a purpose-built mechanical structure. The loudspeaker itself is mounted inside a gimbal-like cage structure that gives the loudspeaker the desired azimuth and elevation control. A miniature servomechanism mounted on one side of the cage drives the loudspeaker's tilt, and a stepper motor drives the rotation of the entire cage. By rotating the full cage structure, *speaker.motion* is able to adjust both the tilt and the rotation simultaneously. Where possible, the moving parts are all mounted inside the enclosure underneath the cage. This design helps with structural stability, protection of the mechanical parts, and safety concerns by limiting access to moving parts. The design also contributes to the visual aesthetic component of the system that draws attention to the loudspeaker itself as the gesturally active object.

Compositional Approaches

The unique qualities of the speaker.motion system allows composers to interact with space in new ways. To fully explore the spatial potential of the system a range of new compositions were developed with not only cite specificity in mind but also instrument/loudspeaker specificity. The creation of these works involved an adjustment of the compositional process to better incorporate the instruments novel capabilities. This new process and the resultant works are discussed in the subsections below. The observations about the spatial affects in the following compositions were made through the author's observations and personal listening experience. Due to the unique spatialisation techniques utilized in the pieces, audience members at varying physical locations throughout the performance venues would have experienced these spatial effects differently.

Music for Mechatronic Speakers

The piece is composed entirely of mechanical sounds made by the speaker.motion units. Any recorded audio consists of recordings of the speaker.motion mechanisms. The main technique deployed in developing the audio element of the piece was an Alvin Lucier-inspired re-recording process. The relationship between the speaker.motion system and the sonic material was evident and iterative from the beginning of the compositional process. This differs to the traditional approach to composition of electroacoustic music which would usually involve first the composition of the sonic material, and then the inclusion of spatialisation techniques and processing for cite specific and system specific aspects of the composition.

In *Music for Mechatronic Speakers* the speaker.motion unit's spatial movements were first composed and then, as the speaker.motion unit played through these movements, the mechanical sounds resulting from the physical movements were recorded. This recording makes up Audio Track One. Audio Track Two comprises of a recording of Audio Track One's audio played back through the loud-speaker while the unit is in motion. Due to this process of recording the audio emanating from a spinning loudspeaker, the audio levels fade in and out as the loudspeaker spins closer to the microphone. This creates the dynamic pulse that is evident throughout much of the piece. The pulse creates a natural flow to the drone textures produced by the motor's mechanical noises being layered on top of each other.

Audio Track Three continues this process, working through third and fourth layer abstractions of the audio recordings. The only manipulation in any of the audio tracks is in Track Two (where a slight edit has been made to the section of silence 5 minutes into the piece). A recording of the servo has been cut and moved slightly forward so that the listener hears the movements of the servo just before they see the servo move. This gives the impression that the mechanics are responding to the audio, and further emphasizes the lack of distinction between the mechanical sounds and recorded audio.

The piece, which is outlined in Figure 3 begins with only the front two loudspeakers ramping up their speeds to quickly move through a number of pitches sounded by the motor itself to create a melodic line. The audio heard at this stage is the mechanical noise of the system performing the composed movements: no audio is played through the loudspeakers themselves at this point. The speaker.motion units then continue their rotation at a slow rate, with one loudspeaker slightly faster than the other to create a denser harmonic spectrum by the variation in pitch produced by the differing motor speeds. At one minute into the piece, the third and fourth speaker.motion units also begin to slowly rotate, adding further density to the drone being created at this stage by all four mechanical systems.

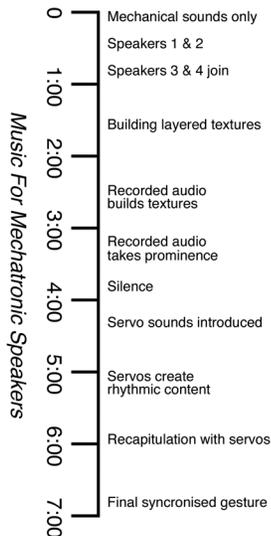


Figure 3. Spatial Structure for Music for Mechatronic Speakers

The physical movement of the loudspeakers implies movement in the timbre of the drone created, and thus is perceived as a subtle pulsing to the drone. At around 1.30, the first hint of any audio being played through the loud-speakers is introduced this is the first shift away from mechanised space. This aims to build the timbral density for just a few seconds and quickly fades back out. At around two minutes into the composition, the recorded audio fades back in, now coming through both front loud-speakers at a louder volume with additional layers on top of each motor that sound as the loudspeakers slowly change their speeds of rotation to continue the melodic change. Though this shift in and out of the mechanised space is present, mechanised space is implied throughout the entire piece as all recordings come from the mechanical elements of the system in their origin. The unique mechanical properties of the speaker.motion system afford this relationship between actual mechanised space and implied mechanised space to be explored throughout the composition.

The mechanical sounds of the *speaker.motion* system were at first considered 'noise' (an unwanted sound). However many composers have chosen to extend and explore this element of the *speaker.motion* system. The fact that the mechanical sounds are created through physical motion (the moving of mechanical parts) gives an ability to infer such motion in any sonic material that occurs at the same time. The MIDI implementation allows such motions to be synchronised with specific sonic material of the composers choosing to explore relationships between the space and motion that is bonded with the sonic material of the piece, and that which is inferred by the physical motion of not only the loudspeaker, but the motor and servo as well. These relationships between mechanised space and implied mechanised space created new ways to explore and manipulate the perceived source and space bonding of the sounding object given that the sounding object was not always clear, and was often implied through a mechanised space, as much as it was through both physical motion (of the loudspeaker) and spatial motion (of the trajectory).

A video and recording of Music For Mechatronic Speakers is available here: <http://bridgetdjohnson.com/speaker-motion>

Snow All Around

Snow All Around (outlined in Figure 4) was the piece

written by the author for the speaker.motions concert. The compositional process in some ways, followed a more traditional compositional approach, however there was still consideration of the reflective aspects of the performance space and the ability for speaker.motion to project sounds at varying vertical angles. This particularly influenced the development of the rhythmic material in the piece. The rhythmic material was developed in a way that would allow the reflections of the space to varying the intonations of the phrasing, and at times where the speaker.motion system was Snow All Around used an acoustic guitar as the original sound source and digital signal processing to create rhythmic and timbral effects on the piece. The piece used minimal spectral processing to use the room itself as the main signal processor. Reversed guitar strikes were used to create evolving gestural content that resulted in a drone-like effect. The layers of varying drones were created to bring out room resonances of the space and to use the long reverberant nature of the space to add depth to the composition. The introduction of the piece evolves over two minutes. The first major structural change in the piece comes from the introduction of more rhythmic material at two-and-a-half minutes.

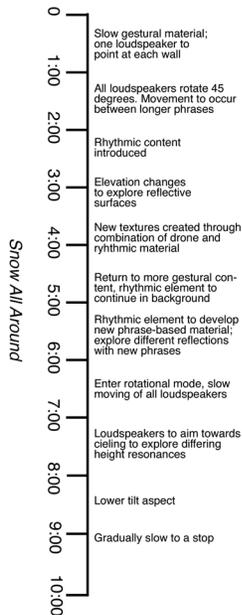


Figure 4. Spatial structure for Snow All Around

This rhythmic material bounced off the walls of the

space in different ways depending on the directionality of the loudspeakers, drawing attention to the reflective nature of the space. From the upper floor of the gallery, the rhythmic material was so spatially processed that it merged with the more drone-like material to create layers of gestural content. From the lower levels, the more distinct rhythmic events held their character separate to the drone sounds beneath them. The same audio files played from all four speaker.motion units. The motions of the loudspeakers were subtle and directional rather than programmed for more dynamic motion. Each of the loudspeakers was in positional mode until six minutes and forty seconds into the piece. Throughout this first half of the piece, each loudspeaker had only moved on its horizontal rotational angle four times, each time pointing to a new wall in the space. Such pointing to different walls was intended to allow sufficient time for the acoustic properties of each surface to be explored through varying acoustic material. The vertical tilt parameter was also uniform across all four speaker.motion units, with the loudspeakers largely pointing in variations of upward directions. The aim of this was to explore the variations in the height of the room with the varied acoustic material.

In the second part of the piece, all four speaker.motion units slowly spun in the same direction. This action was taken for further exploration of the acoustics in a more dynamic way. The speed was kept slow so that as differences in the acoustics emerged through the change in loud-speaker directionalities, there was time for these to be explored and the differences between them to be observed.



Figure 5. Performance environment for Snow All Around. The speaker.motion units can be seen in front of the audience

Composers Comments

Six composers of electronic music completed the user study, each of whom had performed with the speaker.motion system. The composers all came from a back-ground in electroacoustic composition and had all performed with other custom-built instruments before. After performing with speaker.motion, the composers completed a user study that asked a range of questions about how they utilized the system and the aesthetic considerations they made both spatially and through their wider compositions. They were also asked questions about their experience as audience members participating in concerts utilizing speaker.motion. The user study was conducted with ethics approval from Victoria University Human Ethics Committee. The user study was conducted in the week following the public performance of new works for speaker.motion and participants responses were anonymous. A total of six composer participated in the concert all of whom had written and performed site-specific pieces for the speaker.motion system.

The response from the user study was positive. All of the composers felt that speaker.motion had changed the way they that thought about space in their compositions and that, having used the speaker.motion system, a heightened level of spatial engagement would now continue in their future compositions. Selected composer statements in response to questions about this area include:

Spatial elements have been a strong element in my compositional process, but what speaker.motion affords is a more complex, dynamic and controllable interaction and intention within the spatial parameters of ideas.

Even without speaker.motion, I feel that I have now been made more aware of the great potential afforded by using non-traditional speaker configurations.

It is possible that the physicality and visual phenomenon of seeing the loudspeaker actually rotate helps to draw attention to the spatial elements of a piece and their compositional intent. These comments suggest that having deepened their spatial awareness through their use of the speaker.motion system, the composers will now continue to think about the spatial aspects of their music in that depth, even when they are not using the speaker.motion system.

All of the composers felt that there were aspects of their piece that they would not have been able to achieve with-out the speaker.motion system. All of the study

participants also described ways in which they used the speaker.motion system to engage with the physical space in which they performed, which validates a key design goal of the system. Some composer comments related to this include:

I was able to aim the speakers specifically at the various reflective surfaces in the space. I also found that, by aiming at the more absorbent audience, I could affect timbral change.

By having two symmetrical pairs of rotating speaker, which rotated in different phases, some very interesting phasing effects were created (with the same source sent to each pair).

Five out of six composers also felt that the speaker.motion system drew their attention to spatial attributes as a listener or audience member.

The way composers used space as a compositional tool was much more evident then traditional speaker setups.

The visual coupling led me to consider their use of space more than with a traditional loudspeaker array.

The speakers were brought to life as a very important aspect of the composition, so was the space itself.

When given an opportunity to suggest changes to the system, all of the composers felt that they would like to see the system explored with larger loudspeakers; this is an avenue that will be explored in subsequent iterations. Many composers also suggested that they would like to see further dampening of the mechanical sounds created by the system, another aspect that is intended to be addressed in future versions of the system.

Conclusions

The design of the speaker.motion system was driven by a compositional desire to be able to constantly change a loudspeaker's direction. The intuitive nature of this system was an integral part of ensuring that new spatial aesthetics were not only available to the researcher but also to other composers and artists. *speaker.motion* affords new approaches to spatial composition and performance through its intuitive and novel approach to spatial engagement.

The *speaker.motion* system has now been used by a number of composers in concerts at different physical locations, many of which were described in this chapter. The ability to dynamically adjust the directionality

of the loud-speakers has afforded the composers a new range of ways to interact and engage with the physical space of the concert venue. The physicality of the moving loudspeaker has also proven popular from the audience's perspective. The spinning gestures of the moving loudspeaker can at times appear to be choreographed in a more dance-like fashion, and the character that becomes the loudspeaker has incited a great level of curiosity from the audience members. While variation in spatial attributes may be achieved through synthesizing variation in filter frequency and amplitude within any concert hall, the physical motions of *speaker.motion* effectively make the room itself both a signal processor and an expressive instrument.

Throughout this research a range of experienced electronic musicians used the new *speaker.motion* loudspeaker system. In the user study conducted, a majority of users felt that the system afforded new ways to interact spatially in performance. So far, only a relatively small number of pieces have been written for the system, meaning that there is still a great deal of room for composers to write new musical works that use the *speaker.motion* system and to explore how the directionality of a loudspeaker might be used for aesthetic purposes. Future work exploring compositional approaches with the *speaker.motion* system includes further user studies that explore not only the specific use of the system but the ways in which the use of such a novel system might impact the compositional process.

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Author Biography

Bridget Johnson is a sound artist and composer whose work crosses many platforms and mediums. Her main focus is designing new intuitive interfaces for musical expression, and this often manifests in the design of custom-built music performance hardware and software. She is a Senior Lecturer and the Major Coordinator of Music Technology in the School of Music and Creative Media in the College of Creative Arts at Massey University in Wellington.

Extending/Appending The Perceptual Apparatus: A History of Wearable Technology in Art

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Abstract

Our understanding of how we perceive the world, and our ability to manipulate it, has become increasingly mediated by technology. As this technology progresses, the possibilities for a closer coupling between technology and our sensing faculties is possible, blurring the line between body and technology. This paper explores the history of the relationship between wearable technology and our perceptual apparatus. It spans from the invention of the lens through to the current exploration of embedded technology, which allows for the manipulation of the perceptual apparatus itself. This paper discusses the various ways in which the relationship between our perceptual apparatus and forms of wearable technology has been developed and explored in the arts. It then uses this framework to speculate on new works, and describes two new works by the author: *Your Hearing Them*, and *Your Localisation Exposed*.

Keywords

Wearable Technology Artworks, Perception, History of Art, Bio-hacking, Sense Substitution, Artistic Framework.

Introduction

The intersection of art, body, and technology has produced a range of mind-bending, perception-altering experiential art works. The history of this coupling between technology and body has two simultaneous streams: innovations driven by medical needs, and technology explored through art. Through this coupling, sight can be fixed, hearing restored, and now with more active and advanced technologies, senses can be crossed. This can allow for a blind person to hear what others see. The other stream has been driven by a range of forces. Explorations of the ontology of this coupling between body and technology, the repercussions of how we think about our body, and how our perception filters our experience of the world. This stream is the domain of art, in which artists have created new forms of technology to create experiences that speculate and examine the ways in which we perceive the world. They

append and extend our perceptual apparatus, mediating our experience of the world.

This paper will focus on the intersection of art, perception, and technology. Specifically, the paper will focus on those wearable artworks, which explore couplings in which technology mediates our experience of the world by being a medium positioned between ourselves and the world. This is derived from Don Ihde's conception of embodiment relations between the body and technology (Ihde, 1990). The intent is twofold. Firstly, through ordering and explicating a history of the exploration of this coupling, this paper seeks to provide an overview of the different forms that have been manifested through this intersection. This is intended to both connect implicit themes in previous art-works, as well as provide a framework for new works. To this intent, the paper will then move to discuss two new works by the author that have been strongly informed by this framework: *Your Hearing Them* and *Your Localisation Exposed*.

The paper is divided into categories, which are all continuums. These distinctions have been made to group works and ideas together; however, they aren't intended to be exhaustive of all possible manifestations of this coupling. We start with the first examples of perception altering technology, showing how these innovations were developed as perceptual correctors. This will lead into those technologies that seek to amplify our current perceptual abilities through allowing us to experience things beyond the limitations of our perceptual horizon. Following this, those artworks that provide a translation of experience through altering and augmenting the organization of our perceptual apparatus are investigated. This rearrangement is then pushed further in the Cross-Sense and Biohacking category. These couplings start to blur the line between body and technology, and start to question what the repercussions are when this relationship becomes increasingly close. Some examples will be given of each of these cate-

gories, with most attention given to those works, which were directly influential to the author's two new works,

Your Hearing Them, and *Your Localisation Exposed*, which will finally be discussed. This paper, then, explores a number of categories through which the intersection of art, technology, and our perception has been explored, and presents two new artworks which have been informed by them.

Perceptual Correctors

The following section will outline the development of wearable technology created for the correction of deficiencies in our perception. Although these lie outside of the field of art, they are heavily influential to the development of the field of wearable technology in art. Not only did they create new forms of technology that would later be used in artworks, they also formulated the idea of perceptual alterers through coupling our senses with technology.

The starting point for these wearable technologies can be traced back to the invention of the lens. Anthropologists George Sines and Yannis A. Sakellarakis's research indicates that the use of lenses was widespread throughout the Middle East and the Mediterranean basin over several millennia (Sines & Sakellarakis, 1987). With a very pragmatic perceptual purpose, these lenses were sometimes used as magnifying glasses to authenticate seal impressions. However, the lens wasn't incorporated into a wearable design until the invention of the eyeglasses, which required a semi-permanent coupling of the technology and eye. The eyeglasses were invented as a corrective tool, allowing for a malfunctioning visual sense to be repaired. As the technology for corrective lenses developed, a closer and more embedded coupling was invented in contact lenses. This progression of the relationship between technology and the body becoming increasingly embedded is at the heart of the transhumanism movement, provoking a range of artworks in the Bio-hacking and Cross-Sense category presented below.

This use of technology as a corrector is not limited to our visual sense, with deafness also being aided by technology. Early hearing aids were ear trumpets, hearing fans, and conversation tubes, developed in 1800 (Mills, 2011). In a similar design to the magnifying lens, ear trumpets were first used as passive amplifiers of the stimulus to help people who were hard of hearing. Their tubular shape funnels and amplifies sound waves. The

end of the tube is pushed up against the ear, which, allows for better transmission of sound energy to the eardrum.

The history of the development of hearing aids is similar to the evolution of vision aids, as the coupling between perceptual apparatus and technology has become more embedded. However, one large difference is the adoption of digital electronics in modern hearing aids. The current technology transforms the hearing aid from a simple amplifier to a device that is capable of signal processing for speech enhancement, noise-reduction, and feedback cancellation (Levitt, 2007). This allows for a dynamic relationship between signal and stimulus, automatically adjusting its filtration and amplification of sound depending on the environment.

Although these technologies were developed for medical, non-artistic purposes, these innovations and affordances have subsequently been utilised for many artworks, discussed below.

Sense Amplifiers and Extenders



Figure 1. PHOX Ears - Rebecca Kleinberger

There are a range of wearable artworks that seek to provide a heightened experience of our everyday environment through amplifying and filtering our perception. These works are related to other technological perceptual enhancers including magnifiers, microscopes, telescopes, and microphones. Their main departure is in their wearable nature, which allows them to be a tool or filter to explore the world through.

PHOX Ears (2015), by Rebecca Kleinberger, changes the way we interact with our sonic environment. The wearable technology consists of a pair of head-mounted, independently articulated parabolic microphones that allow the wearer to sharply direct their aural attention to far away sound sources. This wearable technology

mediates our experience of the world through changing the shape of the wearer's auditory field. Usually, we hear sound from all directions, creating an auditory field that is shaped as an omnidirectional sphere. What *PHOX Ears* allows for is an interactive negotiation of this auditory field, allowing the wearer to actively filter out areas, and amplify points at will.

This filtration of our auditory field is also present in *Eidos* (2012), a sensory augmentation technology artwork that offers the wearer the ability to enhance and control their senses in real time. Where *PHOX Ears* is intended to be an open interactive tool for negotiating the auditory field, *Eidos* has a more specific enhancement in mind. The auditory enhancement is a technological amplified version of the cocktail effect (Cherry, 1953). Through auditory attention alone, we are able to filter out parts of the auditory field to focus in, and make sense of, one particular element. This happens in busy social settings like cocktail parties to follow one person's voice against background chatter, however, in more dense settings this can be impossible. *Eidos Audio* extends this effect by using a directional microphone that allows the user to isolate a person's voice, and then amplifies this sound to a bone transducer and headphone set.



Figure 2. *Eidos Audio* - Tim Bouckley et al.

Eidos Vision takes on a different element of our experience, by compositing our temporal experience of motion. Similar to the effect that long exposure photography creates, the headset can detect motion and track the subject, showing how it moves over time. This is an example of an augmented reality technology that is heavily informed by attempting to enhance how we perceive the world.

These works afford the wearer a finer degree of autonomy over their senses through allowing them to intentionally amplify and focus on an area of their world.

This coupling has the potential to not only allow the wearer to have more control over what parts of their environment they experience, but to also experience things outside of their limited perceptual horizons.

Perspective Changers

The following artworks are wearable technologies that allow for an interface between our perceptual apparatus and another form. They all share similarities through offering the wearer a change of perspective. In the case of James Auger and Jimmy Loizeau's *Social Tele-presence* (2001), and Takehito Etani's *Third Eye Project* (2002), this change is a translation in space of the wearer's point of perspective. Other works seek to offer the wearers another person's, or in some cases, another animal's, experience. Lastly, a range of works that rearrange the organisation of the wearer's senses are described. These works offer the wearer a new medium to experience the world through.

Perspective Movers

Telepresence is the use of virtual reality technology to allow someone to transport their senses to another location. This translation of origin effectively removes the perceptual apparatus from the body's location, and translates another environment to it. While this technology is heavily used now in commercial applications like telepresence videoconferencing, early explorations of the idea can be found in the arts, with James Auger and Jimmy Loizeau's *Social Tele-presence*.



Figure 3. *Social Tele-presence* - James Auger and Jimmy Loizeau's

The work consists of two parts. A camera and binaural microphone is mounted on a controllable platform that can rotate through three dimensions. This is connected to a headset that has a pair of TV glasses, speakers, and a gyroscope to track the wearer's head movement. The

head movements of the user are monitored and translated directly to the remote camera in real time so that they can control the directionality of their transported perceptual field, while the camera and microphone stream the audio and visual perspective from the surrogate body. The authors speculated on different uses for this technology, including a rent-a-body service, where the wearer could rent the physical body of another person, and direct them around so they see and hear a place without having to physically be there.

Where *Social Tele-presence* transports the wearer's point of perspective to a new remote location, Takehito Etani has developed a work, which gives a new perspective of the self, through *The Third Eye Project*. It questions conceptions of objective and subjective perspectives of body through moving the wearer's visual point of perspective to a third-person view. This allows for a re-contextualisation of the wearers relationship of themselves to their environment, blurring the distinction of the self and the outer world.



Figure 4. *The Third Eye Project* - Takehito Etani

Translators of Experience

Works that seek to translate experience aren't limited to other people's perspectives, with many being influenced by the physiology and experience of other animals. Haus-Rucker-Co's were influential pioneers of creating a range of perception-altering architectural pods and headgears, as part of their 'Mind Altering Program'. *Flyhead* (1968) is a transparent bulbous green helmet that filters the aural and visual senses of the wearer. It fractures the visual stimulus into a multi-image vista, by using a split prism in front of the eyes. The differences between our perception of another animal's perceptual

faculties is used as a metaphor for creating an experience for the wearer, seeking an evocation rather than an direct duplication.

A series of works by artists Chris Woebken and Kenichi Okada's entitled *Animal Superpowers* (2008) explores similar themes through a range of methods. The *Ant Apparatus* seeks to offer the perspective of being a minute bug, exploring the relatively large blades of grass in a field. The technology consists of a headset with virtual reality goggles, and gloves that have embedded microscopes. The apparatus allows the wearer to see the world at the scale that an ant does, magnifying their vision to 50 times its original size, and translating their point of view down to a low level.

The *Bird Device* focuses on the perceptual abilities that other animals have that surpass the limits of our own senses. This is related to the 'Sense Amplifier and Extender' category, as it presents the wearer with an experience that lies outside the normal limitations of our perception. Inspired by the ability of birds to detect the orientation of geomagnetic fields for navigation, the wearable headband can detect direction through GPS, the wearer is led in a path by vibration feedback when they're on the right track. In this case, the experience of the bird is used as a metaphor for designing the experience of the wearers, as it is heavily limited to an approximation of the bird's experience.



Figure 5. *Ant Apparatus* - Chris Woebken and Kenichi Okada

Lastly, *Giraffe Device* focuses more on the wearer's perception of themselves, through the physiology and metaphor of a giraffe. The artists describe it as a child-to-adult converter, raising the height of perception through a periscope extension, and lowering the voice of the wearer to make them feel like they're older. This idea

of offering the wearer the experience that others have of themselves is shared with the author's work, *Your Hearing Them*, presented at the end of this paper.

Animal Superpowers is one of many works that are informed by the perceptual apparatus of various animals. Heavily influenced by Michael Land's comprehensive account of all known types of animal eyes, (Land, 2002) Clearly Connolly and Neil McKenzie's developed a range of *Metaperceptual Helmets* (2014). These works include *Hammerhead*, *Chameleon*, *Horsehead*, and *Giraffe*, and aim to translate the optical mechanism of these animals onto the wearer's visual sense. Each helmet changes the perception of the wearer in a different way. *Hammerhead* changes depth perception by widening the interpupillary distance. *Chameleon* allows for one eye to face forward, while the other faces behind. *Horsehead* widens the wearer's peripheral vision to 350°. Lastly, *Giraffe* elevates the height of the viewer's perspective. Through modeling these passive perceptual filters on other animals' physiology, the wearer becomes aware of the differences between how we see the world, and how other animals do, allowing for a meditation on how this colours our experience of seeing the world. These works are exemplars of Don Ihde's concept of embodiment relations, as they are clear mediums to experience the world through.

The authors have speculated on future helmets, which they have described as Para-perceptual (2015), and Exo-perceptual (2015). Through moving away from the zoological topologies that informed the metaperceptual helmets, these new works explore new forms of optical constructions, which are not based on natural arrangements. *Cross-Eyed* skews the direction of each eye outwards, and *Cyclops* explores binocular rivalry, with a large central eye in front, and a smaller eye focused downwards.



Figure 6. *Chameleon* - Clearly Connolly and Neil McKenzie

Perceptual Re-arrangers



Figure 7. *Upside Down Glasses* - Carsten Höller

The move away from zoological organisation of the senses opens up new mediums for experiencing the world through. These perceptual rearranges may not have a functional intent, however, by confronting the wearer with new structures of experience, elements of their normal modes of experiencing are revealed. Carsten Höller explores non-natural arrangements of our visual perception, through his *Upside Down Glasses* (2001). This is an extension of the neural adaptation experiments of George M. Stratton, who devised a set of glasses that could invert both vertical and horizontal visual field of the wearer. *Upside Down Glasses* horizontally inverts the visual field of the wearer, and allows the wearer to explore the rest of his exhibition through this new arrangement.

In a similar vein, Alfons Schilling *Vision Machines* (*Sehmaschinen*) confront the wearer with completely

new organisational structures of their visual perceptions. This range of wearable visual alterers were influenced by Schilling's war against the 'tyranny of Cyclopic sight', with these works attempting to break out of our normal modes of seeing the world. The most emblematic of his antithetical intent are his works *Kleines Rad* (1978) and *Antelope* (1984). *Kleines Rad* inverts left and right, and front and back, creating a disorienting experience where the wearer can move through the world only through seeing what they've left behind. *Antelope* intensifies this idea by making far things now near on top of the previous inversions. Similar to the *Meteperceptual Helmets*, these works are informed by the optical physiology of other animals, however, it's intent is more grounded on a meditation of the limitations of our own visual senses.

This idea of inverting the perceptual field of the wearer is explored in a different modality in the author's work *Your Localisation Exposed*. The auditory field is inverted through effectively swapping the ears: making left and right reverse.

This category of works all explore how we experience the world through changing our point of perspective or modifying the organisation of our perceptual faculties. With the use of technology, it's now also possible to change the modalities of our senses, transferring one stimulus into another mode of sensing.

Cross-Sense and Biohacking

The 'Cross-Sense and Biohacking' category feature couplings between the body and technology that become increasingly embedded. The line between body and technology becomes blurred, and questions of identity are provoked. The category is heavily related to the transhumanist movement, which studies the potential of emerging technologies that could be used to overcome fundamental human limitations.

This category is divided into two sections: Sensory Substitution, and Biohacking. The two sub-categories are not mutually exclusive, as it is possible for some technology to be both. Sensory Substitution focuses on technology that facilitates a modality change of our sensory experience. One sense can be converted into a stimulus that another sense can interpret. Biohacking is an emerging transhumanist movement, which includes modifying the body with technology. This can include using technology to modify how we experience the world.

Sensory Substitution

Sensory substitution has become an emerging field in neuroscience since initial experiments by Paul Bach-y-Rita in the 1960's. Driven by research into the plasticity of the brain, Paul Bach-y-Rita's research investigated the possibility of the brain being sufficiently plastic to develop an entirely new sensory system. Through this research, the first sensory substitution system was developed as a practical aid for the blind, which substituted visual stimulus for tactile stimulus. The user sits in a chair, which has a camera in front of it. The visual feed from the camera is translated to a bank of 400 small vibrators that are connected to the back of the user. The pattern of vibration from this modality translation device allowed the person to detect faces and objects successfully (Bach-y-Rita, 1969, 2004).

Since Bach-y-Rita's initial research into sensory substitution techniques, a whole research field has emerged which has systematically approached this crossing of modality. A full overview is outside the scope of this paper, (for a detailed discussion see Hatwell, 2013) however, some recent developments include Bach-y-Rita's *Brain-port* (Bach-y-Rita, 2005), which gives vision through the tongue. Using glasses with an embedded video camera and a small tongue pad that hosts an array of 400 microelectrodes, *Brainport* can encode visual stimuli into electric current that can be interpreted as visual information by the brain. Users report the sensation as pictures being painted on the tongue with tiny bubbles. In another function, it can also aid the vestibular system. By using accelerometer data from the glasses, the wearable technology measures the tilt of the head, and stimulates the tongue to help the wearer re-balance themselves (Danilov, 2005).

Concurrent to the innovations of Bach-y-Rita, Dutch physicist Peter Meijer was also developing sensory substitution devices with the *vOICE* vision technology (Meijer, 1992). Designed for people who are totally blind, the *vOICE* converts a live camera feed into sound. Images are converted into sound by scanning them from left to right while associating elevation with pitch and brightness with loudness. This is an exemplar of how our senses can be translated to a new modality, with vision being traded for hearing.

The exploration of sensory substitution in art is still in its infancy. There may be multiple reasons for this. The technology itself is still developing, however, it is becoming increasingly accessible for artists who

lack in-depth technical training. The coupling between the body and technology is often quite invasive, with many examples including a large array of electrodes coming into contact with the body's nervous system. The invasiveness may be a deterrent for a wearable technology artwork, which is intended to be used by a range of people. However, there are some examples in which less invasive technological couplings have been explored.

XSense (2005), created by Adam Danielsson, is an interactive helmet that crosses sight and hearing. Sounds are translated into colour through an array of 64 LED's. The visual stimulus is turned into distance information, which is then translated into stereo sound within the helmet. The helmet is much less invasive than many other sensory substitution methods, however, it is not intended to be a permanent aid. Instead, the helmet can be worn for a short period of time, asking the wearer to re-negotiate their navigation of their environment.

Biohacking

Other artists have embraced the invasiveness of some sensory substitution methods, and have questioned the repercussions for the identity of the self when this coupling between technology and body becomes so intimate. Neil Harbisson is a recognized avant-garde artist and cyborg. He was born with achromatopsia - an extreme form of colour-blindness that means that he only sees in greyscale. This inability to see colour was a part of his desire to augment his visual experience of the world, and, in 2004, he implanted an antenna in his skull. Originally, Harbisson collaborated with Adam Montandon to create, *Eyeborg*, a wearable technology, which consisted of headphones, a laptop and a camera (Jeffries, 2014). Eventually, this coupling became much more embedded by implanting the speaker itself in his skull, and by having the camera attached to be a permanent appendage. *Eyeborg* allows for Harbisson to hear colour, translating the colour data from the camera to a sound transducer that vibrates his skull, allowing him to hear via bone conduction. Harbisson uses this technological mediation of the world as the basis of many other art works in a range of media. Colour concerts, sound portraits, colour scores, city colours: all these projects are informed and mediated through the *Eyeborg*.

Harbisson's adoption of this embedded technology, and his identification as a cyborg, is closely related to the

ethos of the biohacking field. Whether these couplings still belong to Don Ihde's conception of embodiment relations is somewhat ambiguous, as biohacking has the ability to not just be a medium to experience through, but to approach the ability of modifying the perceptual apparatus itself. The field itself ranges further than just altering perception, with many couplings providing biometric data of the body, or augmenting their experience with informatics.

Tim Cannon was one of the first to implant an electronic sensing system that can provide biometric data of his body. The system wirelessly sends his body temperature and blood pressure to a computer, giving him real-time updates about the status of his body dynamics (Wainwright, 2015). Although this can be done through much less invasive means, part of the impetus for this project is start a dialogue of what could be possible through biohacking.

The Cross-Sense and Biohacking ethos provokes many questions about the relationship between the body and technology, what can be possible with this coupling, and what repercussions these relationships have for defining the self. The possibilities for new artworks, which use these embedded technologies to alter the perceptual apparatus, have yet to be thoroughly explored. With the technology becoming more accessible to artists, and smaller and safer to integrate with the body, this could a fruitful field.

New Works

This history of wearable technologies that mediate our experience of the world can be used as a framework for new works. As with most studies that focus on perception, the field is dominated by works that explore the visual sense. Some works included in this history focus on our experience of sound including *Phox Ears*, and *Eidos Audio*, however this is a largely under-explored field that has the potential for interesting new works.

This has informed the creation of two new sound-art works that use technology to append and extend the perceptual apparatus of the wearer. Both works fit in the 'Perspective Changers' category. *Your Hearing Them* is informed by both the 'Translators of Experience' works that seek to offer the wearer someone else's perspective of themselves, as well as, the 'Perspective Movers', which translates the wearer's point of perspective to a new location in space. Alternatively, *Your Localisation Exposed* explores the rearrangement of the perceptual

apparatus, forcing the user to renegotiate their aural awareness, and revealing their normal modes of localising sound.

Your Hearing Them



Figure 8. *Your Hearing Them*

Your Hearing Them explores the deeply personal experience of one's own voice, through allowing others to experience it as you do. When someone speaks, they hear the sound of their voice as it reflects off the surfaces of the room and then returns to their ears. Additionally, the skull of the speaker is resonated by the vibration of the vocal folds, creating a full-bodied sound with much low frequency content, as well as the embodied experience of the skull vibrating. This additional element causes the speaker to hear their voice differently than how others do, and is the cause of the 'foreign' sound of our recorded and played back voice when heard by the speaker.

A duplicate pair of wearable technology headsets enable two people to have an augmented conversation. Through appending the perceptual apparatus with the wearable technology, the bone transducers are able to reintroduce the speaker's extra layer of experience. This allows for a conversation to be had where two participants experience each other's voice the way the speaker hears themselves - creating a powerful transportation of subjectivity and experience.

Your Hearing Them shares themes with the 'Perspective Movers' sub-category, as it translates the wearer's point of perspective. The work has a very specific perspective that it translates, and similar to Takehito Etani's *The Third Eye Project*, offers a new perspective of the self. The 'Translators of Experience'

themes are also explored, as the work seeks to give the wearer the experience of their conversation partner.

Your Localisation Exposed

Your Localisation Exposed is a perceptual rearranger. The work is informed by the inversion of perception that Carsten Höller's *Upside Down Glasses* and Alfons Shilling's *Kleines Rad* both explore, with *Your Localisation Exposed* producing this inversion of perception in the aural domain.

Through a wearable headset that hosts binaural microphones and speakers, *Your Localisation Exposed* inverts left and right in the wearer's auditory field. This effectively rearranges the ears of the wearer, swapping the spatial location of their left and right ears. The user is invited to then go on a soundwalk, and to explore their surrounding with this new re-arrangement of their senses.

Through depriving the wearer of their normal mode of perception, the work re-contextualises our normal mode of hearing, and exposes an element of our hearing that is often sub-conscious. Our evolutionary history has shaped the use of our hearing as a survival mechanism, allowing us to determine the location of other animals and threats by sound. (Heffner and Heffner, 1992) This process is usually subconscious, yet constantly active. Through laterally inverting the auditory field, this localisation process becomes conscious, as the wearer is confronting with a paradoxical sensual world. The visual and aural worlds are in conflict, intensifying the experience of inversion.

Conclusions

The intersection between art, technology, and body is a fertile site for art across different mediums. The power of these works lies in the engagement and interaction with the audience. Their own perception is at the heart of the work, with many new couplings offering the allure of a new experience, or a new perspective on their everyday experience. Through the identification of these categories of works, it's hoped that this framework can connect previous works with shared implicit themes. This shows the ways that different facets of our perceptual apparatus have been explored, and reveals those that haven't. Although this history is not exhaustive, it is representative of the shape of the field. The visual sense is most heavily explored, with sound and touch being secondary. This is an element of

motivation for the new works *Your Hearing Them*, and *Your Localisation Exposed*, as often the nuances of our personal listening experience go unexamined.

This history has been used as the basis for the creation of two new works presented in this paper. It is the hope of the author that this history can be used as a basis for speculations of new works from other artists, and in a range of fields. The ways that biohacking, and the close integration of technology, can alter our perception are starting to be explored. There are still many facets of perception that haven't been explored yet through this framework. Visual works dominate the history, with some sound works included as well. Our other senses could prove to be fertile sites for exploring how technology can augment and extend our experience.

The themes explored in this history could have resonance in other fields as well. The emergence of Virtual Reality (VR) has created a proliferation of innovation in wearable technology. The history presented above has focused on works that use technology to mediate their experience of the physical world. However, as the VR technology develops, it may be possible to virtually create physical environments accurately enough that it becomes convincing to the wearer. The distinction between real and virtual may soften, and the same themes that have been explored in the perceptual alterers discussed above, may provoke interesting new experiences in the virtual realm.

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Corporeal Cinema: Tactility and Proprioception in Participatory Art

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Abstract

In this article I analyse performances, artworks and installations in audiovisual and contemporary art which emphasise tactile and corporeal experiences. This tendency can be observed in technological art, cinema and large visual attractions. I aim to demonstrate that due to technical developments and new tools, the possibilities now exist for new aesthetic experiences in which the body's position and its biological reactions play a decisive role.

Keywords

Spatiality, Tactility, Proprioception, Multi-Screen Environments, Corporeal Cinematic Experiences, Interactive Art, Biofeedback.

Introduction

In this article I analyse performances, artworks and installations in audiovisual and contemporary art which emphasise tactile and corporeal experiences. This tendency can be observed in technological art, cinema and large visual attractions. I aim to demonstrate that due to technical developments and new tools, the possibilities now exist for new aesthetic experiences in which the body's position and its biological reactions play a decisive role.

The Proprioceptive Experience in Art

This leads to the question of how the critical or theoretical point of view of an artwork changes when the spectator's reactions to it are documented and quantified in real time and are changed into source material for the next stage(s) of the artwork. Does this constitute the next step in the research of interactive artworks which were based on the subjective analysis of the participant's reactions? Does it require us to rewrite analyses of artworks which were based on the subjective judgements of the researchers?

The main emphasis in this article is the proprioceptive experience in art. I will start with an analysis of earlier inventions and analogous practices which introduce

corporeal artistic experience. I then investigate whether we can talk about the 'proprioceptive image' in the same way that we can speak about the artistic, musical or literary image. This analysis is influenced by a media archaeological approach, in particular Erkki Huhtamo's interpretation in which his approach is termed "media archaeology as topos study" or simply "topos archaeology." I aim to demonstrate how these "topoi"—"haptic and corporeal experience in audiovisual performances and visual art" or "spatiality, tactility and proprioception in participatory art"—change and "transfigure" those examples in which the corporeal experience is translated into digital data and subsequently used for manipulations of the artwork. Before starting to analyse the works of Jeffrey Shaw, Char Davies and Bill Seaman in the sub-chapter "Proprioception in interactive art", I will provide a series of historical examples which lead to contemporary developments in media art.

The main focus of the text is on changes in the "art world", with an emphasis on fields which could be called media art, new media, electronic art, and contemporary art. To a lesser extent there is also a focus on discussions happening in crossmedia and transmedia—even though some projects are not easy to define, or belong to the fields of both new media and transmedia. This particularly concerns those works of multimedia where the tactile experience on screen is gradually becoming spatial and corporeal. Another topic under analysis is to determine how clear is the tendency to make the audiovisual experience tactile, tangible and physically experienceable, in contrast to the virtual experience.

The goal in presenting these examples is to illustrate the attempts in cinema, theatre, art and research environments to create multi-screen environments that engage the audience, offering them entertainment, information and an explorative experience. The tendency is to make the visual medium tangible and corporeal so that in some examples in interactive art the viewer "puts

his hands” into the artwork.

Proprioception basically means the spatial orientation arising from stimuli within the body itself. This term is used to cover sensorial systems which give information about position, posture, orientation and movement of the body (and its parts) in space. In regard of a proprioceptively perceived artwork we can talk about the situation in which the viewer’s whole body and behaviour is involved in the decisive interaction.

The U.S. National Library of Medicine (2017) defines proprioception as the sense of position: “Sensory functions that transduce stimuli received by proprioceptive receptors in joints, tendons, muscles, and the inner ear into neural impulses to be transmitted to the central nervous system. Proprioception provides sense of stationary positions and movements of one’s body parts, and is important in maintaining kinesthesia and postural balance.” There is a distinction between exteroception and interoception, the former being responses from the five traditional senses which are receptors of information from the outside world including for temperature, vibration and pain. Interoceptors transmit information to the brain about hunger, the need for oxygen, the visceral and bladder condition etc. Proprioception concerns mostly those receptors and systems which are responsible for the movement and position of the body and this is best exemplified by our capability to perceive our body and limb positions in total darkness.

The Expansion of the Cinematic Experience

In the following discussion of multi-screen and physically perceptible environments I will highlight situations, solutions and artworks from the beginning of the so-called television era, as well several experiments that expand the cinematic experience, in which:

1) An “interrelation” occurs between the visual screen content and a “communication” occurs between screens: the visual or auditive content on different screens is transferred from one to another, and a narrative is split between different (two or more) screens;

2) a connection occurs between screen images and stage activity: actors in physical space and screen-space are acting in collaboration or antagonism between each other;

3) viewers are influencing and directing the screen content: screen environments which surround viewers are gradually changed into environments which are

shaped by users/viewers;

4) viewers or actors are “in the image”: viewers or actors are corporeally in the image or influencing it directly;

5) the spectator’s physiology is influencing or directing the screen content: the viewer’s participation in the presentation of images is influenced by their own biological data (such as Heart Rate Variability, HRV; Galvanic Skin Response, GSR etc.) which is used as input data for audiovisual variations.

Analysed Works

Let us now examine a variety of works according to the aforementioned characteristics:

1) An “interrelation” occurs between the visual screen content and a “communication” occurs between screens: the visual or auditive content on different screens is transferred from one to another, and a narrative is split between different (two or more) screens.

Immersive screen environments of this type were popular in the context of World Fairs. **Charles and Ray Eames**, who were known as architects, interior and furniture designers, were also the creators of theatrical and other large scale experiments. One of their most famous projects was the exhibition “Glimpses of the United States” shown in 1959 in Moscow, which was a huge spatial composition comprised of seven 20 x 30 inch screens on which scenes of American life were shown (Figure 1).



Figure 1. Charles and Ray Eames’ “Glimpses of the United States”.
©<http://www.eamesoffice.com/the-work/glimpses-of-the-usa-film/>

A superimposed narrative built a bridge between the USA and Russia by presenting a cross section of life,

starting with the description of a similar sky, common to both countries, and finishing with everyday things of ordinary people—the morning rush, goodbye kisses, entering school buses etc. (Eames 1959). The successful exhibition was visited by three million people and the famous “kitchen debate” (about the merits of socialist and capitalist systems) between Nikita Khrushchev and Richard Nixon took place there and was later aired in the Soviet Union and United States.

This was not the first project by Eames worthy of mention here. “Konditorei” was designed in 1955 after a visit to the München Conditorei Kreuzmann, it depicted the history of bakery through 96 images divided into three screens (Eames 1955). In 1962 they were invited by the U.S. Department of State to create a film/multiscreen presentation entitled “House of Science” for the United States Science Exhibit at the Century 21 World’s Fair in Seattle, Washington (Eames 1962). This was an introduction to five governmental pavilions, each of which was focussed on a different aspect of science. In order to depict the development of disciplines architectural structures were used which gradually became more specialised (Eames 1962). Eames’ subsequent work was an IBM pavilion with an Ovoid theatre designed for the New York World’s Fair, which was a collaboration with Eero Saarinen (Eames 1964- 65). Inside the egg- shape theatre, which housed a field of 22 multi-sized multi-shaped screens, visitors watched the Eames presentation “Think” (Eames 1964).

2) A connection occurs between screen images and stage activity: actors in physical space and screen-space are acting in collaboration or antagonism between each other.

During the 1950s and 1960s multi-screen projections were met with excitement and they later developed into immersive screen-environments. The Czechoslovakian “Laterna Magika” staged during the 1958 World’s Fair in Brussels is worthy of mention, it being described as a new media show and the first multimedia theatre (Figure 2). Director Alfréd Radok and scenographer Josef Svoboda collaborated to create a performance which combined ballet, theatre, film projection and a sound environment.



Figure 2. Czechoslovakia’s “Laterna Magika” at the World’s Fair in Brussels in 1958. ©http://web.uncg.edu/dcl/courses/eyeappeal/u7/u7_3_b.asp.

The activity/performance in the foreground was perfectly synchronised with multi-screen projection in the background to produce the effect of interaction between the two. This gave the impression that the film had come to life and was reacting to the performance (Havránek 2003, p 103). It is possible to find many parallels to such a tendency in the earliest theatrical performances or in hyper realistic *trompel’œil* paintings. Examples from art and film in which characters enter or exit the screen illustrate the same tendency—the movement between reality and artificiality.

There are plenty of related examples in contemporary technical and digital performances, for example Tmema’s (2003) “Messa di Voce” in which actors influence the visuals on the screen. What previously required rehearsal and careful planning (mutual collaboration) is today achieved quite easily with the help of visual sensors and the use of programming.

It seems that this yearning for a mixture of reality and artificiality is quite primal. Humanity has a desire to be fooled by illusions and the ambivalence of the visual world. To be deceived by an illusion whilst also being aware of it creates, as well as disappointment, some kind of enjoyment which evolves from the ability to understand and uncover the underlying fakery.

To illustrate the imaginative movement between screens and reality we may call on examples from visual art. A very famous and often-used story is that

of Pygmalion and Galathea in which the sculptor falls in love with his creation and asks God to transform the artificial being into a living body. Interpretations include paintings by Louis Gauffier 1797, Ernest Normand 1881, Jean-Léon Gérôme 1890 and many others. This myth has also been used to illustrate interactive art, although there are two sides to this phenomenon: reviving the non-living artwork, and permitting the real spectator to enter the artificial environment.

Returning to “Laterna Magika”, it is of interest that the success of the performance in Brussels paved the way for the establishment of a professional theatre in Prague bearing the name “Laterna Magika” which still exists today. This theatre is based on a variety of technical solutions in a contemporary context. It provides an example of how artistic experiments can prove to be the foundation stones of established institutions.

3) Viewers are influencing and directing the screen content: screen environments which surround viewers are gradually changed into environments which are shaped by users/viewers.

The 1967 EXPO in Montreal featured the most important participation film in the history of interactive cinema: Radúz Činčera’s “Kinoautomat” or theatrical cinema, where viewers were able to change the plot direction of the movie by pushing a red or green button on their seat. Historically speaking it is the most important experiment of this type to which researchers are constantly returning (Carpentier 2011, pp 276–308; Hales 2014, pp 150–179). For the purposes of our discussion, the salient point is that viewers were able to participate in decisions about the directions of the cinematic story—this category could in fact contain the majority of interactive art works in which something is happening between the viewer/user and the moving image.

4) Viewers or actors are “in the image”: viewers or actors are corporeally in the image or influencing it directly.

Here we can start with several examples including Tmema’s previously mentioned “Messa di Voce” (2003), most of Paul Sermon’s telematic work (“Telematic Dreaming”, 1992; “Telematic Vision”, 1992 etc.), Myron Krueger’s “responsive environments” from the 1970s, and Dan Graham’s installations using delayed image. Also included would be installations of the 1970s by Bruce Nauman, Peter Campus and Peter Weibel, Jeffrey

Shaw’s “Video Narcissus” (1987) and many others.

Experimentation with screen and performance was evident already in the 1960s which raises the question of whether earlier experiments like “Laterna Magika” influenced later artworks. We can talk rather about a trend which was made possible by technology—for instance, in Robert Whitman’s screen-based performance “Prune Flat” (1965) a woman in white was mimicking the movements of a woman represented on screen. Whitman was arguably the first who brought film projection into sculptural environments with his “Shower” (1964) in which a naked body was projected onto a shower curtain. Whitman mentioned that he was influenced by childhood memories of the clown Emmett Kelly’s performance in which he tried to sweep up a searchlight which would move or get smaller (La Prade 2003). Similar techniques of connecting physical objects with images could be encountered in Tony Oursler’s works from the 1990s up to the present day (Oursler). Also, Nam June Paik in collaboration with Charlotte Moormann realised many versions of a piece in which Moormann was connected to working television monitors or she played the “cello” formed by three television monitors.

The digital performance researcher Steve Dixon (2007, pp. 99–100) discusses the British theatrical group Moving Being which as a multimedia and theatrical collective staged performances in the 60s and 70s in the UK. The group was created as a collaboration between actors, dancers and musicians with the help of film and video. Dixon’s own group Chameleons was devoted to stage performances using screens and projections—the Chameleons multimedia performance research company was created in 1994 at the University of Salford in the UK.

In their 1994 project “Chameleons: The Dark Perversity of Chameleons” five actors in their bedrooms were situated on stage. Televisions in the same room reflected their dreams and hallucinations. Every actor had a system of movements—four physical movements which were repeated and borrowed from each other. The subsequent (1996) project “Chameleons 2 – Theatre in a Movie Screen” featured actors moving between screen and stage—the screen was supplied with windows and doors through which actors could pass. An interactive CD-ROM of the performance was produced which served both as documentation and a meta-analysis of the performance. Even more complicated was the performance “Chameleons 3 – Net Congestion” (2000) in which the audience gave instructions to the actors via

the internet. According to Dixon (at a presentation made at DRHA2015 in Dublin) this attempt was unsuccessful and remained only in the form of an experiment.

The experience of “Chameleons 2” is comparable with the Estonian performance “Estonian Games. The Wedding” at the Von Krahl Theatre which was staged practically at the same time, in 1996 in Tallinn. The screen was used similarly: the screen functioned as a character, co-actor and a surface through which actors and the choir could move. It was touched, opened and closed directly and physically and was equally an object, a mediator of distant reality, and a participant in the narrative. True, we could describe the screen as passive, it did not possess the interactivity that was inherent in the play itself. In the context of these performances the important aspect is that the screen was split and functioned as an object—it was not only a medium and a mediator, but was itself part of the content which gave meaning to the actions taking place on stage.

A discrete categorisation could emerge here which would investigate interactive dance environments in which the goal is to develop specific hardware and software to facilitate the creation of devices (shoes, clothes, etc.) which would permit dancers to influence sounds or the visual environment around them. This category of digital theatre and “cyberformance” would include several groups such as Troika Ranch (Troika Ranch), Dumb Type (Dumb Type) and others (Sparacino, Davenport, Pentland, 2000).

Special attention should be directed to visual environments in which the goal is not only to immerse the viewer in a multisensorial environment, but also to influence the viewer kinesthetically, vibro-acoustically and unconsciously. The goal here is not only to involve the senses in the perceptive act but rather to involve the whole body—since physical reactions are important to the perception of art these reactions themselves could become the artistic goal. An illustration of this is the group Granular Synthesis (the Austrian artistic duo Ulf Langheinrich and Kurt Hentschläger) who created several multiscreen, acoustically marginal and physically challenging environments during the 1990s in which the viewer was surrounded by four (or many more) screens with approximate sizes of 3 x 4 metres showing visuals with low frequency sound that induced physical discomfort. Ryoji Ikeda’s projects “Supersymmetry” (2015), “The Planck Universe [micro]” (2013), and “Test Pattern [n°5]” (2013) are also worthy of note.

These projects truly challenge the viewer’s perceptive ability and physical tolerance.

One contemporary direction lies with virtual environments such as the CAVE or VR-Cube in which the viewer is surrounded by stereoscopic images which give a feeling of immersion. Examples such as this shift the notion of multi-screen environments to the extreme. This is particularly true of the six-sided CAVE (VR-Cube) at the Royal Institute of Technology in Stockholm. Here the viewer is surrounded by six walls, covering 360 degrees, one of them being the floor. The environment is used for design and technology research but also for a few artistic and architectural projects. The impressions produced are so powerful that audiences in the cube grab each other’s clothes to keep their balance whilst “flying” over architectural representations—it is well known that in order to maintain balance we need adequate visual feedback from the environment around us.

In terms of physical image-environments there is a long history of conceptual, entertainment and research activity aimed at inventing spaces with the ultimate immersive potentiality. My interest lies in observing those artworks and their contextual elements which are based on tactile and proprioceptive interaction. With regard to corporeal feed-back effecting changes connected with the presentation of content, an example is Orit Kruglanski’s (2000) poetic and interactive multimedia project “As Much as You Love Me” which deals with the issue of guilt. As an additional physical interface, a so-called *force-feedback mouse* is placed on a steel plate and on screen *non-apologies* are displayed encrypted as symbols which are accompanied by the words “don’t forgive me” etc. To hear the text the user must gather symbols which resemble bugs. Each collected symbol makes the mouse feel “heavier” (technically this is realised with electromagnets attached to the mouse) and in consequence, the more the user collects non-apologies and guilt, the more the mouse sticks to the surface, and the more heavier becomes the burden of guilt. By moving the mouse into the circular *denial zone* the user succeeds in freeing themselves from “guilt” and the mouse becomes lighter and returns to normal. Upon exiting the denial zone the bugs—the guilt—gather on the mouse cursor which turns heavy and “sticks” to the surface (Kruglanski 2000). In this way the user experiences emotional states through their physical equivalent, the whole process being made possible by technical means.

Many historical and classic projects could be mentioned here in which corporeal contact with the artwork takes place, for example Lynn Hershman Leeson's "Deep Contact" (1984), Monika Fleischmann's "Liquid Views" (1992), Christa Sommerer and Laurent Mignonneau's "Interactive Plant Growing" (1992) and "A-Volve" (1994), Thecla Schiphorst's "Bodymaps: Artifacts of Touch" (1996) as well as many others. These projects are distinct from ordinary hand-controlled projects that use a mouse or button-based device because they make the interaction with the content much more physical. In Hershman Leeson's project the user can touch an image of a woman's body using their hand—something that during the 1980s when the project was made was considered extraordinary. Using a finger or a hand directly to make selections on screen is much more intuitive than using a mouse or remote control.

In other projects sensors and electrical conductors are employed to react to the user's actions or force. As a result, there is not only a tactile, but a haptic relation to the content of the artwork. Erkki Huhtamo, for example, makes a distinction between tactile and haptic feedback, nevertheless the terms are used synonymously. Tactile is associated with physical touch whereas haptic involves physically perceptible feedback (vibration, shock etc.). Haptic is in Huhtamo's interpretation connected with a much bigger physical engagement.¹

The viewer's collaboration occurs not only manually but involves the upper body and physical behaviour—the viewer can experience different tactile and multisensorial sensations such as touching plants or water.

5) The spectator's physiology is influencing or directing the screen content: the viewer's participation in the presentation of images is influenced by their own biological data (such as Heart Rate Variability, HRV; Galvanic Skin Response, GSR etc.) which is used as

¹ See also E. Huhtamo, Touchscapes – Tactile and Haptic Interactions in the Works of Sommerer & Mignonneau. – Christa Sommerer and Laurent Mignonneau – Interactive Art Research. Eds. C. Sommerer, L. Mignonneau, G. Stocker. Vienna, New York: Springer, 2009, p. 33. See also Huhtamo's articles on touch in art and interactive art: E. Huhtamo, Twin-Touch-Test-Redux: Media Archaeological Approach to Art, Interactivity, and Tactility. – MediaArtHistories. Ed. O. Grau. Cambridge: MIT Press, 2006, pp. 71–101; E. Huhtamo, Tactile Temptations: About Contemporary Art, Exhibitions and Tactility. – Interface Cultures. Artistic Aspects of Interaction. Eds. C. Sommerer, L. Mignonneau, D. King. Bielefeld: Transcript Publishers, 2008, pp. 129–139. Huhtamo's articles list: MediaArtHistories, p. 95, note 4.

input data for audiovisual variations.

In discussing projects that involve perception via the whole body we can find a sequence of examples in which the viewer is perceptually embraced by the environment of the artwork. The artist TeZ (2008) does this in his work "Optofonica Capsule": the viewer places their head inside a capsule which gives an experience of "tactile sound" combined with audiovisual sensations. Vibrations are transferred through the floor where the viewer stands and which is connected to the audio environment. The performative environment "Ilinx" by Chris Salter, TeZ and Valerie Lamontagne (2014) offers an intensive visual, auditive and tangible experience to its audience. Participants wear specially designed equipment and clothes fitted with sensors. The performance lasts around twenty minutes during which the audience members experience sound, visuals and vibrations which produce a total corporeal experience that is radically different from typical everyday experiences.

In this context I would like to mention Pia Tikka's (2008) PhD thesis and her project "Enactive Cinema" shown in Kiasma, Helsinki, in 2005. In this piece the cinematic narrative of an interactive movie entitled "Obsession" was manipulated through the heart rate and skin conductivity of participants.

Finally, in this category I would like to point to Sean Montgomery's (2010) installations "Emergence—biofeedback art installation", "Vital Threads Biofeedback Apparel" (2011) and "Telephone Rewired" (2013), all of which employ biofeedback and achieve attractive and entertaining results.

Proprioception in Interactive Art

I will now choose three well-known examples of interactive art to examine from the proprioceptive point of view: Jeffrey Shaw's "Legible City" (1989), Char Davies' "Osmose" (1995) and Bill Seaman's "Exchange Fields" (2000). Transferring proprioceptive cognition into interactive, participative and tactile artworks allows us to enquire whether the corporeal experience is interesting and aesthetically novel. Also, does the corporeal experience make these art-works proprioceptively distinctive?



Figure 3. Jeffrey Shaw “Legible City” (1989). ©<http://www.medienkunstnetz.de/works/the-legible-city/>

In Shaw’s “Legible City” (Figure 3)—which is probably one of the most well-known interactive artworks—the user sits on a bicycle and pedals through a computer animated text-city which is rendered by the computer in real time. Choosing direction, which is depicted by the image changing direction, is effected by the user turning the handle-bars—the image reacts instantly. Although the bicycle is static and not moving in space, the visuals imitate this movement in space. The user, however, does not need to worry about keeping the bicycle upright, in fact it is not even necessary to be able to ride a real bicycle. Nevertheless, turning the handlebars, pedalling, and watching the moving image creates quite a convincing illusion of spatial movement.

In Char Davies’ (1995) project “Osmose” the user wears a motion-tracking vest which enables real-time motion to be tracked based on breathing and balance. A head-mounted display shows 3D images. To move in the virtual space the viewer needs to breathe in and out and change their body position. “By breathing in, the immersant is able to float upward, by breathing out, to fall, and by subtly altering the body’s centre of balance, to change direction, a method inspired by the scuba diving practice of buoyancy control.” (Davies 1995). Davies’ inspiration came from scuba diving, but in her artwork the viewer moves in electronic cyberspace. It is worthy of note that this movement occurs through movements of the body and posture. In connection with this Heidi Tikka (2001) writes about the “femininity” of the space of Osmose and suggests that it is possible to

think about it “in a gender specific way”.

Bill Seaman’s “Exchange Fields” (Figure 4) allows the viewer to influence videos featuring the choreography of Regina van Berkel. In collaboration with Gideon May, Seaman tried to develop a new kind of interface: “Exchange Fields sought to develop a novel interface strategy by eliciting culturally determined environmental ‘behavior in relation to objects’ as a grammar of gesture that could be used as input to the reacting system.” Seaman designed specific furniture-sculptures, each of which offered a “suggestion” as to how the body should be positioned in relation to that object. As Seaman (2000) writes, this suggestion was non-logocentric.



Figure 4. Bill Seaman “Exchange Fields” (2000). ©<http://www.arttribune.com/>

It is not hard to imagine that many users would not dare to put their hands or legs into Seaman’s boxes, or would prefer to watch as somebody else was “performing”. Those who tried were required to keep their balance and steer their body. Understandably, with such nonstandard movements the whole proprioceptive system is engaged to maintain coordination and balance.

In discussions about art the issue of physical experience is seldom raised. This is not entirely accidental since in exhibitions the use of touch and physical (proprioceptive) sense of position is rather rare, even though the tendency to engage the viewer is becoming increasingly common. Also, physical action and touch are important in children’s art education, children being undoubtedly more receptive than adults and their manual and physical interaction with the environment is socially acceptable. The public social space of the so-called adult world has its own non-written rules of behaviour, for instance sitting on the floor or laying on the ground is considered rather odd, even if the artwork demands it. The same can be said about touching artworks. Even if it is permitted to touch an artwork most visitors are

shy to do so even if others are seen to be touching. In connection with such behaviour Erkki Huhtamo (2006) writes about “tactiloclasm”: Tangible behaviour is ostracised from art communication because touch is connected with the fear of a “dirty” hand.

Moving now to look at dance, where physical experience and expression is important, an article by Barbara Montero (2006) makes a case for “Proprioception as an Aesthetic Sense”. In this article Montero tries consistently to convince the reader that proprioceptive “sense” is also a source of aesthetic experience. Dancers experience a quality of movement even without seeing themselves in a mirror and a dancer makes decisions about movements of the body on the basis of “internal” perception from “within” the body. This does not mean that visual feedback from a mirror is excluded, because all movement adjustments are carried out by a combination of proprioceptive and visual perception. On the basis of proprioceptive “sense”, decisions are made about whether the movement is graceful, dynamic, boring, etc. In terms of visual art, this is a similar process to when an experienced viewer perceives intuitively whether the artwork (or its details) is interesting, aesthetically valuable (or not), and so on.

Bringing proprioceptive cognition to interactive, participative and tangible art allows us to ask whether this corporeal experience offers the viewer interesting and aesthetically innovative possibilities. We can ask what is happening in those artworks in which corporeal experience has a primal role, is this proprioceptive experience aesthetically distinctive, different, and new?

The aforementioned projects “Legible City”, “Osmose” and “Exchange Fields” each differ from the point of view of physical activity and challenge. In my opinion the most traditional is “Legible City” because the user should pedal in the accustomed manner through the virtual city. Nevertheless, at the time this work was created the bonding between the participant’s physical movement and the moving image on screen was novel, a fact which renders this work remarkable and influential. With the other examples (Sea-man and Davies) we can say that the user’s proprioceptive experience is unique—there is no comparable artwork in which interaction between body, sensors, audio and visuals happens in a similar way. I conclude therefore that “Legible City” is a more ordinary work than “Osmose” and “Exchange Fields”—these are projects in which the viewer’s proprioceptive participation can be said to be original.

Conclusion

In this analysis I have avoided any discussion of biofeed-back-based interactive art and cinema. The goal of the article has been to prove that the expansion of the viewer’s experience in cinema and art has reached as far as corporeal and tactile experience. In these artworks the visual-auditive-spatial presentation is related to the viewer’s physical activity or reactions. Building on a series of historical examples I prove the existence of this trend and reveal the historical tendency that was already visible in *trompe l’oeil* paintings—the desire to erase the difference between artificial and real worlds. It is interesting to observe the consistency of attempts to “break the barrier” between reality and artificiality which occurs at different levels of technical complexity. We can talk about a cultural topos which seeks to make the virtual tangible, one which we encounter in visual art and media art, but also in works of experimental cinema.

Firstly, I focused on artworks in which “immersion” occurs to a maximum extent and where the proprioceptive “sense” defines the aesthetic experience. Since proprioception is a complex corporeal-physiological feedback mechanism it would be wrong to call it “a sense”, but undoubtedly it has been unjustly omitted in discussions about art. This article aims to foreground this term and to demonstrate that we can talk about a proprioceptive aesthetic experience.

I conclude that artworks which are designed for tactile, proprioceptive and biofeedback experiences are pushing boundaries to the extent that they could be considered research experiments. The creation of these works depends on the availability and cheapness of respective sensor technologies, the level of competency of the artists, designers and programmers, and the rise of new collaborative practices.

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Does Ritual Disappear as Walter Benjamin describes in “The Work of Art in the Age of Mechanical Reproduction” in the Age of Digital Technology?

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Abstract

This article refutes Walter Benjamin’s opinion about the disappearance of aura and ritual in ‘The Work of Art in the Age of Mechanical Reproduction’. According to this essay, rituals disappear through a method of mass reproduction—a film. I argue one of the mass reproductions, the film, actually creates a new aura and new ritual unlike Benjamin’s opinion. In the digital technology era, numerous replicas influence the fact that the massive reproduction leads to create a new ritual phenomena as well. This phenomena appears as a piece of creative writing, a piece of fan-fiction in the cyber space. Firstly, we are going to look at a new ritual which is created by a character in the television series, Star Trek. Then, we will examine a new ritual phenomenon which is generated by a fan-fiction, in the late 1990s Korean pop culture, in the age of digital technology.

Keywords

Popular Culture, Creative Writing, Cyber Space, Fanfic, Aura, Ritual, Ceremonial Cheerleading, Balloon.

Introduction

“Mechanical reproduction emancipates the work of art from its parasitical dependence on ritual.” - Walter Benjamin, ‘The Work of Art in the Age of Mechanical Re-production’

Walter Benjamin argues in his “The Work of Art in the Age of Mechanical Reproduction” that the mechanically equipped reproduction frees works of art from ritual¹, allowing them to transform into political art. Benjamin also believes that reproduction disseminates art to a wider audience. For Benjamin, film is the perfect medium for mass reproduction. I argue that despite Benjamin’s thinking, works of art cannot be freed from ritual. Aura has been recreated via the medium of film though film is not as radically open as Benjamin hopes. The masses recreate the ritualized aura using mass communication.

Benjamin discounts the reality of a pluralistic public. Dominant, hegemonic opinion can alter artwork, and this fact refutes Benjamin’s idea.

In section II of Benjamin’s essay, he states: “Which withers in the age of mechanical reproduction is the aura of the work of art.” The result of the collapse of the aura is that the thing’s one-timeness is challenged by the mechanical equipment, mass reproduction. For instance, a rare valuable fine art object has a stronger aura than widespread multiple copies of that objects’ aura. When people go to a theater, they meet actors face-to-face in front of them. In that situation, the audience will be exposed to the actors’ and the characters’ auras via the play. This is called Audience-Actor aura. In Benjamin’s essay, the film is the most powerful agent of mass reproduction. He suggests that a film actor, acts in front of the camera, the mechanical equipment, for the public. Accordingly, the aura that conceals the actor vanishes, and with it the aura of the character he depicts.

Creation of Aura and Ritual

An Aura between Audience and Actor

However, I claim that the film is not an effective agent to explain the aura’s disappearance because the film cannot separate the Audience-Actor aura through Mechanical Equipment. Therefore, this mechanical equipment is a midway point journey of a new aura. The easiest and the most persuasive practical example is Hollywood’s star system. This system puts an emphasis on the image rather than an actor’s acting. Agents who work together with the actor create and plan the star’s persona through his/her filmography, lifestyle, and accidents that would expose to the public. The star system leads people to think s/he is a good/bad person, and this includes the reproduced aura through the moving images. Stars² are

¹ Ritual is a set of activities involving gestures, words, and objects, performed in an appointed place.

² The word ‘star’ in this context represents a person who is a subject of fandom. In many cases, it is replaced as ‘entertainer’ and ‘celebrity’ (Lee

about putting on their face to represent something that actually is not there. According to Suzanne Hayward's book, "Yet we as spectators accept this construct as real" (Hayward). This means that the actor makes a new virtual image that we can see on the screen. Therefore, because an enormous number of show venues run duplicated films, it is not possible to free the spectators from the imaginary image: this is the broadened definition of the audience-screen relation³. During the screening, people will perceive a cinematic character's aura as real. In other words, people will sense such a filmic experience as a projection of the actor's real character. Thus, to the spectators, film story delivers a new aura of the actors and the characters during and after the running time. For instance, a Vulcan⁴ salute (Figure 1) has become a popular gesture from the 1960s television series 'Star Trek'. It consists of a raised hand with the forwarded hand and extended thumb, while the four fingers are parted between the middle and ring finger. This hand gesture was created and presented by an actor, Leonard Nimoy; a half-blood Vulcan character, Spock. For over five decades, people still use this character's gesture as a casual salutation in various situation as Figures 2. A new greeting ritual has been created through the actor and the film.



Figure 1. The character 'Spock' makes a Vulcan salutation in television series Star Trek. ©greenbloodedcomputer

Hun-Yul and Ji Hye Min). In this essay, I mainly use two words, 'star' and 'celebrity'.

³ It is the same as 'spectator-screen relation', which includes the notion of voyeurism and lawless seeing (Hayward, p.345).

⁴ It is an imagined extra terrestrial in television series 'Star Trek'.

Actors know they have a relationship with the audience, although not one in real time, because the actor and the audience meet each other mainly through mechanical equipment. Hence the actor plays a part in creating the rituals which float around her/him in the movies. This is one of the reasons why actors and actresses prefer to portray a new character from one film to the next, and one of the reasons why they want to sustain the newly created aura as lifelong characters⁵. In sum, mechanical reproduction encourages the creation of new rituals by presenting newly generated auras to the public.

Art Is Not Freed from Ritual, but Creates It: Re-production and Digital Technology

The advent of the Internet encourages the creation of new auras and rituals as well as filmic mass reproduction. As a film has been copied in large numbers by mechanical re-production, text content has also been duplicated in the advent of the Internet. The Internet is a tool to interact with billions of people in the virtual space. In this space, anyone can have access to the information and can copy and paste contents from any web pages as many times as s/he wants. The contents consist of hyperlinks⁶ which navigate between web pages. It is a system that links topics on the screen to related information and graphics, which are



Figure 2. One of the MPs (Member of Parliament), Dr Philippa Whitford, performed a Vulcan salute as she concluded her speech and urged

⁵ Leonard Nimoy wrote an autobiography book call *I'm not Spock*. The title is quite sensational because he made the Spock and the character 'Spock' helped him to be a well-known actor, yet he denies the character's aura in his book title. We can see that the created aura is a double-edged sword: creation of new aura and ritual, and the disturbance of creating the new one.

⁶ A hyperlink is a link that transmits to a new document or to a specific element within a document.

ministers to envision the UK's space industry project in the House of Commons. ©Tim Sculthorpe, Daily Mail Online

typically accessed by a point-and-click method. One element of hyperlink is 'hypertext'⁷. For example, one web page contains lots of information such as pictures, words, banners etc. The hypertext makes it easy to access the information by a user's clicking on hyperlinks. In a book or printed text, a reader gets linear information when s/he reads the context, while the hypertext can provide information associated with what the readers want to navigate. Any phrases or words in any sentences are text data that is connected via node⁸, and forms an information network. Therefore, the hypertext user can produce his/her own non-linear web histories by interaction. In summary, such open accessibility and user interaction of the internet promote the creation of celebrities' new auras and new rituals in the digital technology era.

Art Is Not Freed from Ritual, but Creates It : Fan Fiction in Digital Technology

In the 1990s, internet was a text-centered environment, so writing became a more effective means of communication than images. As the Internet became an everyday tool starting in the mid-1990s, one new form of ritual emerged radically, specifically in Korean pop culture. Since the late '90s, in Korea, there have been lots of rising teenage idols⁹, and their influence has grown remarkably, especially that of boy bands, such as H.O.T. (High-five of Teenagers)¹⁰. Web-based fan fiction is a great example of the ritualized aura. 'Fanfic', which is a short term of 'Fan Fiction'¹¹, means fiction written and read by fans, and it is a type of cultural phenomenon

⁷ Hypertext is a text with hyperlinks, which is called an anchor text.

⁸ In the Internet, a node is an individual bridge of a data structure, such as linked lists and data.

⁹ A word 'Idol' is equivalently used as 'Talento (タレント)' celebrity who works in various media, such as singing and acting (*Idols and Celebrity in Japanese Media Culture*, 2012). However, in Korea generally the term is used as a celebrity who is a teenage singer.

¹⁰ H.O.T. is a fist generation of boy group from 1996 to 2001. It is the starting point of the fandom culture in Korean pop music industry. There are many broadcasting systems which introduce the first generation of fandom culture.

¹¹ A cultural recognition of fan fiction began from the women's book discussion and the television series 'Star Trek' fandom (Lee Hun-Yul and Ji Hye Min, 2015; Bacon-Smith, 1992).

within the fan groups. In fanfic, the main characters are the stars who the fan, an author, likes to write about the most. The author uses his/her own imagination to create a story. In fact, in the beginning of a story, the character's personality is based on the widespread image of the celebrity—it is also a created aura via rumor— yet it is mutated by the writer as the story progresses since anyone can access the story and can leave feedback and/or their ideas to the writer through the Internet. The fanfic author applies this feedback to the following stories. As such little changes accumulate, a new aura of the celebrity is created by the end of the story. For instance, it is hard to define which fanfic started the homosexual story¹² among H.O.T. fandom, yet specific homosexual couples, such as Jun-Ta and Ton-Hyuk¹³, were set as a common story structure gay fiction of the H.O.T. fandom.



Figure 3. A scene of H.O.T. concert. ©Ha-yan-cheon-sa

Since the readers create and know how the character evolves in the story as time passes, they feel that he celebrity is an intimate friend although s/he has not met the star in face-to-face. And each of these personal preferences leads to the construction of various fan clubs. Therefore, the mutated aura is dispersed through the fan fiction in the cyber space fan clubs.

In fact, the newly created aura in the digital environment has a power to gather the fans into a group in the real world from the virtual space as Jenkins points

¹² In the late 1990s, there was a lack of knowledge about the copyright issues in the internet, so every digital resources were vulnerable to be copied without authorities as well as its date of publication.

¹³ An imagined couple with Hee-Jun and Gang-Ta was called as 'Jun-Ta', Tony and Woo-Hyuk was called as 'Ton-Hyuk'.

out in his discussion on four elements¹⁴ in the media culture. The fans' meetings in the real space eventually turn out to compose a new ritual. The most popular ritual gesture in Korean pop culture is shaking colored balloons. Shaking a colored balloon began with the H.O.T. fan clubs¹⁵ and it has developed as a traditional cheerleading gesture among Korea popular culture. Here is an example in Figure 3. We can easily see a new form of ritual ceremony surrounding a Korean pop group, H.O.T. As you can see in the Figure 3, it is not a few balloons, but hundreds of balloons are shaken by the fans in the concert as a whole group. And during the concert, they normally shout out all the group members' names according to the order they agreed on in the virtual space. Finally, ever since this fandom created 'shaking a white balloon', current celebrities and idol-group fans follow this tendency.



Figure 4. A scene from a K-pop singer, Big-Bang's concert in Malaysia.
©Kristal Lee

¹⁴ Jenkins sees participatory culture, which is a culture with relatively low barriers to access, has four essential ideas: affiliations, expressions, collective problem solving and circulations. I carefully suggest that the Internet's accessibility and its interaction make the fanfic can be one of the participatory cultures.

¹⁵ There are two big categories of fan clubs. One is that some fans who organize and participate in formal clubs. Another is that those organize and maintain with fundraising and other activities, may attract a large enrollment (Bacon-Smith, 1991). These two types were included in the development of the H.O.T. fandom. And this tendency can be observed in current fandom culture in Korea.

¹⁶ Before H.O.T. fandom, only autonomous fan clubs existed. In H.O.T. case, they gathered the 34 autonomously appeared clubs into 'CLUB H.O.T.' and its an official number of the club member record was 780,000 and unofficial record was 1,580,000 (Kim, Dong-Hwan, 2015).

The material has advanced from a balloon to a stick-like light bulb today. Figure 4 is recent K-pop star Big-Bang's concert scene in Malaysia. Shaking the glow-in-the-dark light stick has become a new mode of ritual ceremony in contemporary art history. New forms of writings in the digital environment recreate a new aura of stars, and a new style of rituals. All in all, artwork cannot be detached from the rituals, but generates it.

Conclusion

Walter Benjamin thinks that the mechanical equipment leads the dissipation of the aura. He envisions that the film is the most perfect medium for mass reproduction. Benjamin insists that the mechanically equipped reproduction freed human beings from ritual art. However, aura has been recreated via the medium of mass reproduction. Benjamin misses three points:

1) As time passes, the advanced technological mass reproduction can boost up the number of replicas more than the film can do.

2) People can create new stories from the initial storyline as a group.

3) They can set their own rituals through the interactions.

In other words, he misses the entire fact that people feel a connection with the celebrity in a friendly way through the work of art via mechanical equipment, and it regenerates the contemporary ritual aspect in diverse artworks. Mechanical reproduction encourages the advancement of new aura and new form of ritual on the massive amount of people. Consequently, although Benjamin insists the disappearance of aura in 'The Work of Art in the Age of Mechanical Reproduction', the work of art, creative writing, reconstructs a new aura and new rituals in the digital technology era.

Future Research Plan

In this essay, I introduce the regenerated aura and a new ritual in contemporary art specifically in Korean pop music. In Benjamin's essay, aura is never separated from its ritual—first magical then religious—function. However, the aura of the celebrity is created by both from the celebrity and the creative artworks in the digital technology era. Such mixed influences of the auras establish a new ritual in fandom culture: Shaking an object. It has changed as a traditional gesture to cheerleading the idols in Korea, and it has spread out to Southeast Asia. Through reading other scholars' articles, I can see that the popular culture in Korean music

industry has been explored in more various perspectives than I assumed, such as political and economical viewpoints. Yet it is hard to see any scholar who investigates ceremonial and ritual-like fandom in pop culture. I plan to continue exploring the links between text-based artworks in the digital technology era and its cultural influences.

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Politics of HCI and the User–Programmer Continuum

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Abstract

In this paper, we propose characterising Human-Computer Interaction (HCI) as a negotiation between a specific design and its context of use. We then argue that HCI design is a political activity, and that the classification between users and programmers it commonly uses reflects a political stance, deeply rooted in its socio-political context. Finally, we propose that HCI can take inspiration from new media art's subversive appropriation of technological knowledge.

Keywords

Politics, Users, Programmers, HCI, New Media Art.

HCI as Negotiation

Human–Computer Interaction (HCI) is hard to define. Not only it is difficult to agree upon the range of topics that form it (Hewett et al., 1992) but, being a multi-disciplinary field, it also admits several different approaches.

Understanding HCI requires a holistic approach. Instead of focusing only on the design of the interface that a given product offers, it is necessary to take all its related phenomena into account. This implies understanding interaction itself as a significant and distinct object, subject to being studied and characterized. The *verbal* dimension of interaction needs to be studied, that is, HCI consists on something that happens over time when users employ a particular product to solve a particular problem in a particular context.

When focusing not only on the design of the interfaces devices offer but also on the sequence of actions that emerge from their use, this sequence of actions becomes a design object.

A rather trivial example would be that when a HCI practitioner designs a coffeemaker, not only its image and behavior are the design's outputs but also, more importantly, the *way* in which the user prepares coffee is.

It can be argued that HCI's scope is broader than this, for it is easy to imagine areas of interest that seem not to fit this framing. One example could be the design of the software of a call-center. In this case, with a captive user base, an ad hoc design, and a stable and known context of use, the HCI practitioner would not be at all concerned with the emergence of interaction but, instead, would focus on other, predefined, objectives (for example, maximizing the number of calls answered by an operator per unit of time).

Even in rather extreme cases like this one, the designed object still is the interaction that emerges, and the difference resides in the objectives that would guide such design.

In general, designers have limited control of the context of use of their products, and cannot control the characteristics, desires, and needs of their users. HCI practitioners, often only design a negotiation between the actions that their products propose and the specific characteristics of their use (the context, the users, the problems to be solved, etc.).

A main subject of interest of HCI is, then, the design of this negotiation and the cultural phenomena that surround it.

Users and Functionaries

Users of tools are much more prevalent than makers of tools. This imbalance has traditionally been rooted in the vast difference in skill levels required for using a tool compared to making a tool: To use a tool on the computer, you need do little more than point and click; to create a tool, you must understand the arcane art of computer programming. -- John Maeda (Maeda, 2004).

Maeda's quote assumes that there exists a border, a frontier, which divides computer programmers from computer users. This assumption is very prevalent and common analyses of interaction and digital media are

routinely constructed using these two actors: users and programmers. Many users of tools and few makers of tools.

In the early stages of computing history, however, all users were programmers and there existed not a conceptual division between programming a computer and using one.

The creation of the *user interface* as a distinct concept is, interestingly, technological-centered, existing in a world where the computer is assumed, yet the user must be specified (Grudin, 1990).

Vilém Flusser introduced the concept of “functionaries”. According to him, the functionary dominates an *apparatus* by controlling its exterior, its interface, and is in turn dominated by the ignorance of its interior. Functionaries are persons who dominate a game for which they are not competent (Flusser, 2013).

The “functionarization” of users is a deeply political process rooted in the role that software production plays in capitalist society. In effect, the separation between producers and consumers of digital artifacts constitutes a market necessity.

Software’s increasing intricacy and power creates a new stratum of interactive complexity that, in turn, generates a new layer opaquing the interior of the digital apparatus. Yet, the very same powerfulness of new software products requires more refined expressive abilities from its users.

This apparent contradiction has been often tackled by inserting programming languages into user-oriented software products. These programming languages operate within a restricted context, and users become “contextual programmers”, acquiring the needed expressiveness without subverting their assigned role.

This new layer of programmable complexity also operates in a self-contradictory way: it offers an appropriation path that diminishes the opacity of the inside of the apparatus, while at the same time creating a new level of abstraction that—in a Kantian turn—further separates the users from this inside, increasing the apparatus’ opacity.

Still, a very significant cultural phenomenon appears: users writing code. There is an appropriation of the ubiquitous underlying technology, software. These hybrid users can acquire very sophisticated vocabularies in the languages proposed tools for which they become experts.

This empowerment becomes particularly important when we consider that software-creation techniques are

usually translatable from one programming environment to the other; the logical building blocks of the clear majority of programming languages are extremely similar.

Creative Users

In a parallel phenomenon to the complexification of software and its need of allowing users to express themselves programmatically, new programming languages have been designed to facilitate the artistic appropriation of the digital medium. This is usually aimed at cultural producers and not at “regular” users. Again, this appropriation implies the appropriation of the underlying technology: the ability to write computer code.

A new name for this activity has been coined: creative computing. This coinage seems to only have the intention to demystify computer programming and encourage non-programmers to learn how to code, while simultaneously reclaiming the pertinence of “creative” individuals to this new environment. Interestingly, the division between users and programmers is so deeply rooted that cultural operators intuitively renamed computer programming in order to help users mentally cross the fictional user-programmer frontier.

However, this democratization of creative computing is a bounded one: only “creative” types are invited to the land of software creation.

Many efforts have been made to help this mental crossing, and several art and design-oriented programming languages and frameworks have been created. There are programming languages that do not look like programming languages (e.g. *patchers* like Max/MSP, PD, or VVVV), and programming languages that look like programming languages but are inserted into an environment where its essence is less noticeable (e.g. shader programming in 3D computer graphics software like Autodesk’s Maya or 3Ds Max).

Some of the main characteristic behind the success of these “creative computing” environments include: a simplified syntax that does not hinder power; a consistent, step-by-step, online documentation; a custom, simple, programming environment; multiple platforms, including web; easiness to migrate to other (art-oriented or not) programming languages; and an active community and an open-source model (Laurenzo, 2009).

The User-programmer Continuum

There are, then, two symmetrical and complementary tendencies: the increasing programmability of software products, and the creation of programming environments that try to dissimulate their nature.

It should be obvious all programmers are also users. Even the most skilled in expressing themselves programmatically, when writing code are pure users of the operating system, the compiler, the IDE, and whatever other tools they happen to be using.

The truth is that there is not any conceptual difference between users and programmers, for programming languages are a specific subset of all the interaction languages.

In 1985, Hutchins, Hollan, and Norman introduced the concepts of articulatory and semantic distances as variables of direct manipulation interfaces (Hutchins, Hollan, & Norman, 1985). Semantic distance measures *what* is possible to be expressed in the interaction language and *how concisely* it can be expressed. Articulatory distance, in turn, measures *how similar* the interaction expression is to the idea behind it, how close a metaphor the interaction language offers.

Programming a computer consists on encoding orders in a specific interaction language. Programming languages are interaction languages with short semantic distance and usually long articulatory distance.

The only conceptual difference between a user clicking on a button and a programmer writing a specific algorithm are the different values for the semantic and articulatory distances of the interaction language used.

HCI is a Political Activity

The binary division between users and programmers is a crystallization of an ideological distribution of power. This distribution is propagated by a reductionist taxonomy of software that does not reflect the complexity of the interaction modes between humans and computers, and is functional to a power distribution schema that empowers a certain subset of interactors to the detriment of the vast majority of interactors, demeaned as “users”.

The difference between users and programmers resides in the attitude that governs the interaction and not in the specific activities. Programmers naturally adopt an appropriating attitude that dives into the opacity of the apparatus, trying to understand its functioning and to profit from the freedom that emerges.

HCI has a peculiar relationship with power, for one

of the main roles assigned to an HCI practitioner is to represent the users, being as a sort of users’ advocate within the software construction process (Iivari, 2006).

HCI traditionally conceptualizes the user as a powerless entity to whom solutions are to be provided (even in participatory and user-centered processes). In the end, there is an ideological dispensation of power that demarcates the operational conceptual field and conceals a potentially richer field of appropriating interaction modes between humans and technology.

New Media Art as a Subversive Practice

New media art can be thought of as the art that emerges when artists appropriate the knowledge behind a certain (usually digital) technology (Laurenzo, 2013).

New media art’s systematic explicitation of the appropriated technologies operates by situating the artist on different places on the user-programmer continuum. Every artistic production situates the artist somewhere in this axis (it always implies a certain relation with technology); however, it is new media art’s appropriation that turns it explicit. The location within this axis becomes a fundamental part of the art practice; *how* an art piece is created becomes a defining part of the artwork.

For example, an artwork created “functionarily” manipulating a certain piece of software such as Adobe After Effects is ontologically different from an identically looking piece programmed using the Processing programming language.

The difference lies in the (explicitly) different relationship with the technology. Even if the results can be the same, the appropriating relationship only in one case conceptualizes the technological manipulation as part of the artwork.

This was intuitively understood by new media artists, and the already mentioned renaming of programming into “creating computing” reclaims some power, proposing a different relationship between artists and the creation of software.

However, every technological product is understood from within a certain conceptual framework. For example, bitmap drawing software could be seen as tools for creating drawings, or as pieces of software conceived to allow their users to modify the values in a specific area of a computer’s memory.

The meaning and significance of a specific tool is dependent on its own conceptual opacity. Understanding

the cultural significance of a new media art piece also requires an analysis rhetoric that understands (that appropriates) the piece's technology.

For example, we can compare a record player and a violin, both understood as musical instruments. If we were to pick the best musical instrument, it is easy to find reasons for both (a violin can only sound like a violin, while a record player can sound as many things. A record player only can play whatever is recorded on the available records while a violin can play whatever its operator chooses. This choosing is very hard in a violin, while it's much easier on a record player. A violin does not need an external power source while a record player does, and so on and so forth).

What cannot surprise us is the conceptualization of the record player as an instrument, for our knowledge of its possibilities and the involved technology allow for it.

Conclusions

The immanent politicality of HCI and its deep intertwining with its sociopolitical context is often overlooked. Contemporary discourses aim at understanding the implications of HCI practice but usually fail in grasping that some of its fundamental blocks are dependent of this context. Especially important is the characterization of users and programmers as distinct entities, which obeys to a market need and not to an ontological reality.

This has been intuitively understood by new media artists who have reclaimed some of the power that has been taken away from users.

New media art is an intrinsically subversive activity. Its appropriation of the knowledge behind technology production effectively challenges this division of power, up to the point that new names for traditional practices had to be employed.

If the future of HCI includes perceptual interfaces and context awareness (Canny, 2006), then this reality will be even harder to dissimulate, for HCI practitioners will explicitly be describing the social contexts of the problems to be solved.

If HCI is to contribute to a better, more just world, it needs to question its philosophical stance. Its rhetoric cannot ignore its inextricable politicality. If one possible objective of the artistic practice is to know more about the human condition, HCI, with its systematic study of the human interactor, may take inspiration from new media art's questioning of the power behind the assumptions in our relationship with technology.

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Temporary and Distributed Libraries, Breaking Boundaries, Creating New Resources

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Abstract

The central role of the library as a central cultural system is transforming into a still undefined new type of cultural body influenced by the spontaneous creation of different types of DIY libraries interconnecting at some point (or not) to the centralised library system.

Libraries should evolve from their historical and “monumental” role, which delivers socially relevant services, into an extended, networked and shared infrastructure of knowledge, rivalling the online type of “instant” knowledge in facilitating social and cultural exchange. Two of the possible approaches to start this kind of process, which would be meant to open and socialise even more the library system, is to create “temporary libraries”, in order to fill specific knowledge needs during cultural events becoming then permanent, and “distributed libraries”, in order to integrate relevant collections of specialised knowledge accumulated elsewhere in the traditional library system without structurally intervene in it.

Keywords

Libraries, Publishing, New Media Art, Preservation, Online platforms, Digitalisation, Online Libraries

Introduction

Libraries are evaluated as superfluous and outdated entities by common sense, especially because “everything” seems accessible from computer networks, and particularly the ones accessible through the small computers in our pockets that we still call (smart) phones. Despite that, they are still efficient systems for the preservation and the sharing of knowledge produced under high standards (Kurzweil, 2013), often just impossible to retrieve online, or not yet digitised anywhere. Beyond any fetishism for the books as an object, physical libraries are provided with space to facilitate the meeting of people and fellow experts, creating concrete opportunities to learn and improve knowledge.

Physical libraries are the outpost of a social kind of sharing, while digital libraries are enabling enormous accessibility, but not necessarily building communities,

often the opposite. Establishing Temporary Libraries and Distributed Libraries can let libraries reclaim their historical role, dealing more efficiently with the rapidly evolving contemporaneity.

Digital Libraries and Custodians

The digital library is a concept belonging to the current digitalisation of every medium and content, often fostered by the so called “online giants”, eager to create specific type of assets. One of the proven examples is Google Books, admittedly being created not to be the the most comprehensive digital library, but to serve as the most sophisticated corpus of text-based Google’s AI services (Kurzweil, 2013). On the other side there are huge spontaneous and unauthorised collections including millions of publications in the form of files, such as Library Genesis or Sci-Hub, to mention the most inclusive, but also specialised smaller collections defined and technically quantified as “personal portable libraries” (Warwick, 2014) when they are offline, exchanged on a personal basis and small enough to fit into portable storage. They embody (sometimes unawarely) one of Aaron Swartz’s leading thought: “We need to take information, wherever it is stored, make our copies and share them with the world”. This is also one of the founding principle of the self-appointed “custodians”, a group of intellectuals pushing citizens to act through the scanning and sharing of content. In their words: “We are all custodians of knowledge, custodians of the same infrastructures that we depend on for producing knowledge, custodians of our fertile but fragile commons. To be a custodian is, de facto, to download, to share, to read, to write, to review, to edit, to digitise, to archive, to maintain libraries, to make them accessible. It is to be of use to, not to make property of, our knowledge commons”.

Custodians have made a mirror backup site of the Ubuweb.org very valuable collection in 2016, and they

collaborate with the huge archive.org platform, based in US, who has started to plan a whole backup facility in Canada after the election of Donald Trump as President of the United States, fearing a new wave of digital censorship.

Artist and writer Kenneth Goldsmiths, a Custodian and founder of Ubuweb.org, has used backup strategies in both ways: the digitalisation of content as a liberating paradigm on his own platform, and the re-embodiment of digital content into print in his “Printing The Internet” project, where in one occasion he printed out 250,000 Pages of Pirated JSTOR Documents (as a tribute to Aaron Swartz) in an exhibition at the Kunsthalle Düsseldorf. And the concept of preserving to avoid censorship has been also embodied by French artists David Guez in his project Humanpédia. Here he is quoting the basic strategy used in Bradburies’ Fahrenheit 451 novel, asking people to learn by heart a single Wikipedia article, in order to become a living functioning backup of an almost endless digital content.

Most the above projects are meant to build shared and liberating digital libraries on a global and personal level, with no self-imposed whatsoever boundaries, a principle which was brilliantly synthesised by Marcell Mars when he affirmed “When everyone is librarian, library is everywhere”. But this statement, in its principle, doesn’t necessarily imply that these DIY libraries should be exclusively digital.

Temporary Libraries.

In between the huge classic libraries and the big digitised ones, there are various types of smaller efforts, bringing the library concept and often its working system off the institutional walls. As a starting point let’s consider Alberto Manguel’s statement that “every library is migratory”, as he consider historical examples of small libraries travelling with famous warlords like Alexander the Great carrying a copy of the Iliad with him in his military campaigns, and Napoleon carrying a wood box in similar trips, with history books about almost every country (Cronin, 1994). A more recent example of migratory libraries can be found the end of 19th century, then the first projects to bring selection of books in areas dislocated far from libraries took place.

They were carried with means of transportation which have evolved over time from carts to cars and vans, and since the mid 20th century they have started to be usually called “bookmobiles”. The structure was simple, a modified vehicle was filled with publications,

which were lent in the place where it was parked, in the usual public library scheme. In some underdeveloped areas they are still used, but the concept of establishing independent libraries has been then further elaborated in different approaches, defining the contemporary concept of DIY libraries, which is nevertheless serving focused small communities. The Prelinger Library, founded in San Francisco in 2004, for example, has a remarkable collection of 50,000 image-rich 19th and 20th century historical ephemera, periodicals, maps, and books, mainly donated in order to be available to the local community of artists, writers and activists, remaining independent from the institutional libraries system. It is the young ancestor of the so-called DIY libraries, which recently has started to spread in North America.

Their goal is to share among a restricted community a small and usually quite focused collection, build up by a few bibliophiles, in a private space collectively rented and wi-fi equipped, through a monthly membership fee. “Wendy’s Subway” in Williamsburg, Brooklyn is a classic example, dedicated to the history of revolution and the avant-garde. The books are non-circulating (they can be read only in the library), but one of the main concepts embodied here is to explore “the social life of the book” as Rachel Valinsky, one of the founders, affirms, and how to “activate the book beyond the shelf and have people engage with the idea of the library more broadly as a place of coming together.” They are rewriting classic library rules, benefitting from the limited amount of people and the small environment, but also opening it to lecturing and other types of social-based activities. Maru Calva, founder of the similar Biblioteca Aeromoto in Mexico City says “We dream about it being open all the time, and always having someone researching or giving a lecture or learning something.”

This social approach goes beyond the so-called “citizen libraries” or spontaneous bookshelves placed in public space in order to facilitate free book exchange (like BookCrossing, Little Free Libraries, Ourselves, etc.), as it pushes a community to better organise, develop, or gather and manage a collection, and starting from there to give space and time to a shared interest in specific cultural fields, with the opportunity to be learnt and discussed further.

Then my formulation of a “Temporary Library” relies on a similar concept based on breaking the classic library’s boundaries. Classic libraries are open,

but physically very centralised, so breaking these boundaries (metaphorically represented by the library walls) means to bring publications in new places and finally expanding and redefining their public role in a more contemporary sense. The Temporary Library concept consists in curating a selection of publications, reflecting a relevant topic, possibly also with a local/national character or declination. When the selection is agreed among the curators, a minimal physical library is built asking publishers to donate these publications (or acquiring them), and a specific space is dedicated for consultation, typically during a compatible event (a festival or a conference with similar topics), eventually granting the opportunity for attendees to get in touch with publishers through a list of contacts, in order to compensate the donation. Finally, when the event ends, the temporary library is donated as a “special collection” to an established institutional library, but only under the condition that it’d be lent to other events upon request, and to be shipped back when this event is finished.

Under this approach, the curated selection is able to attract new type of readers, who can then be connected also to the publishers’ community, finally contributing to create a public resource which is meant to stay and hopefully travel, to release even more of its potential of knowledge. And if different Temporary Libraries (with compatible or similar topics) are created they can be ideally gathered altogether at some point in a single place for a while, proving minimal redundancy and locally built richness in that specific topic that would probably have been impossible to grasp in a classic library.

In a way, they are metaphorically breaking the monumental character of the library and its physical centrality, giving space to external qualified intervention, still integrated into the systems.

(At the moment there are three Temporary Libraries under development for three international conferences/festivals.)

Distributed Libraries.

If Temporary Libraries are meant to create new mobile library resources, the concept of a Distributed Library is based instead on the observation that a lot of cultural “scenes”, particularly some art-related and media-related, are misrepresented in official cultural repositories, especially libraries. On the other end, there are plenty of unofficial repositories of publications about

these cultures, usually assembled and hosted by small institutions, critics or journalists. These collections of publications form altogether a “Distributed Library” whose content is mostly absent from library catalogues. This Distributed Library approach is about supporting the online publication of the respective catalogues, being then searchable altogether. In particular, Neural magazine has developed a web platform (the Neural Archive) that facilitates this process, through free software and the most basic IT standards, is free to be downloaded and used through Github. The whole software platform allows any collection to be indexed scanning the publication’s covers and entering the bibliographical data.

With a few working partners, the next fundamental step would be to create a small vertical search engine that would search all the different “distributed libraries”, or better their respective catalogues, altogether, creating an important tool for researchers in that specific area, which in this case is new media art. In fact, it’d result as a collaboratively-compiled bibliography, extremely specialised and, very importantly, based on the physical books preserved in the respective physical spaces of the participants. Even if probably none of the small entities would be able to grant a real public access to the respective physical collections, it’d guarantee proper indexing and preservation of specialised cultures. Beyond intrinsically taking public responsibility of these collections, once the catalogue is published, one of the most crucial challenges would be at some point to structure the data in a way that it’d be compatible with the current libraries standard, forming an independent conceptual “other side” of the library system, perfectly searchable and compatible. Distributed Libraries can grow even more and faster than classic libraries because they are not constrained in a single place. They would more deeply reflect then Manguel’s contemporary library definition as: “an evergrowing entity; it multiplies seemingly unaided, it reproduces itself by purchase, theft, borrowings, gifts, by suggesting gaps through association, by demanding completion of sorts” (Manguel 2008).

Preserving knowledge under these conditions assumes new values which rise from social needs and self-organising networked structures, so that the distribution of knowledge itself becomes a strategy rather than a limit. While Kittler underlined the remarkable difference between “transmission” and “storage” in media, and their respective values, in a Distributed Library system the “transmission”, obtained through the networked

infrastructure, becomes fully functional to the storage, needed to preserve the physical copies, in a way that they are mutually necessary rather than be in competition.

Conclusions.

“The mission of librarians is to improve society through facilitating knowledge creation in their communities” (Lankes, 2016) and the physical libraries are the outpost of the social sharing of knowledge, while digital libraries create shared access but not necessarily communities. Mostly the combination of the two can have a relevant social impact. The selection curated in temporary libraries is meant to let the interested readers to progress and learn about unheard consistent (curated) titles. Furthermore, being placed in a public space during a public event, it'll allow the creation of a space of dialogue, where the shared knowledge will affect fellow interested people and experts.

The Temporary Libraries are meant to accomplish both the goals, being temporary as social installations, then transforming themselves into stable cultural resources.

The Distributed Libraries are instead letting focused collections to emerge and being publicly acknowledged, intrinsically compiling extensive bibliographies and becoming valuable and strategic repositories.

Finally, the role of the citizen librarian, dealing with these types of structures, should embrace both the tasks: being a custodian to preserve share and duplicate, when needed. But also a shaman, knowing these collections so well to be able to guide other citizens to discover new connections and to establish new social and cultural relationships.

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Valuably Unsought: Systems for Digital Serendipity

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Abstract

Contemporary interaction with media is mediated through a plethora of digital systems, conditioning said interaction to the experiences that these systems anticipate and limiting the potential of the medium for surprise and serendipity. Through a literature-review and system analysis, we assert the value of serendipity in our digital interactions, arguing the necessity of a distinction between Natural and Artificial Serendipity, while establishing key areas of action of serendipitous systems: Information Encountering, Experience, Collaboration, Creativity and X. We identify specific systems within each of these key areas, as well as their methods and mechanics for achieving Artificial Serendipity in the Digital Medium.

Keywords

Serendipity, Digital, Information, Experience, Collaboration, Creativity, X.

Introduction

There's an incredible opportunity to create tools that help people move beyond search and social modes of discovery and increase the chances of serendipity. Builders of these tools have a chance not just to gain great fiscal success but to make a positive impact on the world, increasing the range of perspectives and strategies we can bring to bear on complex problems. (Zuckerman, 2014)

The vertiginous adoption of new or digital media as the privileged method for virtually all of our endeavors, from the most mundane to the highly specialized, has resulted in a necessity for the tools and methods used to interact with it to be created, transformed and mutated *in medias res*.

The consequence is that we are unable to foresee the impact that new systems created can have both on our habits interacting with media as well as ourselves as the interactors. Technologies that were created in order to better serve the user and her necessity for timely discovery of relevant information are now being

questioned on their possible effect as personalised echo-chambers and *filter bubbles* (Pariser 2011).

Much effort has been dedicated in the past years, to cater to the user, through data collected of her habits and preferences, online shopping, social media *likes*, and search history. The same, however, cannot be said of an exploration of the user unknowns, of *possible* interests, yet to be discovered. To wit, the medium's capacity to provoke serendipity, be it in the tools and systems used for productivity, for discovering new information, for play or for collaboration.

On Serendipity

Historically, the definition of serendipity is a malleable one, open to interpretation. It has been so since the term was coined by Horace Walpole, in 1754, describing "a particular mix of chance and reasoning" (Merton & Barber, 2004), through examples and anecdotes that did little to strictly define it but rather left it to what Stoskopf referred to as "robust plasticity" (2005).

As it pertains to this research, we refer to Boden's definition of serendipity: "the finding of something valuable without its being specifically sought" (2004, 234).

The particularity of Boden's approach, and contrary to the common understanding of the phenomenon, is that chance and unpredictability aren't a prerequisite for serendipity, that it "need not involve any inherently improbable event" (2004, 235). While the experience of serendipity is seemingly random, unexpected or accidental, it can be the product of a knowingly approach to induce it. As Boden exemplifies: the parents of a child can leave a book open on the table that would help the child solve a particular school problem. From the child's point of view, the event is mere happenstance, a lucky, fortuitous coincidence, even if it was planned by the parents. This approach to serendipity allows, therefore, for procedural, computational and digital systems that, knowingly, attempt at provoking serendipity. With

this approach to serendipity we propose a distinction between serendipity that happens naturally, without any interference, and that which is in any way premeditated.

Natural Serendipity

Natural Serendipity is the common interpretation of serendipity: an elusive, rare phenomenon that is wholly unpredictable and unprovokable. This interpretation is akin to Boden's notion of A/E-randomness (2004, 239), insofar as to be, likewise, indeterministic and, therefore, unfit to be conscientiously explored. In fact, to do so would be negate its very *raison d'être*.¹

Artificial Serendipity

When we consider that serendipity can have some sort of deterministic nature, i.e.: there may exist a commonality of conditions that promote a serendipitous experience, we are now discussing *Artificial Serendipity*, since we are now in the camp that serendipity can be, if not created, possibly induced. It is with this approach that we encompass our research.

From the interactor's stand point, *Artificial Serendipity* can be (and often is indistinguishable from Natural Serendipity. Take, for example, the power-ups from the video-game series *Mario Kart*. These seemingly random items of varying outcome change their probability according to the relative position of the player in the race. The worst you are playing, the better the power-up will be, and vice-versa. The result is what is referred to as *rubber band effect* (a method for dynamic game difficulty balancing), where you are, quite literally in the case of *Mario Kart*, thrown into a better spot in the race. To a player that is unaware of this mechanics, this struck of luck can be considered serendipitous. As such, *Artificial Serendipity* exists from the perspective of the interactor, even if designed.

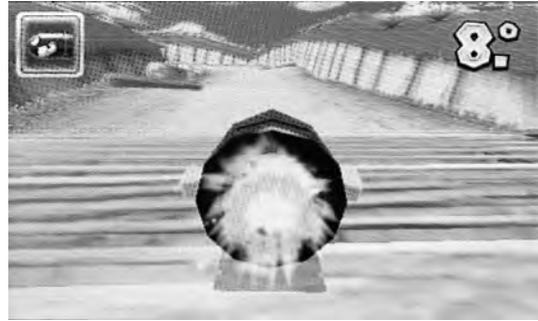


Figure 1. In *Mario Kart 7* (2011), the “Bullet Bill” power-up transforms the player into a racing bullet, propelling her across the track. The duration of this power-up is dependent on how distant the player is from first place.

Serendipitous Systems

Returning to Boden's definition of serendipity, it remains undefined what is or is not “valuable”. Naturally, this is dependent of the intentions of the subject of serendipity. We, have, however, identified a series of domains in which value can take shape: through *Information Encountering, Experience, Collaboration, Creativity* and *X*.

Information Encountering

One of the most common areas of activity of serendipitous systems is in the attempt to provide an answer to how one finds both relevant and surprising information. This necessity became that much pertinent with the commonality of the Digital Medium (Murray, 2012), and its capacity to store virtually infinite amounts of data, where methods that were applied to the physical storage of information, such as the Dewey Decimal System, for example, were now impractical.

Advances in search technology and user profiling solved the problem of information seeking: by knowing something about what we were looking for we were now able to, with a certain degree of accuracy, find what we were looking for. The question then became how do we discover about what we ourselves don't yet know.

Prior to “searching” the web, the verb most often associated with navigating from web page to web page was “surfing”. With search engines we no longer surf, we ferry across the web via algorithmically catered timelines, without much opportunity for chance or side tracks.

¹ Although if considering the universe itself as a computational system — as per the pancomputational argument — Natural Serendipity would be deterministic, if unpredictable.

The software itself that we use to access the World Wide Web is referred to as a “browser”, suggesting a notion of wandering. To browse is to be noncommittal, it is to read superficially, perhaps even randomly. This experience of casually and accidentally discovering information is what Erdelez called *Information Encountering*, a “memorable experience of an unexpected discovery of useful or interesting information” which would occur when one would be looking at a different topic or “carrying on a routine activity” (1999). Here, the unsought “something” referred by Boden is information.

Interactive systems have been created in order to provoke Information Encountering on the Digital Medium. Two of such systems, *StumbleUpon* and *Max*, have distinct approaches:

StumbleUpon’s premise is to enable its users to, as its name indicates, stumble upon interesting websites. Starting with a declaration of the user’s interests, the platform sequentially shows webpages randomly (or pseudorandomly) which it had indexed in its database and categorised according to the user’s preferences. The user can then like or dislike the particular webpage being shown, improving the algorithm. Pressing the “Stumble” button will present a new, randomly selected webpage.

StumbleUpon requires an investment from the user in order to constant improve its algorithm. Furthermore, as the algorithm increases its relevancy, the potential for unexpected webpages, outside of the user’s tastes and preferences, can become greatly diminished.

Max (Campos & Figueiredo, 2002) has no front-end graphical user interface of its own. Instead it records and analysis the user’s browsing history and sends suggestions via email of links that it believes the user will be interested in. In order to deliver not only information that it believes the user will be interested in, but also new information, *Max* also adds to its suggestions alternatives pulled from random profiles, as well as random links. *Max* was able to produce 27.7% of unknown, relevant information, 5% of it being “unknown, unexpected” pages, that sparked a new area of interest, while 6,5% of the results showed “a new and unknown connection between two current domains of interest”. This led to the authors conclusion that “programming for serendipity is possible”.

While *StumbleUpon* requires engagement and constant feedback to improve the algorithm. *Max* is passive and presents its recommendations at a later date, not forcing the user to act immediately on a suggested

webpage. In *StumbleUpon*, you are taken webpages after webpage, with minimal control. In *Max* you choose which suggestion you wish to explore.

Another approach to Information Encountering is Thudt, Hinrichs, & Carpendale (2012)’s *Bohemian Bookshelf*, recreating the feeling of wandering through a physical library or bookstore in a digital catalogue, while taking advantage of the opportunities that the Digital Medium allows, as a way to “support serendipitous discoveries through information visualisation”.

It defined six design goals for serendipity through information visualisation, which represented in the *Bohemian Bookshelf*’s graphical user interface, through five distinct representations for the digital catalogue, all accessible simultaneously (Thudt et al., 2012).

This approach can also be observed in *StackLife*, a visual navigation for The Harvard Library System.

Designed in order to “help users explore topics, find the next works they need, and help others in their own explorations”, *StackLife* (formerly *ShelfLife*) uses the visual representation of the book as a metaphor for its metadata: horizontal lines tells how old the book is, vertical lines the number of pages (this directly relates to the book’s physical form), while its color (*StackLife* uses only shades of blue) represents how popular the book is: the darker the shade the more times its metadata has been downloaded.

Selecting the book sends the user to a “Subject Stack”: a new vertical stack that group books within a genre or theme. We also get access to “Community Stacks” — stacks that are user-generated — as well as tags associated with a particular book.

While both the *Bohemian Bookshelf* and *StackLife* use the concept of thematic grouping of information, *DEVONthink* — a macOS programme by *DEVONtechnologies* — provides the same functionality for information discovery, although with a different approach to user interface. Relinquishing analogies to the physical world, the programme uses the paradigms of the OS for representing documents, be them books or other pieces of information. These documents are organised in a similar way as one organises documents in the Finder — the file manager and graphical user interface shell used on Macintosh operating systems

— through hierarchies of files, folders and tags. However, it has a unique functionality that displays related information, one that author Steven Berlin Johnson in *Where Good Ideas Come From* claims

to “foster private serendipity”² (Johnson, 2010). This functionality, called “See Also & Classify” analyses the content of an open document and searches *DEVONthink*’s database for similar documents, organised by “Score”. The metrics used for this score level aren’t clear, however it appears that it is based on common keywords between the documents.³ The stronger the score, the more common words the documents share between them.⁴



Figure 2. *DEVONthink*’s “See Also & Classify” functionality

Doodlebuzz, a project by Brendan Dawes, approaches information encountering through an interactive visualisation of the news, helping the user to “bump into connected articles and topics” and “find things you didn’t know you were looking for”. The user initiates interaction by typing a keyword, similarly to how one would in a search engine, afterwards the user is prompted to draw (or “doodle”) a line in the screen. Results related to the initial query are presented across this line, which the user can expand (by drawing a connected line) to

² Detailed information on how the author uses *DEVONthink* to cultivate serendipity can be found on his website: <http://www.stevenberlinjohnson.com/movabletype/archives/000230.html> (accessed December 1, 2016).

³ The same concept is also used in another product by DEVONtechnologies — *DEVONagent* — aimed at online searches.

⁴ The software appears to ignore synonyms and related words. Testing with two documents in the database: one with the word “dog” the other with the word “canine”, neither appeared in each other’s “See Also & Classify”.

see in detail as well as further explore in related topics. This “draw-to-explore system”, according to the author, “creates a chaotic structure that allows for a greater level of serendipity than traditional linear paradigms normally allow for” (Dawes, 2011).

Experience

While not as common as *Information Encountering* but an emergent approach to serendipity on the Digital Medium is *Experience*. This was specifically explored by Tuck Leong (Leong, Vetere, & Howard, 2008) in regards to media consumption, particularly when using the shuffle functionality on an iPod.

Leong’s argument is that the necessity of having to choose what to listen to within a large musical library can be “unpleasant and even paralysing”, particularly when the user doesn’t have a particular preference. As such, by abdicating their ability to choose what to listen to, it can lead to better user experience, an enriched listening experience and even encourage “encounters with serendipity”. Leong defines serendipity “as the meaningful experience of chance encounters”. This can be exemplified in music listening by a surprising sequence of tracks with a common theme that resonates, in some way, with the listener.

Serendipity can also be experienced as the result of good design that enables and empowers the user with the necessary knowledge to carry out a specific task, through the act of experiencing or interacting with a specific system. Take, for instance, the design of level 1-1 of *Super Mario Bros*. Here, the player learns that she has to jump over the enemies, to do otherwise would result in game over. While doing so, the player also learns that if she jumps and hits a box with a question mark, she will earn a coin. The second time she attempts to do this, a *Super Mushroom* comes out from the box instead of a coin, which could be seen as an enemy. At that point, even if the player tries to jump over the *Super Mushroom*, as she did with the enemy, she won’t be able to, resulting in getting hit by the *Mushroom*, which in fact won’t hurt the player, quite the opposite. In the words of *Super Mario Bros*. designer Shigeru Miyamoto “by being hit you become bigger and that makes you feel really happy” (Eurogamer, 2015).

Here, the player is conducted, through clever game design, to understand the difference between an *Goomba* (which hurts the player’s character) and a *Super Mushroom* (which helps the player). To the unaware

player, this could be experienced as serendipity, within Boden's definition.

Similarly, in the 2004 first-person shooter video-game *Half-Life 2*, the player learns that she is able to efficiently kill an enemy zombie with a saw-blade seemingly serendipitously. The player sees herself trapped in a room where the only visible exit is being blocked by blades stuck to the wall. As soon as the player removes one of the blades, a zombie enters into view, compelling the player to "instinctively hit the fire button and wa-pow! You chop the sucker in half!" (Brown, 2015).

Both this and *Super Mario Bros.* method is a more immersive method of teaching the user or player, preventing a break of flow which is key not only while playing but of any other activity.

Collaboration

Tee et al. explored this serendipitous collaboration with digital artefacts through screen sharing (Tee, Greenberg, & Gutwin, 2006) through the implementation of a *Community Bar* — a sidebar peripheral display which aggregates different media items: A *Presence* item that shows a live video stream of a co-worker; a *Chat* item, a multi-person public conversation; *Stickies*, which contain text postings from one individual to the group as well as *Photo* and *Web* items through which users are able to share photos or webpages

— Tee et al. attempted to increase artefact awareness, the "easy awareness of the documents, objects, and tools that other people are using." Through their initial experiences, they reported "serendipitous and opportunistic" interactions, where users would begin to collaborate together on a specific document simply by being aware of its presence, as well as engage in spontaneous conversations triggered by, i.e.: observing another's desktop background.

Similarly exploring serendipitous collaboration in the workplace, Philip Jeffrey developed *Forum Contact Space* (Jeffrey, 2000), a "networked, virtual world with three-dimensional avatar representation." With *The Forum*, Jeffrey intended to explore if chance encounters that occurred within a physical workspace could be reproduced in a virtual one. *The Forum* consisted of two different shared spaces, one for "hanging out" (*Forum Contact Space*) and one for synchronous meetings with the aid of audioconferencing technologies (*Forum Meeting Space*). Preliminary findings reported the possibility for chance encounters within the *Contact*

Space, triggering their memory or enabling them to interact with someone who they otherwise wouldn't without the *Contact Space*.

Tanaka et al. developed two systems that would facilitate serendipity applied to cultural production, through collaborative music mixing. With *CC-Remix* — a network-based collaborative music creation system — up to four users in different locations could participate in a process of music collaboration by taking excerpts from existing songs and mixing them together. With *Malleable Mobile Music*, they these concepts and apply it to a mobile environment, using wireless ad-hoc networks and incorporating "subconscious gestures made in the act of listening" such as gripping the device tighter or tapping along with the beat into the actual music creation.

Within the subject of musical creation and collaboration, Bryan-Kinns designed *Daisyphone*, a "novel environment for remote group music improvisation" with the aim to understand how could musical environments be designed to be more "engaging, social and serendipitous" (Bryan-Kinns, 2004).

Starting with the premise that music has lost a fundamental part in our daily lives, being relegated to a "highly stylised activity requiring serious practice, performance, and accuracy", *Daisyphone* is positioned to reintroduce the "everydayness" into music, through remote group music improvisation, through the use of mobile devices (such as smartphones or tablets). To this end, *Daisyphone* adopts a unique interface that distances itself from desktop graphical user interfaces, opting instead to represent music as a circle, with a play head that rotates around, playing the notes underneath it. These notes are placed and removed by the users, by clicking on the small circles. When joining a *Daisyphone* session, a player is given a unique hue that represents her. Different musical sounds can be selected, represented by different shapes, such as square, round, diamond and triangle, which users can select by clicking on the centre of the system. Pitch decreases with distance from the centre and volume is represented by saturation of color. Players are also able to easily add hand-written comments, be it notes or drawings. Through this visually rich and, possibly, "messy" interface, they hope to "encourage exploration, fun, and contextualisation" (Bryan-Kinns, 2004).

Creativity

To experience serendipity is to experience a unique form of creativity that is the result of a specific series of events, combining unexpectedness and insight. Therefore, one experience of serendipity is achieved through the creative process, when systems and methods are used as facilitators for creativity, enable the interactor to overcome creative blocks or generating solutions that would be possible otherwise.

Ancient methods of divination, such as the *I Ching* or cartomancy, while acting as triggers, are possible vehicles for serendipity. In these systems, randomness (in the form of shuffling cards in cartomancy or coin tossing in the *I Ching*) was used to combine symbolic representations of ideas which, together, would create something that could be interpreted as meaningful by the user.

This same concept, devoid of mysticism and directly aimed at the creative practice, can be found in Brian Eno and Peter Schmidt's *Oblique Strategies* (1975), where cards taken randomly offer aids that can be used to break through creative blocks. The aphorism printed on these cards are often vague and abstract and it's up to the user to interpret them in a way that can be applied to their own work.

These systems, while analogue, have a procedural nature to them, while making use of randomness as the underlying mechanic. In digital environments, randomness can be used both as a trigger for creativity and a creative process in and of itself, as in the case of generative systems. The impact of these systems and their relationship with serendipity will be the subject of future work.

X

By *X* — the mathematical variable that represents the unknown — we consider the systems that provoke serendipity through unfamiliarity and unexpectedness, confronting the interactor with something that challenges conventions and require a reframing of expectations, such as with Anthony Dunne's user *un*friendliness, a design intention that purposefully distances itself from the user-friendly norm:

In design, the main aim of interactivity has become user-friendliness. Although this ideal is accepted in the workplace as improving productivity and efficiency, its main assumption, that the way to humanize technology is to close the gap between people and machines by designing “transparent” interfaces, is problematic, particularly as this view of interactivity has spread to

less utilitarian areas of our lives (Dunne, 2005, p. 21).

Naturally, user-friendliness is a necessity, particularly in the case of user-tool interactions, however, not all interactive artefacts need to be designed in this fashion, as there are experiences to be explored by consciously and purposefully designing unfriendly interactive systems that break with common best practices.

Dunne's consequences of generalised user-friendliness are similar to what Wilson and Sicart refer to as “player narcissism”, an “extreme but inevitable consequence of user-centred design practices that subordinate all design concerns to the satisfaction of an ideal player's desires and demands.” (2010) They argue that there is a necessity to break conventions and to draw attention to the dialogue between player and designer, through what they refer to as “Abusive Game Design”. This concept can be observed in the flash game *Unfair Mario* (2013), a re-interpretation of *Super Mario World* (1990).

In *Unfair Mario*, the familiar mechanics of the Nintendo series are distorted, inconsistently and unpredictably, throughout the game to the extent that the player is led to distrust any possible outcome. Within the very first moments of the game, the player jumps over a gap, just to have the landing spot collapse resulting in the character's death. This unpredictable behaviour is avowed by the designer through the encrypt message “NOT EVERYTHING IS WHAT IS [sic] SEEMS...”, appearing shortly after the start of the game. This warning, as well as the initial hidden traps in apparently safe areas of the game, rapidly condition the player to mistrust everything that follows, such as a message urging the player to pass under a series of blocks which, unsurprisingly, reveal a hidden trap. In order to avoid dying, the player needs to ignore the message passing over the blocks. However, when attempting to do the same with the blocks immediately after, she is surprised to learn that this will result on her death, having, this time, to pass under in order to be able to continue. This happens throughout the game. More so, the game defies good game design practices, particularly in collision detection. A player can be killed by a deadly spike without these clearly and visibly touching the character.



Figure 3. *Unfair Mario's* attempts at misleading the player

Players of *Unfair Mario* struggle with unpredictability of the game, experiencing moments of joy, of delight, of incredulity that they were able to (eventually) overcome the game. This is a type of agency that results not from a well-designed interaction but from the successful struggle with a frustrating one. It is the end-result of exploring a *defamiliarised* design.

To Shklovsky, *defamiliarisation* was a valuable technique applied by Art as a means to make objects “unfamiliar”, increasing the difficulty and, therefore, length of contemplation and perception of the artistic object, “because the process of perception is an aesthetic end in itself and must be prolonged” (1917).

Through challenging conventions of user-friendly and user-centred design in interactive digital systems, we make them unfamiliar, promoting reflection by the interactor on the experience itself. We are able to see and experience these interactions anew, and reflect on their outcomes, encouraging creative and unexpected, serendipitous, experiences.

The concept of *defamiliarisation* was explored by Helmes et al., with the intent of grabbing the user’s attention and projecting digital abstracts into a physical world, by creating two ambient devices that explored both the potential of *defamiliarisation* in our personal media collections, as well as randomness (specifically choice abdication). These two devices — *Meerkat* and *Tuba* — engaged the user in two distinct fashions and offered distinct methods of interacting with personal media in order to “enable serendipitous presentation of digital content from people’s personal media collections”.

With *Meerkat*, Helmes et al. attempted to grab the

user attention by “pushing content towards the user”. To achieve this, *Meerkat* had the ability to “pop-up” at random moments, while showing a random combination of photos. Featuring an embedded IR sensor, *Meerkat* could sense presence, triggering its action. Furthermore, *Meerkat* was designed as to increase the frequency it activates if it is ignored, while decreasing it if it’s regularly activated, as a means to play with the levels of engagement.

Tuba, on the other hand, requires a deliberate act by the user. The display sits face down, requiring the user to pick it up and turn it. Doing so, would trigger a random presentation from the user’s personal media collection: an image, music, random trivial or a Facebook post.

Helmes et al. reported that the deployment of these devices on user’s familiar contexts, as potential serendipitous devices, created certain expectations that couldn’t be kept by the devices and would even decrease the potential for serendipitous interactions.

Still, the random and unexpected behaviour of these devices created a level of engagement between the users, their personal media and the devices themselves.

Conclusion and Future Work

Having acknowledge a necessity for serendipity in digital interactions, we propose the concept of *Artificial Serendipity*, in contrast to *Natural Serendipity*, as a knowingly, intentional process that can be considered in the development of digital interactive systems.

We have, as well, identified five key areas of action for serendipitous systems: in *Information Encountering*, *Experience*, *Collaboration*, *Creativity* and *X*, as well as observed the individual methods used by these systems towards serendipitous experiences.

We will continue our analysis of these areas and identify the underlining mechanics that are used by the serendipitous systems, in order to provide designers a framework for the creation of artificial serendipity within interactive, computational and digital systems that will allow for a broader range of experiences within the digital medium.

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Journalism Visualization Devices: Six Visual Modes of Seeing

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Abstract

The growing number of visualization devices in the online journalism world draws attention to the mechanisms both technical and symbolic that build the relation between the producer and the user in the interaction with the device. This relation has been studied in different approaches and empirical research; some of them related to the visual studies field. This paper aims to contribute to the study of the visual aspects of this relation through the analysis of the implicit representation of the user that the producer depicts into the device. This symbolic approach tends to find the guidance operation for interaction as a prescriptive model of information consumption focused in the visual representation. This paper proposes six-visual modes for this guidance operation as the established models in the current online journalism: (1) visualization of events, (2) visualization of hidden issues, (3) visualization of spaces, (4) visualization of narratives, (5) visualization of the subject involved with data and (6) visualization of convergences. These six modes are defined and their characteristics explicated.

Keywords

Computer-Journalism, Data Visualization, Visuality, Visual Modes, Online Newspaper.

Introduction

In the last fifteen years online newspaper have included a growing number of visualization devices borrowing techniques, software and knowledge from the science to the benefits of the investigative journalism; a movement that receives names like data journalism, computational journalism, journalism as programming, etc. Nevertheless, these devices includes certain ways to know and see as West et al. (2015) remind us in her analysis of the gap between the capabilities of data technology and traditional representations of data in media, art and society. She argues that we are facing a crisis of representation due to the prevailing of certain framing narratives in the choise of algorithms, statistics, representational schemas, displays, interaction technologies, and metaphors for processing and

representing data. But before discarding these framing narratives we attempt to analyze them for the purpose of find the prevailing ways of see into the Journalism visualization devices (from now on JVD) and its way of guide the audience towards a point of view. We decided to proceed with this approach with the aim of find both the cultural origin of the visual communication practiced in the newsrooms and the social representations depicted into the visuality of the devices which makes sense and set the relation between the producer and the users.

For Segel & Heer (2010) data stories offers new techniques for telling current news due to their interactivity, capability of verification and alternative explanations. In their study, based on 58 collected examples of visualization devices, they gathered these techniques in seven genres: magazine style, annotated chart, partitioned poster, flow chart, comic strip, slide show and film/video/animation. This seven-genre system highlights the graphical and interactive elements present into a visualization device, though giving less attention to the experience of the reader. The Segel & Heer approach shows the visual elements of the interface as a non-linear-reading process opposed to the linear-text storytelling. In this paper we are going to put in practice a complementary approach to find the visual guidance symbolically built into the JVD with the purpose to expose the user experience that data journalists suggests to the news readers. This approach follows the *visuality* concept, which describes the way cultural objects speak for himself through a visual mode as J. W. Mitchell (1986) pointed out. Every cultural object shows its own visual mode depicting specific stagings, communication models, plausibility methods and social inscriptions. Therefore, interactive images, digital devices and technology developments present their own visuality as part of the contemporary culture. In addition, we take the concept “position of the viewer” analyzed by Kress & van Leeuwen who show that “the interactive meanings

are visually encoded in ways that rest on competencies shared by producers and viewers” (2006: 115).

In the first place, The JVD have been derivate from scientific-data visualization, which involves a set of technical abilities that can transform non- visual-nature data into visual expressions. These technical abilities allow throwing light upon some information both making it understandable and showing unknown facts or events. Besides, they take advantage of representational schemas or metaphors like maps, organization charts, narrative models, etc., to organize database information and produce cognitive reactions to the viewer. Lesage & Hackett (2013) point out that data journalism is mediated through discourses and practices from computational and journalism fields that relies on the social scientific epistemological traditions and expertise, including the journalistic ideals of objectivity, transparency and accountability.

Likewise, Edward Tufte (2006) suggests that data visualization aims to discover new knowledge, in the same way, the device that support it operates like the proof of that knowledge. Hence, visualizations devices combine two elements: the new knowledge accomplished and the device serving as evidence. This dual nature makes visualizations complex but not obvious objects. Complexity comes from the link of the new knowledge with certain visual expression creating a logic relation; that sort of relation is special because knowledge and expression hide behind each other, not allowing questioning their own existence. The task to discover visibility into the JVD consists of isolating visual expression from accomplished knowledge. This approach allows perceiving the socialforces footstep (like cultural and historical), which contributes to form the meaning and the communicative intentions from the producer on the JVD. The viewer accepts to play the role not only through the interactive possibilities offered in the interface but also by a particular visual mode.

The sorts of JVD visual modes are not alike; everyone has its owns interactive characteristics and its specific depicting features. This study analyzed 116 JVD produced between 2010 and 2012, which were awarded in the online category of Society for News Design’s Malofiej Awards. The analysis heads to the identification of six visual modes that show a strong presence within the selected corpus. In this paper we will display one JVD instance for each visual mode in order to describe the role suggested by the producer and the guidance for

interaction as a prescriptive mode of visual-information consumption.

Visual Modes of Journalism Visualization Visualization of Events

In this visual mode the interface works like a prosthetic eyes, which can view either beyond the natural vision (physiological) or what could not be seen due to its representational characteristics like engines, components, outer space, nanotechnology, etc. The prosthesis leads users to have a close view of the represented object and get an in-depth exploration of what is in front of eyes. This symbolic mechanism encourages the user to leave the limits of daily life view in order to open the eyes to the evidence exposed by the JVD and its arguments.

In some cases, the JVD depict visual instruments like telescope, microscope, even imaginary instruments able to trespass through walls, components, compartments and machinery parts. In other instances, the JVD allows to accelerate, slowing or repeating a video action with the goal of finding details, measure changes or just to appraise a social practice. This mechanisms work together with social science methods introduced by Philip Meyer in the newsrooms in the 60’s and called Computer-Assisted Reporting —CAR (Gynnild, 2014)

The JVD offers the user to embody an expert view, it means to take the glasses from specialists like judges, trainers, referees, polices officers, engineers, architects, etc., with the purpose to analyze data or events as an expert. In this symbolic movement the JVD not only use numerical data as their primary news material but also create a narrative structure, which user is the star actor bringing to light the information that a regular person couldn’t recognize. In the way to reinforce this representation the JVD interface depict control and measuring instruments to evaluate, estimate, judge, or supervise the information.

In the case of *El Juicio a las Juntas* (Figure 1), the interface penetrates the trail room where Argentina’s ex dictators had been prosecuted for crimes against humanity. The JVD transport the sight to a place where offers a data-sensory experience, an emotional bonding with the trail and the awareness of the historic moment.



Figure 1. El Juicio a las Juntas. 2010, Argentina. ©Clarín

Visualization of Hidden Issues

The second visual mode brings to reality facts, information or patterns that would have been impossible to know in a non-visual way. The JVD reveals a hidden issue like discrimination, injustice or unfair treatment thanks to data patterns (like accumulation, reiteration, etc.) or statistical evidence (like time and space variations, etc.). The pass from invisibility to visibility occurs highlighting the unexpected knowledge and open it to public debate. This visual mode matches with traditional statistical journalism, which pursue to discovery the news behind the public data. Usually, this sort of “stories” strongly influences the media agenda and forces the investigation of the revealed issues (Parasie & Dagiral, 2012)

The visualization of hidden issues operates to raise awareness in the newsreaders about the size of natural disasters, responsibility for the planet, causes and effects of political decisions, etc. The readers should follow the path of discovery to check the argumentation and get the conclusions. This sort of JVD draws its explanation power on data evidence due to the use of data mining, data mapping and cross-referencing databases. Therefore, the user’s involvement is not related to the immersive mechanism but for the argumentation.

Besides, interface makes use of visual conventions like pie charts, data tables and bar graph, etc. that enables to shape a new data into a familiar one. As Norman Bryson (1991) remind us in his critical study of vision, the use of codes of recognition allows

to identify an object into the social landscape and therefore to be able to see. Once the news explanation is clearly viewed due to visual conventions it embeds into the general knowledge.

The JVD *How Mariano Rivera Dominates Hitters* (Figure 2) shows, for instance, the use of accumulation patterns to unveil the play style of the invaluable player of the New York Mets. This JVD attempts to reveal the special Rivera’s techniques due to the mix of data retrieved by The Movement Lab, the argumentative explanation exposed by the narrator and the video image sequence. The JVD discovers what is almost impossible to see for a regular person unless he has trained eyes.

Published June 23, 2010

How Mariano Rivera Dominates Hitters

The closer has confounded hitters with mostly one pitch: his signature cutter. Related Article »

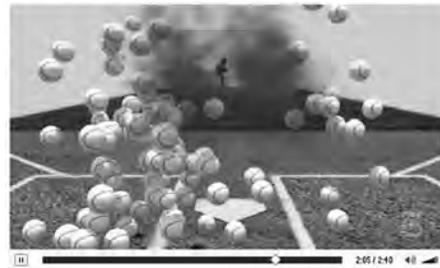


Figure 2. How Mariano Rivera Dominates Hitters. 2010, USA. ©The New York Times

Visualization of Spaces

This base-on-maps visual mode carries the user’s view into geographical spaces to collect data from the locations and find out some unexpected information. Maps usually displays some paths guided by visual and interactive techniques like trend chart, zoning and flow charts in order to discover the “story”. In this case the upper interface layer—the annotation layer, which attaches labels for name places and measure distance— creates a framing vision of the territory using text boxes and graphic symbols. The JVD sacrifices a free-travel around the map for a guided story about places. In addition, map representation suggests to the users a dispassionate and natural view thanks to a group of conventions such as: Planimetry, scalability, point of view, observation distance (generally simulation of a satellite view), georeferencing and sociodemographic segmentation. All these technical elements improve the JVD’s plausibility and ease the user to achieve the agreement with the argument.

The art historian Ernst Gombrich (1982) refers to map's view like a world selective gaze caused by pre-established symbolic determinants, like conventions, for the sake of simplify representations. Thus, in the map acts an insequence view of the information, which allows following varied routes into the map. In the same way, the map is a vestige of what cartographers saw as spatial proportions and identification of objects in the past. However, it must be taken into account that maps entail both a distortion and adaptation of reality. This idea sends the analysis back to the Jorge Luis Borges's paradox about the scale between map and territory expressed in the short story *On exactitude in science* (1946). This story shows the impossibility of a perfect land representation because the maps just would duplicate the referent; hence the map representation can be only partial.

For instance, the JVD *Election* (Figure 3), which accompanied BBC's live broadcasting of British voting in 2010, present a dynamic distribution of space according to the electoral results and the balance of power. This JVD compares different states or zones of events to draw the new map of power. The map represents each electoral district by a hexagon colored by the winner-party color. This adaptation creates not only a new British map but also an unbalance party-power distribution.



Figure 3. Election, 2010, UK. ©BBC

Visualization of Narratives

The features and advantages of narrative audiovisual structure offer support to this JVD visual mode, not only proving the argument exposed through the sequence of images but also arousing users' emotion and interest thanks to the *mise-en-scène*. In the field of argument, some visual and audiovisual techniques helps to validate the data like: appearing and disappearing

images, highlights, acceleration and slowing of video clips, shots, sequences and scenes from the audiovisual language, etc. Moreover, the narratives structure frequently corresponds to a classical Aristotelian organization integrated for three acts: setup, confrontation and resolution. This structure links ideas, opinions, explanations, jokes, etc., to drive the story to a conclusive argument as a result of the linkage. This classic structure often arranges a confrontation between two opposites: the past against the present, right against wrong, myth against reality, etc. These confrontations reinforce the argument and lead the user to a logical conclusion.

Video techniques prevail in these JVD, even though they limit interactivity. This happens because video is an accessible and familiar format that requires only a passive-watching spectator. Arguments like editorial positions and abstract concepts such liberty, justice, patriotism and victory are convenient for being performed in this visual mode. In addition, an extradiegetic narrator organizes the story mixing archive images and showing them according to the script; this mechanism is proper for event reports, recaps and historical accounts. The image, in this performance, works as auxiliary of an argument drawing the visual elements to explain the central point.

These elements are performed in the JVD *Snow Fall* (Figure 4). The story tells the tragic moments lived by a group of skiers in the middle of an avalanche in Washington. A long-scroll rolls out five chapters of the story, each one including several multimedia elements such short videos, landscape photographs, graphics, maps, photo galleries, audiotapes, etc. All the elements are arranged by a structure script that heads the story in many details and emotional experiences.

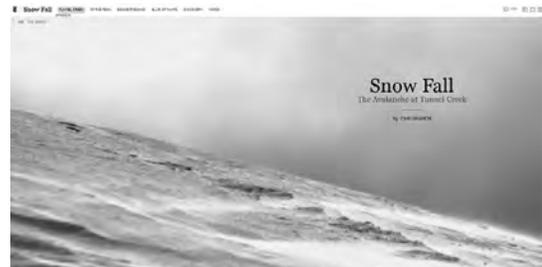


Figure 4. Snow Fall. The Avalanche at Tunnel Creek. 2012, USA. ©The New York Times

Visualization of the Subject Involved with Data

This sort of JVD enables users to get involve with data in such point that the subjectivity is also involved in. This visual mode matches with the Gynnild (2014) analysis of the data-journalism entrepreneurial approach, which claims for the idea of “journalism as programming” or the data-base as the locus of news attention. In this approach the user is in front of a non-mediated contact with raw data and the journalist accountability function is replace by algorithms. Parasić & Dagiral (2012) pointed out that these programmer-journalists take distance from the traditional conception of “story hidden in data” and claim for news as computer-processable data.

In the users field, this visual mode aims for the improvement of data searching. The contact between data and the user promotes a sense of control that enhances the sensorial immersion into the device. This user-data meeting creates personal and temporary significances different for each user. Therefore, the user generates the story of its own experience with data through the dramaturgy and staging provided by the JVD. According to Arlindo Machado (2009) the user projects its feelings on the screen, like in the case of videogames, in order of pursuing a new experience into the device, which only get results from a negotiation between the user and the software. Thus, the experience shapes the memory of the contact with data. In terms of time the user experience is endless, however the user defines duration of the experience as well as the starting point, rhythm, speed of ride, and closures.

This sort of experience could not be completely either planned or reckon by the producer, in many cases it depends on the capability of the device to allow the user project his imagination and interest on the interface. For instance, the JVD *World Cup Twitter Replay* (Figure 5) shows Twitter-users reactions of each match in the 2010 FIFA world cup. This JVD simulates a new game lived in parallel while the real one was being played. Twitter users act like players of its own virtual soccer team and match due to the real-time interface. In this stage personal data mix with database information building new—or at least unexpected—information. In this way, users become part of the news.



Figure 5. World Cup Twitter Replay. 2010, UK. ©Guardian

Visualization of Convergences

The last visual mode study in this paper operates through the translation of terms from one system to another, providing the same value of data (equivalence) in two different stages. In this case, a journalist or an expert does not produce the translation, instead it comes from a programming calculation that makes to converge datasets from databases with personal information introduce by user. It is consistent with Henry Jenkins convergence-culture concept whereby different media-content-flows are connected in technology platforms to produce experience and new significances. According to Jenkins (2008) the convergence encourages the users participation, interactive collaboration and collective intelligence. More than a simple technology concentration, convergence is a cultural action grounded in media technology that works like a social articulation.

This visual mode is more suitable for users' personal searching than journalist stories. Users in front of this JVD must show dynamic attitude, participation skills and collectively sharing, even promoting activism and fanaticism. The activist attitude rejects the journalistic mediation and pursues for a self-constructed conclusions. A mix of skepticism and enthusiasm heads the users to reach the desired data experience. The JVD *Is It Better to Buy or Rent?*

Figure 6 visualizes the users' data (real or simulated) with database information to offer answers about the real estate market in NYC. The answer helps the user to build future scenarios, foresights and forecasts. The

visual experience does not exist until the user feeds the interface with personal data.

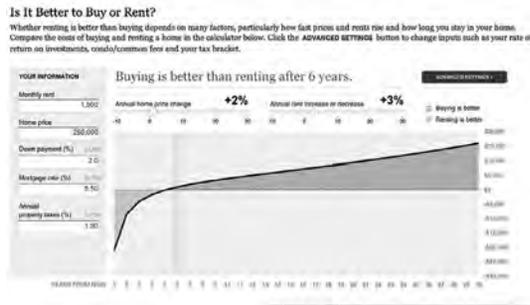


Figure 6. Is It Better to Buy or Rent? 2010, USA. ©The New York Times

Conclusions

This paper presents six visual modes of JVD identified from a corpus of some award-winning examples and analyzes the interaction of the user with the device, not only in a practical way, but also in a symbolic relation. These visual modes merge elements from the journalist tradition and technological improvements in the production of JVD. As a result, the current JVD not only explores new technical mechanism to access, decode, understand and present data, but also reinforces the journalistic precedent modes of report visually. Therefore, JVD production is more complex than a technological update, it implies to search and chose a desired experience for the potential users in a multiplied background of visual languages and ways of make sense. We are sure about the existence of an array of varied visual modes in JVD, different of those we discuss here, but the study shows that these six are the most established visual modes used in current online newspaper. Then, It is important to questioning about the mechanisms that privilege a group of visual modes over others.

The user experience with the JVD ranging from the visual aspect to the interactive behavior is complex alike. The user is invited to take some actions in view of get a complete experience with data and stay informed, but, at the same time faces a bunch of discourses represented through images, actions and data. As Lesage & Hackett (2013) pointed out, the technology, organizations and symbolic characteristics of online newspapers mediates data in such way to make it problematic. The six visual modes indicate that the way of seeing news affects the

information in the same way that discourses affects our sight. To put it differently, to view information through JVD is a cultural action instead of a technological one. Moreover, the prescriptive models of guidance through the JVD involve more than a neutral consumption of information, it carries values, ethics, ideologies, etc. expressed in visual terms.

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Projects Desluz and ZN:PRDM (Neutral Zone: A River Passes Through Me) by Poéticas Digitais Group Gilberto Prado

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Abstract

The purpose of this communication is to present some recent projects developed by the Poéticas Digitais group related to the theme of environment and flow, visible and invisible forces, and how to dialog with the construction of the context, in which the public is part of a large collaborative system related to the environment. The discussed projects are: “Desluz” (2010) and “ZN:PRDM – Zona Neutra: Passa um Rio Dentro de Mim (Neutral Zone: A River Passes Through Me)” from 2013.

Keywords

Media Art, Environment, Dowsing, Flow, Poéticas Digitais

Introduction: Experience and Belonging

To live is go from one space to another, trying insofar as possible to not bump into things.¹

Georges Perec (1974, p. 14)

How does one make the various vectors and forces that make up our cross and circulations appear, even if we do not notice them? And how to compose with them?

Some layers may seem interesting to overlap. The first would be the layer of signs that are apparent and that guide flows. The second layer, the mapping of paths, signs or situations that are not so evident in our metropolises, which cross them from underneath or at different frequencies and are less noticeable. This type of interest also guides some of the work by the Poéticas Digitais Group², such as the “Desluz” and “Amoreiras”

¹ Vivre c'est passer d'un espace à l'autre, en essayant le plus possible de ne pas se cogner. Translated by O'Rourke, K.

² The Poéticas Digitais group was created in 2002 at the Visual Arts Department at ECA-USP as a multidisciplinary group to promote the development of experimental projects and a reflection on the impact of new technologies in the field of arts. The group is an unfolding of the wAwRwT project started by Gilberto Prado in 1995 and its participants are artists, researchers and students, with vary in each project (Prado, 2010b).

projects (Prado, 2010a), in which we have flows and movements that are not in our visible or audible tracks and frequencies but that affect us in some way. In the same line of conception of these projects is the ZN:PRDM (Neutral Zone: A River Flows Inside of Me) that also poetically explores these tracks and frequencies using antennas to neutralize energy, forked sticks to find water and mobile phones to reconstruct underground river routes. The projects are a starting point in revealing the current relationships with the city, some of which are crystallized, and to eventually generate the potential to destabilize the subject of conventional movements and routes following the paths.

Through art and digital systems in public areas, we can design new experiences in relation to the cities and our surroundings. In this manner, the intention is to encourage the interest, use, sense of belonging, and dialog in public areas, not only in parks and the usual places of leisure, but in all areas in general. Actions like these also intend to make streets a venue not only for functional moving, that is, to commute from one place to another, but for interactions without previous guidance.

The presence of technologies in areas subject to traffic has produced a new type of temporality and sociability. They have created a new way to perceive these areas and move across them. We generate an invisible and immaterial mesh after crossing electronic and digital technologies in these areas – no longer considered strange objects, but incorporated into the area itself.

In *Paris: Ville Invisible/Paris: invisible city* (Latour & Hermant, 1998) the authors show in text and image a perspective of these invisible meshes that cross the subsoil and the air of the cities. Data are provided by sensors installed in the urban areas, with remotely located monitoring rooms. Safety cameras are installed to monitor the traffic, traffic lights, telephone transmissions, water volume in dams, sewage,

airplanes, etc. Everything required to keep the city functioning and in supposedly stable conditions.

In the project *Rivers & Streets*, (Campos Junior, 2013), the author develops a process for the rivers that have been canalized and are hidden in the city of São Paulo. Many rivers and streams that, being concealed and out of our daily lives, are in a type of non-existent state as they are not in our field of vision and perception. Well, these controlled or uncontrolled systems are only noticed when they become defective or when catastrophes, natural phenomena or interventions occur that affect their – and our - routine.

It should be noted that all these new processes, that attest to the presence and influence of information and communications technology in the routine of contemporaneous citizens, represent new contexts for reflection and for the arts, with huge space for public intervention. It is a social and artistic imaginary world at stake and in transformation. As transitional spaces, they act as enablers or catalysts of actions that are sequentially triggered. According to Roy Ascott (2001), “meaning is not something created by the artist, distributed through the network, and *received* by the observer. Meaning is the product of interaction between the observer and the system, the content of which is in a state of flux, of endless change and transformation.” The artist proposes a context, an exploration of the relations between beings and things, a sensitive frame in which something may or may not be produced (Prado, 2003).

Insofar as the individual moves, its radius of action, of belonging can be activated by other elements. We can then think of the permeability of these shared spaces, by seeking a more poetic approach to the city, to allow exchange, discovery, creation and experience, recalling O’Rourke that “the environment map encompasses both the immediate, physical and urban surroundings we often walk by, our own actions and perceptions as pedestrians, and the cultural or ideological filter through which we see this experience” (O’Rourke, 2013. p. Xviii). This leads the individual to feel like belonging to the street, the square, places, that is, the public spaces, regardless if they do not have a large infrastructure, wrapping him in a state of harmony and commitment in his daily interactions with the city.

One of the intentions of the projects described is to conduct interactive pieces possessing a hybrid structure (not necessarily transformed with direct and prompt public intervention), the actions for which, however, are

incorporated into a larger system. This is an integration of normal or routine elements, like trees, antennas, vases, etc., with devices and apparent prostheses, electromechanical or cellular devices, etc., into the same piece. (Prado, 2016). People don’t know what to do, indecisive whether to interfere or not, touch or not, transpose or not. Is it allowed or not? This question is always present in our life, always hybrid in all senses, with its frontiers, matrixes and nuances.

Also, the relationship of a constructed group/object to an almost non-direct action in systems ensures a *quasi*-contemplative space in contrast to a very frequent obligation of action/intervention in interactive areas. Such *quasi* includes noises, either for the fascination in possible deviations, or for the poetic discovery of different ways to perceive the other and our complex position within these networks and systems. (Prado, 2013).

Desluz

How Insects use the moonlight and starlight to mark location, maintaining a constant angle to get to and from their breeding places (Barghini, 2010). Insects are confused by the artificial light of our light bulb, trying to get closer to the source of light, flying in circles, forming clouds, attracted by the light in endless loops.

The light that attracts them is the ultraviolet wavelength that the human eye cannot see, but which acts as a sexual attractor of insects. Moths are attracted by the infrared light wavelength that our human eyes also cannot see, but for them it is a potent sexual attractor. Thus, electromagnetic frequencies have been covertly perceived through the ages under the moonlight or electric light, perpetuating the survival of species.

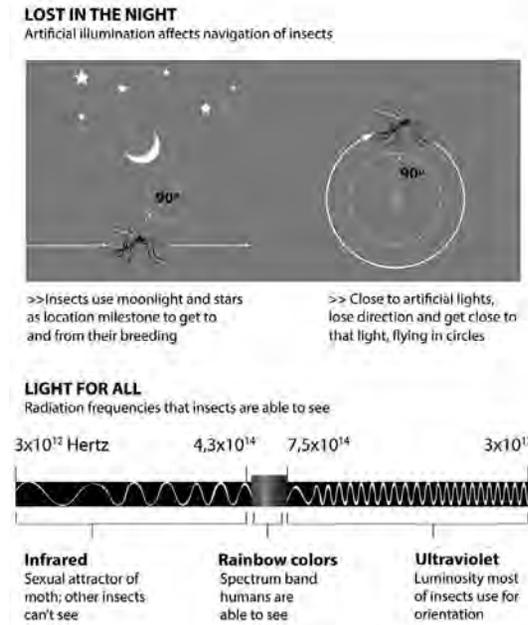


Figure 1. Infographic based on an illustration published in the newspaper *Folha de São Paulo*, 04/21/2009

Our exhibition space features a cube of transparent LEDs (8X8X8) that emit infrared light and loudspeakers that respond simultaneously to the flow of passers-by; in another place, a region of housed red lights, as attractors, conceal a hidden game of seduction. The flowing movement of the visitors in the red-light area is captured by a camera located on top of a structure, which films a top view of the area, a network, a mesh which scans an area and the flow of people passing by. The acquired information simultaneously feeds the system installed in the exhibition. This system consists of a cube of LEDs that emit infrared light, an Arduino board which creates the relationship between analog and digital data, and two computers that process and handle all data (input and output). Thus, the data sent by the remote camera that turns the lights of the exhibition cube on and off generate movements and flows. This process is dynamic, simultaneous, and occurs in real time. Meanwhile, nothing is seen or heard in the exhibition space, however the body perceives these other frequencies.

Sound is another important component of the work. Although the speakers are clearly seen, they emit

sound frequencies that cannot be heard by human ears. Although this distant flow is converted to sound frequencies which cannot be “felt” by the ears, when we approach the work we can feel the reverberation (and some discomfort) in our body. Yet we cannot see or hear it. The lights apparently remain transparent and dull, and the speakers emit sounds that are not audible to humans.

We note that the LED lights of the cube are not visible in the spectrum of our vision, which will require an additional device for them to be seen. In this case, we are counting on the cameras of personal mobile phones belonging to the visitors of the exhibition. By pointing at the LED cube with the mobile camera, visitors can ‘see’ an entire cloud of movements, which represent the flow of pedestrians in areas captured by the camera remotely and transmitted in real time.

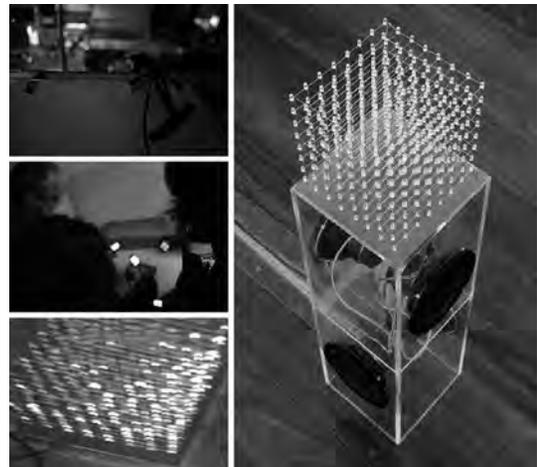


Figure 2. Desluz – Red Light district camera overview/movement of passers-by captured by the mobile phone camera/ Mobile phones pointing at Leds cube/ The flow of the pedestrians viewed through the mobiles/ The installation Desluz at Luciana Brito Gallery (photos: Poéticas Digitais and Érika Garrido), São Paulo, 2010.

As we approach and surround the exhibition, we are placed in such a restlessness, this endless flow, in search of light.

The work is subtle and the perception of the intensity in the change of lights is delicate. Desluz is a work of contemplation, and the public in direct contact with the piece cannot locally interact with it. There is only the LED cube and the sound system in place. It is a work of

reflection on interaction and sharing with one another.

Desluz is a non-light, an intense desire that burns but does not illuminate; it is felt but not seen, in the same manner as a dazed Icarus looked at the sun while it melted his wings on the path that lead to nowhere. The light is only visible through mobile cameras that move around the LED transparent cube, in an unveiling operation that the eye cannot see.

The work is about the discovery of the invisible, our provisional places, our flows and grids, layers that subtly overlap, that lure us but do not let us see them, betray our hidden yet so apparent senses, and bring to light our desires in an endless pursuit of the stars.

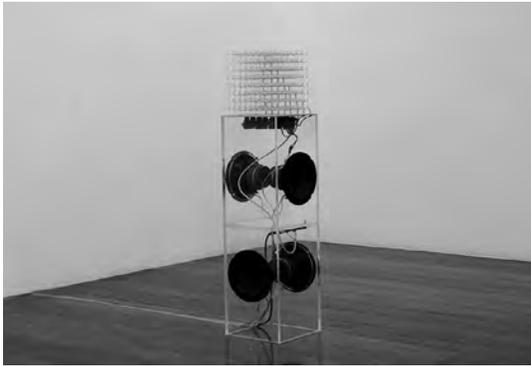


Figure 3. Desluz –Luciana Brito Gallery, São Paulo, 2010 (photo: Érika Garrido).

The work was presented at Galeria Espaço Piloto 16 on 09/30, # 8.ARTE, UnB, Brasília and a new version was displayed at Galeria Luciana Brito, in São Paulo, at the Galeria Expandida exhibition, curated by Christine Mello, from April 5 to April 20, 2010.

The *Poéticas Digitais* Group in this work, is composed by: Gilberto Prado (Coord.), Silvia Laurentiz, Andrei Thomaz, Rodolfo Leão, Maurício Taveira, Sérgio Bonilha, Luciana Kawassaki, Claudio Bueno, Clarissa Ribeiro, Claudia Sandoval, Tatiana Trivisani, Lucila Meirelles, Agnus Valente, Nardo Germano, Daniel Ferreira and Luis Bueno Geraldo.

ZN: PRDM

(Neutral zone: A river passes through me)

In its initial configuration, this artistic action was designed for the ZL Vortex Symposium: Urban Interventions - Laboratory, coordinated by Nelson Brissac Peixoto, Ary Perez, Gilberto Prado and Ruy Lopes, at the Maria Antonia University Center of USP. The laboratory cycle for the symposium took place from April 03rd to June 26th, 2013, at weekly meetings, bringing together specialists from different areas - engineering, urbanism, technology and the arts - to discuss and rethink one of the areas subject to the most intense urban transformations, the East Zone of São Paulo (Known as ZL – Zona Leste – in Portuguese). The Vortex chosen for the undertaking of the project was a portion of the suburb of the East Zone of São Paulo, a huge neighborhood (298.8 Km², 3,620,494 inhabitants).

The ZL Vortex Project is delimited by rivers and avenues: Aricanduva, Verde-Jacú and Tietê (to the north), near the Ecological Park. Therefore, it represents a vortex that begins at Carmo Park. The area is served by different transportation systems: the subway, highways and passenger/freight trains. It is an articulation axis with Guarulhos airport, the South beltway and with the Port of Santos. The East Zone is undergoing an intense transformation process, due to large investments in infrastructure and public facilities. This is the place where new productive and urban arrangements and new social practices are emerging. But it also presents river basins and lowlands affected by occupation and extraction activities, improved buildings, industrial exploration, landfills and waste deposits. [4].

The area chosen to carry out our artistic action ZN:PRDM (Neutral zone: A river passes through me) was a small patch of the Vortex; one of the many areas of the ZL lacking in resources, one of the pockets with poor infrastructure and little political and government support. At “ZN:PRDM”, through distinct markings and maps, we seek indications and signs of underground streams, in addition to water ducts, sewers, wires and cables, garages, the subway, all in the overlapping paths and grounds of our cities.

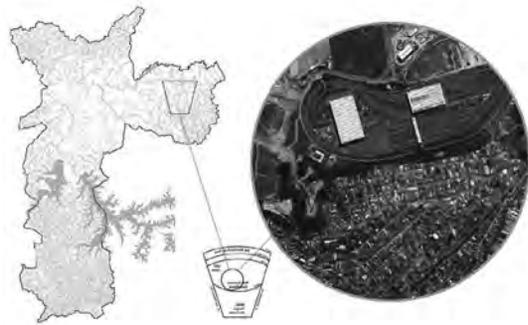


Figure 4. ZNPRDM - The area chosen to undertake our artistic action in the East Zone

How to Listen to the Sound of the River Running Right Beneath Our Feet?

Before we talk about our walk in the East Zone, we would like to discuss some issues that guided our project.

Many rivers and streams that once meandered through cities are no longer visible (nor audible). For various reasons, attempts to tame them have multiplied, repressing them into linear and underground hidden paths, in long straight rows of pipes, channels and cement ducts; in rectified paths that sometimes suddenly explode during rains and floods, when the original spaces, beds and paths are reoccupied. Among references to this work is the “Rivers & Streets” project regarding the channeled rivers hidden in the city. Campos Junior (2013), one of the creators of this initiative, manifests his indignation at how much is spent to hide a river, because it truly is an “absurd engineering effort mobilized for this”, noting that, in an urban space such as the capital city of São Paulo, there is a sort of nonexistence of many rivers and streams that, being hidden and out of our daily lives, no longer belong to our field of vision and perception.

Another question that has concerned me for a long time is the direction of the drain in the vortex. When we, who are located under the equator, observe water drain from a sink, we see that it rotates counter clockwise, unlike what happens in the Northern Hemisphere. And what happens in the line that crosses between the two hemispheres?

Some years ago I went to the equator to see what occurs when the water does not rotate either way, when the whirlpool was at that crossed moment, when it is neither

here or there, but both, when these forces neutralize each other. These are interesting situations and moments, as in art: crossing this imaginary line, from one side to the other, this brief moment of intersection, of silence, the moment of being suspended in a whirlpool.

Then another question came up: where did the water that descended after the forces were rearranged go? Where did it go after it left our visual field?

To accomplish the project “ZN:PRDM”, we employed some dowsing principles, “evaluation technique and control of energy” (Hartman, 2006, p.50) which in its GrecoLatin etymology means sensitivity to radiation rays or waves and is commonly known as an effective technique (Mendonça, 2005, p.10) to find rudimentary water with the use of pendulums and forks. In this same perspective, we built an antenna to point to and “neutralize” the places where there is a perceptible energy variation through dowsing. Neutralizing the resend effect, re -circulating that energy from below, creating spaces from Neutral Zones (ZNs) that tell us that we should stop and keep to what surrounds us, and not necessarily to what is explicit and visible.

What attracted our interest was to create and handle this energy field variation. How could someone sense that and how could we find these points, make them visible and neutralize them? How to apply a force in the opposite direction, what tension would be required? Then, we realized that it was necessary to ground it. We had to join the Earth. This energy attracts ones interest the moment that everything stops and that tension is somehow in suspension yet it is there, still in our bodies.

Then we created our copper antenna to be nailed to the wall, the nail directed towards the magnetic north pole. The energy entering a spiral end crosses it and leaves it through the other end and goes to back the ground. In this manner it would be possible to create not a West, North, South or East Zone but a Neutral Zone (ZN).

Thereafter, we had some fields we wanted to cross:

A search for underground rivers and streams, secret paths of our invisible metropolis;

A forked stick, to sense the energy fields that indicate the presence of water;

An antenna, to neutralize these zones.

We then went to the East Zone in a randomly chosen area within the great vortex, walking without a destination and looking for the curves of rivers and streams that were left behind, not the linear and straight or corrected flows.

At first, we did not use any map or indication, because we wanted to try to find signs as we walked. It was a question of seeking and discovering, of tuning feelings and perceptions. We will get to a place we do not know, that we have never been to, and the shapes, nuances, ways and indications will guide us. It was a question of searching. Trying to identify riverbeds and streambeds now running in pipelines and constructions erected as a consequence. Then, we started to randomly look for any sign of underground water and hidden rivers. We went there during the weekend, in the middle of the week, and we came back through straight, long, empty streets... others were crowded, with many people, traffic, noise, in a state of confusion, and others were narrow, difficult to access, alleys, slums, unfinished and provisional constructions that have been this way for several generations.



Figure 5. ZN:PRDM – The water flow emerging in the back of the house...That was our starting point.

Then, one day, suddenly, from a raised area, we saw one street that had a curve design, a different structure from

the others, and we could visually identify the water flow emerging and then it disappeared in the back of a house...

It was a stream appearing from nowhere and then disappearing.

That was our starting point.

After that, we looked for a cluster of mulberry tree in the outskirts, which was removed by “water seekers”, namely Vô - Grandpa (Geraldo Francisco Ribeiro) and Jocimar Carlos Batista, our special collaborators in this project that preceded the locations of water in that area. We marked the sites where we sensed its presence.



Figure 6. ZN:PRDM – dowsing

Then, we asked local people to use the fork, and sense for the water, and thereafter we asked them to tell us about their experience and memories.



Figure 7. ZN:PRDM – dowsing

Younger boys did not know about those paths, about underground rivers that used to flow on the surface, the older man said: “There used to be a stream behind my house, it was clean, without waste, but then, when they built...” Our concern at that moment was not to know

if the person could handle the fork and find signs of water, rather it was with the perception of these apparent rivers, most of them poorly treated and polluted, and the development of a poetic map with these stories and memories that were remembered and retold. Then, following the flow, we entered the slums, went over other streams, inside homes, and whenever possible, we took our antenna.



Figure 8. ZN:PRDM – antenna



Figure 9. ZN:PRDM – antenna

We drew graffiti at some of these points, on the walls, in the streets, and we gave the antennas to anyone who wanted to take them or place one of them in their home, to remember these invisible water flows.

With some people of the community we marked these

areas, creating trails and routes of another flow, caring for this river, among so many other possible rivers and streams, seeking to restore forgotten and/or erased memories.

Finally, we developed a mobile application that reproduced the sound of underground water as we walked through these places with our own cell phone. Then it was possible to pass through listening to the sound of water from the hidden river also passing by right there, beneath one's feet, returning it to perception. Trying to at least recreate the invisible water noise. A noise that could make us dream and, perhaps, act.



Figure 10. Neutral zone: A river passes through me. A partial schema of one the mapped areas to walk with the cell phone listening to the sound of the river running right beneath our feet

The Poéticas Digitais Group in this work is composed by: Gilberto Prado (Coord.), Agnus Valente, Andrei Thomaz, Clarissa Ribeiro, Claudio Bueno, Daniel Ferreira, Luciana Ohira, Nardo Germano, Renata La Rocca, Sergio Bonilha and Tatiana Travisani. The ZN work: PRDM was presented on June 19th in the communication of Gilberto Prado, with the description of various steps and procedures of the project at <http://www.youtube.com/watch?v=eas9ZI-nZVw>

Invisible spaces, Intensive, Fluid and Simultaneous Experiences

The poetic approach to the presented works claims a place for art as a sensitive field of knowledge which is not subjugated to the same scientific validation tools. In truth, art broadens this field of knowledge by including the influence of flows and subtle fields, bringing to light invisible forces and fluxes at play.

There is an interesting aspect to the field of action of invisible space, of unorthodox forces and of poetic deviations which are present in the works by *Grupo Poéticas Digitais*, which we would like to summarize. Among them it is possible to point out that the changes brought about by the invisible space in its intensive experiences of fluidity and simultaneity imply a reflection on the capacity that space possesses of presenting itself and activate feelings in others (Mello, 2009). Under such conditions, the experience of space is created in its provisional reality, in its relationship with the receptor. Space, under this point of view, dislocates senses: from conceiving works that contain an internal space to the conception of works that generate space outside of themselves, that activate other spaces in addition to those perceived in the surroundings. It provokes, with this, a diversity of experiences as much as in the receptor's body as in the sensory space as a whole. It can be noted that, in such circumstances, space is experienced not only as the internal space of a work but also as a sensitive element capable of activating the space outside of the work, in this manner promoting an amplified dimension of apprehension for the environment in which the work is presented. (Mello, 2009, p.282)

In this way the artistic experiences such as *Desluz* and *ZN:PRDM (Neutral zone: A river passes through me)*, activate spaces proposing deviations and bringing out other points of view and experiences that link and amplify reports and fleeting relationships that may occur during these journeys. Under this perspective, the space of the work as well as social space is observed as an unstable conception, as a force field between practices and experiences in our daily life.

Such a procedure acts in the sense of stimulating the receptor to feel (un)familiar, provoking within him a state of strangeness, suspension of time, in a daily life perspective, that can modulate the relationship between people and spaces. The Poéticas Digitais Group makes use of such perceptive devices to activate in the public

critical modes in which to perceive space and the tensions that exist between the work's space, including the influence of flows and subtle fields from the environment and social reality. A shift of balance that also concerns leaving a personal scale for a collective scale of observation/participation, which brings with it a sense of belonging and sharing.

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Author Biography

Gilberto Prado, artist and coordinator of the Poéticas Digitais. Group. He studied Engineering and Visual Arts at the State University of Campinas and in 1994 he obtained his PhD in Arts at the University of Paris I - Sorbonne. He has participated in several art exhibitions in Brazil and abroad. Among his prizes, one can mention 9º Prix Möbius International des Multimédias, Beijing, China (2001); Rumos (2000) and Transmídia (2002) - Itaú Cultural; and 6º Prêmio Sergio Motta de Arte e Tecnologia (2006). He works with art in networks and interactive installations. Currently he is Professor at the Post-Graduate Programs of Visual Arts at the Communication and Arts School at University of São Paulo and PGP Design at the University Anhembi Morumbi.

Capricious Creatures: Animal Behavior as a Model for Robotic Art

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Abstract

This paper examines issues related to playfulness, cuteness and the modeling of animal behaviors toward the designs of robotic art. Exploring historical and contemporary case studies of the playful ecology and creations of robotic art, as entry points to a multi-faceted discussion of human-machine engagements considering the lenses of philosophical, art historical and curatorial methodological research this text tracks an abbreviated legacy of new media art production beginning with the animal modeled works of Canadian artist Norman White.

In assessing characteristic features of a selection of robotic art works, such as its playfulness, use of humor, and critique/ reconfiguration of cuteness as a mode of critical engagement, this paper aims to unpack the motivations behind artist's aesthetically and behaviorally oriented merging of the nonhuman robot with lively, soft, emotive and fussy animal creatures.

Case studies of animal modeled robotics point to the accessibility of employing animal behaviors and their powers to engage with humans on a level that is productive and non-confrontational. Animal behaviors and zoomorphic aesthetics appear to appeal to audiences in a way that would not be possible for confrontational and/or anthropomorphic bots.

Keywords

Art, Robotics, Play, Animal, Nonhuman, Behavior, Cute, Kawaii, Media, Zoomorphic

Introduction: Modeling Animals

The lure of animal instinct appears to be an important consideration for the development of intelligent (or simulated intelligent) robotic creatures. Studying the behaviors and playful engagements of animals (like humans) provides robotic artists with a plethora of actions from which to draw and mimic in their development of whimsical behaving robot bodies. Animals, as the human other, present us with a counterpoint from which we can study robots as lively entities. I would like to begin this exploration with the work of Norman White whose *Ménage*, 1974, (fig. 1) combines the artist's interest in spontaneous chance interactions and the

behavioral study of the animal kingdom. *Ménage*, was an installation of five interactive robots that played and engaged with one another. The work was inspired by Grey Walter's experimental tortoises, which were some of the first electronic autonomous robots.

Walter's first set of robots, named Elmer and Elsie (fig. 2) were constructed between 1948 and 1949. The robots were oft described as tortoises due to their aesthetic appearance as tortoise-like beings as well as their slow rate of movement. The tortoises were developed to participate in a number of experiments that Walter conducted in order to study the ways in which the brain worked - through mechanical beings (Pickering 2010). One such experiment of Elmer and Elsie tested the robots' ability to become self-aware. Walter attached a light to the 'nose' of the tortoises and watched the robots as they observed themselves in a mirror. The bots flickered, jiggled and twitched like a 'clumsy Narcissus' according to Walter as he argued that the tortoises had displayed some evidence of being self-aware.

The interest in creating artificial life echoes far beyond Walter's tortoises as, according to Edward Shanken's study of the historical legacy of new media art, "in many cases, artists have attempted to bridge the apparent divide between carbon-based organisms and silicon forms of intelligence and life, between the real and the artificial, suggesting that these distinctions are becoming increasingly blurry and permeable" (Shanken 2009; 38).

White's *Ménage* follows in the footsteps of Walter's intelligent behaving robot creatures as he creates experimental works that explore the potential of animal behaviors in autonomous machines. Animal behaviors, like human's, are expressed through actions. Robert Fagen's canonical text on animal play divides these actions into five unique, though fuzzy, types of play engagement in which animals participate. The five types of play are; (1) Isolated play presented through repetitive

and brief movements, (2) non-contact solo play/social play of moving bodies through space, (3) social play (with or without contact) that involves chasing or sparring/wrestling, (4) complex social play that involves the inclusion of objects and features of the landscape and finally (5) mother-infant games such as peekaboo or building and breaking structures composed of smaller objects (Fagen 1981; Sutton-Smith 1997). He also asserts that only a small number of animal types have the capacity for play, “mammals and birds, and perhaps a few fish and reptiles are the only kinds of animals known to play” (Fagen 1995; 24). Their ability to play is expressed through “specific movement qualities and signal patterns” (Fagen 1995; 24) which enable us to visual see that they are playing. It is interesting to note that the robotics presented



Figure 1. Norman White with *Ménage*, 1974. Image courtesy of the artist

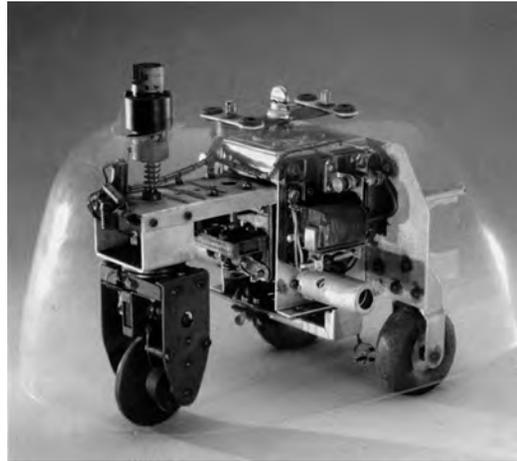


Figure 2. Grey Walter's Tortoise *Elsie*. Photo by Eric Long of the second generation Grey Walter turtle in the collection of the Smithsonian Institution

in this paper on modeling animals do in fact conform to Fagen's assertion that play is reserved to mammals, birds and a few fish and reptiles. None of the robotic creatures' animal models fall outside of these categories.

Let us turn back to the work of art in order to more fully understand Fagen modes of animal play as they relate to bot behaviors. *Ménage*'s five light-sensing robots played and engaged with one another through their sensory perceptions and programmed desires to interact. Four of the robots were mounted to ceiling tracks from which they could move back and forth around the room, across paths limited by the tracks. The fifth robot was positioned on the floor and could move around more freely. Each of the five creatures was equipped with a scanner that was able to sense strong light-sources and communicate the sense perceptions to a computer controlling the bots' behaviors. Each robot was also equipped with a spotlight mounted to their centre body. The robots would lock onto each other's 'gazes' as their spotlights would intersect and compel the bots to move together. The autonomy of the ceiling robots was somewhat compromised in that they could be controlled and pulled apart by non-responsive track-motors. The simplistic response and control systems of the robots created unique and complex behaviors amongst the creatures as they locked 'eyes', connected for a brief moment before being pulled apart and again

beginning their search for a new light source to capture their attention. The robots have a lively quality that pushes and pulls them to act, behave and play amongst one another.

Fagen's third form of animal behavior, that of social play, is echoed in the behaviors of the *Ménage* robots. As the robots chase one another around the room they seem to be modeling the behaviors of most primates and carnivores, pinnipeds, marsupials and some birds through their participation in the social play of chasing (Sutton-Smith 1997; 23). For Fagen, the characteristics of animal play, related to the social play interaction of chasing, are; repetition, reversal, fragmentation, exaggeration, inhibition and unpredictability. For Norman White, the unpredictability of the robots' playful interactions would likely be most important, however, the bots also participate in an engagement that is repetitive (through the ongoing quest to move towards one another), reversed (as their actions to draw together are denied by the track's integrated programming to pull them apart), fragmented (as their playful engagement may be interrupted by human interlopers), exaggerated (by their mechanical bodies as they whizz and whur around the gallery space) inhibited (by their programming to play above all else) and of course unpredictable as their multiplicity of possible movements and interactions make manifest the randomness of their performance. It is through the narrative of animal interaction that *Ménage's* performance is born. This is only one example of animal behaviors being presented in robotic art. I would like to continue this exploration of animal influence through a more specific lens - which I have observed is a reoccurring theme in robotic art and robotics in culture - that of 'cuteness'.

The Little Pygmalion: Cuteness as Critique

Following in legacy of Norman White's lively and interactive robotic beings Jim Pallas' *Nose Wazoo*, 1990, (fig. 3) appears as an object pulled from a children's novel. To quote Pallas' webpage from the *Nose Wazoo*, "in the Frankenstein myth, man created a being that destroys him. While the myth is often associated with technology, I'm more interested in Pygmalia who creates something to fall in love with." Looking at the five-foot tall furry creature it certainly appears as an object to love rather than fear. The *Nose Wazoo* is equipped with four photocell eyes and an infrared sensor enabling it to observe it's surrounding environment.

The creature seeks out and responds to humans as it flexes its long neck and extends its nose up to 20 inches towards a person as it attempts to nudge them to get some attention. Its lower body is covered in sisal fibers, beads and wires while its head, though also furry, is much more mechanical looking with the exception of a molded human nose at the tip of an extendable metal pole. The *Nose Wazoo* gathers viewers through its silly performances as it flings its body around with "back flips" and "floorscapes". Once it has gathered a crowd with its enchanting performance the creature will try to nudge humans nearby with its extendable nose. The *Nose Wazoo* is unexpectedly temperamental and can easily retreat from its peacocking display to sulk if it is teased by a human through an excess of stimuli. The *Nose Wazoo* is playful and engaging and can enthrall viewers through its seemingly humanistic and



Figure 3. Jim Pallas' *Nose Wazoo*, 1990. Image courtesy of the artist

lively behaviors. The creature is furry and fuzzy and in some way cute. According to zoologist Konrad Lorenz infantile or cute features trigger a nurturing response in adults, this is cross-cultural phenomena that is triggered by certain stereotypes of cuteness which include smallness and furriness.

I think it is important to note that these robotic creatures often take the role of prey as opposed to predator or cute

as opposed to frightening or unpleasant. Works such as the *Nose Wazoo*, and *Ménage* are non-confrontational, cute and even cowardly. These bots do not impose themselves of the viewer but are rather friendly bodies that enter in the sphere of liveliness in such a way as not to induce fear. Robotic art, in the survey presented thus far and to come, is allowed to become lively, behavioral, playful and agentic due to nonthreatening status. These bots are not threatening or scary like the vengeful and humanesque robots in films such as *I, Robot* (2004) and *Ex Machina* (2015). While the humanoid robot army in *I, Robot* and the intelligent Ava from *Ex Machina*, who appear to have minds of their own, present us with an image of robots as technological renditions of humans and thus, a threat to our own humanity, while cute and animalistic lively robotic art objects present us with a more palatable - though potentially as critical and subversive (see *Little Brother*) - form of artificial life and intelligence.

The smallness, cuteness and quaintness of whimsy are represented in the aesthetic and performative behaviors of the *Nose Wazoo*. Its mischievous movements draw the focus to endearing attempts to gain attention. The creature is lovable and sweet as it compels the viewer to engage and even nurture the misbehaving machine. Even the name *Nose Wazoo* triggers a sense of silliness for the human viewer.

Cuteness can also function as a mode of subversive activism in robotic art. *Pamphleteer aka "Little Brother"* (fig. 4) was a propaganda robot developed in 1998 by the Institute for Applied Autonomy (IAA). The adorable and small robot is a simplified creature constructed of metal with claw shaped 'hands' and large oval shaped 'eyes' that cover nearly the whole head of the bot. The *Little Brother's* limited features and solid square body make the robot appear as an even more streamline version of ASIMO. The robots massive sad eyes instill empathy in the viewer as they watch the cute robot distribute flyers to passersby. *Little Brother* capitalizes on its cute aesthetic in order to distribute various subversive propaganda literature to the public. Automating the oft dangerous act of activist campaigning and making the distributor adorable allows the bot to infiltrate spaces that would likely be inaccessible to humans. The robot has been sent out in various field tests and the viewer responses have nearly unanimously attributed the robots cuteness to its ability to act in a subversive and critical manner without a negative response. The bot, who has

also been adopted as the IAA's spokesman, is able to veil its cultural and social criticisms underneath its nonthreatening aesthetic. In this case the cuteness of the bot enables it to stealthily enter into a minefield of social criticism relatively unscathed.



Figure 4. Institute for Applied Autonomy, *Little Brother*, 1998. Image courtesy of the IAA

How are cute things such as *Little Brother* able to navigate social spheres and interface with humans while enabling us to more easily adopt autonomous robots? I would like to explore the Japanese phenomena of *Kawaii*; a tool used to soften the hardness of Japanese technological culture with the cuteness of kitties, bears and puppies and their large heart-melting eyes and rosy cheeks. "The Japanese style of 'Kawaii' embodies a special kind of cute design that could be used to inform designers of interactive media how to engage users in a way which reduces fear and makes dreary information more acceptable and appealing. An analogy could be thought of as the bitter pill with a flavored layer that makes the consumption of the medicine more agreeable" (Cheok 2010; 299). The analogy of a bitter pill can also be applied to the 'cute' robotic works I have previously mentioned. For example, *Little Brother* is a confrontational activist who assaults humans with controversial views on social and cultural climates by offering them pamphlets. Though his social and political criticisms remain veiled underneath the sweet 'flavored layer' of the bot's sweet and adorable aesthetic. Adrian Cheok expands upon this analogy to address a parallel between the "cold, digital, electronic, and unsettling internal components of a system and the bitter pill" while on the other hand "the 'flavored coating' is the cute user interface, which is made more agreeable by establishing

a relationship with the user and delivering the content of a system in a more friendly and attractive way” (Cheok 2010; 299). Therefore, the content, or message, communicated by the work of art is softened and made more palatable for the human spectator. Reducing fear and apprehension towards new technologies and the insinuated terror of autonomous robots or artificial life these bots enter the human realm by means of their innocence.

Robotic art may also fall under the category of Kawaii due to the fact that the viewer is oft presented with a ‘trick’ or surprise. Interactivity is essential to Kawaii as the surprise presented “to the user plants the initial emotion through which the continuing experience is colored,” which, beings the ‘micro-relationship’ between user and object. (Cheok 2010; 300). Creatures such as the *Nose Wazoo* present the viewer with an interactive surprise in the form of the object’s performativity and its quest to reach out and tap human’s with its extendable nose. This micro-relationship is a short lived superficial relationship between the cute object or creature and the human. It is likely not lasting, and may lack critical depth, however it may be extremely impactful as a memory, a mode of provoking thought or a highly emotional and possibly even loving engagement.

For Kawaii, and cuteness more generally, the defining characteristics of the aforementioned creatures are “the feelings and emotions that are caused by experiencing something that is charming, cheerful, happy, funny, or something that is very sweet innocent or pure. It can stimulate a feeling of adoration, sympathy, or stimulating the care response” (Cheok 2010; 301).

An example of this more visceral emotive connection to cute robotics is Cynthia Breazeal absolutely adorable social bot *Leonardo* (fig. 5). Breazeal’s work on social robots with the MIT lab has brought forth a number of cute and interactive robot creatures such as *Kismet*, the world’s first social robot. However, it seems to me that the robotic creation able to steal the most hearts is undoubtedly *Leo*. *Leonardo* is a 2.5 foot tall, highly expressive sensing and interactive robot. He is highly responsive to environmental cues and can be taught to mimic human reactions, responses and feelings. He is able to reflect our emotions and console through mimicry. *Leonardo*’s soft fur, small stature, large brown eyes and big floppy ears make him a symbol of cuteness that appeals to human’s desires and embedded emotional responses. Leo is cute and kawaii which enables him to

act as a what Breazeal describes as a ‘social robot’. For her, robots can be used as tools for social technology, as companions, friends, pets, etc. that aid in human’s social interactions with the world.



Figure 5. Cynthia Breazeal and the MIT Lab, *Leonardo*, 2002. Image courtesy of the artist

I will draw upon one final example of cute robotics, this one more exposed hardware than soft fuzzy fur.

Imagine a small autonomous robot with light sensors - symbolizing ‘eyes’ - attached to gangly protruding wires that bobble around atop its body. The creature zooms around the hardwood floor of an art gallery; it is part of an experimental test project, which features a set of eight autonomous interactive sensing robots with the ability to “explore simple behavioral rule systems in an embodied context” (Daniels 2015). This is *Whimsy*, 2007, (fig. 6) by Canadian artist Steve Daniels.

The material and electronic setup of the project is as follows: the robots, or ‘whimsies’, are equipped with sensory-actuator routing rules and real-time feedback systems controlled by visual sensors attached to the body of the machine using wobbly lengths of metal - different heights on each individual bot - that extend the visual sensors, or ‘eyes’, out above the bots. Aesthetically the whimsies can be regarded as simplistic DIY constructions in that they celebrate the hand-made nature of the machine through exposed hardware components such as circuitry and a heaping bunch of multicolored wires housed inside a wooden construction. The scale of the robots is friendly; reaching only slightly

higher than the viewers' ankles. During the experiment they are unleashed into a large open space where they are able to move around and interact with one another as their sensual data is transformed into real-time action. Their movements, controlled by sensory motivated routing rules, can be interrupted or rerouted based upon their relations.

The foregrounding of the *Whimsy* bots' eyes draws attention to the fact that Daniels's robots are programmed to see. They are small, quaint and interactive and appear to function in their own network of interactivity. We can observe the bots from outside, as opposed to directly interacting with them, and still find fascination and an emotional connection through their smallness, persistence and silly mechanical eyes bobbing around atop their tiny bodies.

To return to Fagen's analysis of animals' modes of play, Daniels' *Whimsy* bots seem to exhibit two of the actions of play. Firstly, non-contact solo play/social play of moving bodies through space and secondly, social play (with or without contact) that involves chasing or sparring/ wrestling.

These are not the cold, clean humanoid robots of our cinematic nightmares. Rather, they are silly, cute, and playful. Exploring this constellation of cute robots I wonder how can cuteness be used as a tool of manipulation? In the context of artistic production.

Conclusion: Unruly Artificial Animals

Robotic art, and often new media art more generally, faces inherent problems of display such as the stranding of such work onto the peripheral spaces of the gallery and a separation of 'Art' from 'new media art'. The potentially unruly, animalistic, behaving creatures threaten to break free from the more traditional modern white cube and explore the wilderness of interactivity, liveliness and play. As Christiane Paul notes the segregation of new media art to exterior zones such as 'new media spaces' or 'lounges' oft provokes a "'ghettoization' - contributing to the separation of the art form from more traditional media and epitomizing the un - easy relationship that institutions tend to have with the medium at this point in time" (Paul 2012; 170). We can continue to question the space of new media as it grows ever-more complicated with the production of new work continuing the legacies of participatory, evocative, playful and behaving creatures that are literally and figuratively hard to pin down. In doing so let us develop spaces for robots that are inherently lively and engaging; they may be cute,

sweet, human or animal though they consistently appear as vivacious, engaging and animated. In order to create such spaces for robotic art let us consider the behavioral aspects of such creatures in an attempt to comprehend their essence and experience of the world apart from human beings.



Figure 6. Steve Daniels' *Whimsy* playing with a baby, 2007. Image courtesy of the artist

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Author Biography

Treva Pullen is an interdisciplinary researcher, curator, artist and PhD candidate in Communication Studies at Concordia University, Montréal, Canada. Her research explores the playful and agentic capacities of media art through the lens of 'whimsical bodies'; a term she uses as an evocative metaphor for the lively, humorous and often reciprocally engaging nature of media art objects. Her doctoral studies merge critical theory and curatorial practice based research to explore methods of display for the whimsical bodies presented through bio art; facilitating human nonhuman engagements/learning, and unpacking feminist maker methodologies enacted in bioart laboratories.

Her work has been published in *The Senses & Society*, *InterARTive*, *JAWS* and *AlterNative: An International Journal of Indigenous Peoples*. She has also curated new media based exhibitions such as *#NATURE* (2016) and *Influenc(Ed.) Machines* (2015).

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The Return of Wonder: Speculative Robotics and Re-enchanting the Machine

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Abstract

This paper tracks the critique/reconfiguration of wonder as a mode of critical engagement, with our contemporary condition and the current philosophical paradigm shift towards theorizing the nonhuman; a resurgence in speculative wonder. Comparing the aesthetic language and actions of the Steve Daniels' robotic art work *Device for the Elimination of Wonder*, 2015, this text unpacks the historical shift from enchantment during the pre-Enlightenment period towards the post-Enlightenment disenchantment of magic, wonder and speculative fiction. Employing Daniels' *Device* as a metaphor for an evolution of theory this text draws comparisons between contemporary philosophical trends and the lively, expressive and whimsical creations of robotic art.

Keywords

Wonder, enchantment, Robotics, Speculative Philosophy, Enlightenment, Metamodern, Art, Lively.

Introduction

A slow, sedimentary meditation on measurement, data and documentation; this was the inspiration behind Steve Daniels' creation of the *Device for the Elimination of Wonder*, 2015, (fig. 1) hereon referred to as *Device*. The object is mechanical. Its cogs twist and turn as it is driven back and forth across a wire tightrope held at roughly torso level. A length of paper folds and snakes out of the machine before puddling on the floor beneath the device. The object is meditative; the slow and monotonous movements of its measurements hypnotize the viewer. *Device's* mechanical arm swings forward and back holding a pencil, which marks the paper spool with lines of varying densities that represent its measured distance from the ground. A mass of drawing begins to form under the machine.

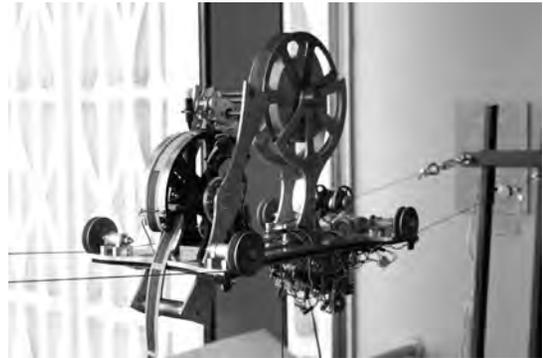


Figure 1. Steve Daniels, *Device for the Elimination of Wonder*, 2015. Image courtesy of the artist

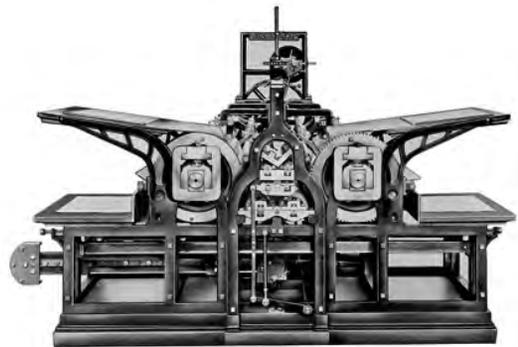


Figure 2. Koenig's 1814 steam-powered printing press

Device collects data through its calculated movements and diligent measurements of the environment. The entire *Device* drives itself along two parallel wires that suspend its body. When it reaches a randomized location on the wires it stops and a bob is lowered to measure the distance between its frame and its environment. The metal bob attached to the trunk of *Device* descends

toward the floor before being stopped by the detection of material. Initially this will be the floor. However, over time, as *Device*'s measurements are recorded and expelled by the machine, as paper accumulates on the floor, the distance between the ground and the machine will be gradually altered. Each new recording of data will transform the next. As paper rolls out of the machine's body and forms into a pile on the floor it will sense that its distance to the ground is diminished. This change will not be quick. It will occur slowly as the machine methodically draws and accumulates new data.

Device emulates the aesthetics of 19th century industrial machinery. The large metal structure and exposed cogs of both gold and silver hued material move and work together through onerous mechanical movements. The strain of the machine is apparent with each rotation of its drawing arm. The labored automatism invoked in the object's design is reminiscent of the Industrial Revolution. *Device*'s turning mechanical wheels and process of continuous printing parallel the industrial printing press, an object synonymous with the Enlightenment era and the demystification of the medieval epistemology in favor of rational and critical thought. In a sense, one can see elements of Koenig's 1814 steam-powered printing press (fig. 2) reflected in *Device*, with the metallic cogs, curving metal forms, and the long sensually curved gilded bob harkening to a 19th century-aesthetic (fig. 3). This allusion to the period is also indicated in the title of Daniel's work - '*The Elimination of Wonder*' -, referring to the kind of demystification or disenchantment often associated with the changes brought about by the mechanical revolution and mass production of the printing press. However, *Device* not only emulates but also seemingly critiques the 19th century elimination of wonder. As information became increasingly more accessible and the mechanical infrastructure began to regulate society, the medieval period's seal of mystique was broken and it is the sobering effects of this change that Daniels' work seems to point out.



Figure 3. Gilded bob. Steve Daniels, *Device for the Elimination of Wonder*, 2015. Image courtesy of the artist

The disenchantment that culminated in the 19th century is written about extensively. Much scholarship has been dedicated to understanding the processes that eliminated wonder during the period (Weber 1958; Foucault 1971; Bennett 2001). This body of writing also questions our current status as a society: are we maintaining the rigorous critical lens of modernity or is this framework slowly dissolving to make way for a re-enchantment that may still comply with modern rationality by celebrating a new type of 'secular magic' (Landy and Saler 2009)? I will return to this question later but first it might help to address the drastic social and cultural paradigm shift that occurred between the medieval period and the Industrial Revolution. In *The Order of Things*, Michel Foucault traces the differences between the epistemological assumptions of the Western world prior to the Scientific Revolution and our modern modes of thought. For Foucault, the cultural climate of the 16th century was marked by intellectual and artistic investments in the resemblance and similitude among things (making illusion and metaphor central to expression) - as opposed to the post-revolutionary interests in difference, exactitude, measurement, and classification. Magic and metaphysics were valid lenses of inquiry into phenomena as were the influences believed to stem from (far-from-epistemological) celestial bodies such as the planets and stars. Sixteenth-century knowledge, for Foucault, "condemned itself to never knowing anything but the same thing, and to knowing that thing only at the unattainable end of an endless journey" (Foucault 1971; 34). While there was room for rational thought, it was seen at the same level of importance as the supernatural; and consequently,

knowledge was not made concrete, defined, structurally sound, or classifiable: “sixteenth-century learning was made up of an unstable mixture of rational knowledge, notions derived from magical practices, and a whole cultural heritage whose power and authority had been vastly increased by the rediscovery of Greek and Roman authors,” (Foucault 1971; 35). The Scientific Revolution and “the Age of Reason” disrupted these more ‘unstable’ modes of thought in favor of systematic modes of organization, leaving their charms and fantasies behind to prioritize difference over similitude.

The Medieval period is oft characterized by its interest in games, fables, magic and overall a sense of whimsical enchantment that was woven through the cultural essence. This particular quality was inherent due to the fact that Church and Nobility, whose word was taken as unquestioned truth, regulated society. This created a cultural climate that valued fable, mystery and superstition, and has therefore been often viewed as a period of ignorance amongst the greater public. While this description of the period might be myopic in certain aspects, it nevertheless serves as an entry point to understanding modernity (from the perspectives of its most common place critiques) as the highly rational and “disenchanted” period that followed. The Renaissance and Enlightenment period saw the movement towards rational scientific critique, which expanded into the Industrial Revolution when disenchantment took full hold on society. Secularization and the decline of magic from the end of the medieval period were primary sources of this change. As scholar Max Weber has noted, secularization, rationalities of science, bureaucracy, and the law and policy-making all contributed to this decline of speculative mystical thinking.

This modernist movement towards disenchantment - debunking of myths, negation of magic and deflation of similitudes - is echoed in the monotonous and methodical operations performed by *Device*. Aesthetically, the object makes reference to the period of the industrial revolution; specifically equipment-heavy and cumbersome mechanics. As a performative self-regulating being *Device* is able to eliminate wonder through its painstaking rigorous measurements and, like the disenchanting modernist movement, emphasizes the notion that everything can and should be quantified. While the machine seeks to eliminate wonder, its own regulatory processes project the image of a self-sustained mechanical being that has a whimsical or

perhaps even enchanted quality as it observes and responds to its reality. This quality is generated by the machine’s evocation of being an intelligent robot, lost in its own thoughts, which frames its actions not as mechanical operations but as lively traits of expression; the expressive flow of matter (Deleuze & Guattari 1987).

Traits of Expression

If the goal of the machine is to eliminate wonder by methodically measuring its surroundings, does it succeed? And for whom is the wonder being eliminated? We may believe that the machine’s boundaries of existence are visible to us as humans; however, we do not know the perspective of a being other than our own. We can only speculate upon *Device*’s experience of the world around it, which it attempts to communicate through a stream of drawings cataloguing data in a language written by the machine. We may ask, what does the machine express to us? And how are these traits of expression constitutive of our own sense of self as we watch the self-sufficient machine perform the disenchanting and monotonous task of measuring and recording data?

Device takes on the quality of a sentient creature with its lively, responsive, self-sustaining mode of existence. It is fascinating to watch the machine’s curious and quizzical behaviors. As it comes to life and then records its interactions, the machine becomes a cybernetic system. In comparison to a human body, which is controlled by a number of cybernetic regulatory systems that sustain breathing, cognition and movement, the *Device* is propelled and regulated by a simplified systemic form. The system that sustains *Device* begins with its initial measurement of the distance between its *torso* and the floor. As it measures and records this data through a minimalist line-based drawing and expels it towards the floor, (fig. 4) *Device* begins to change its own surroundings. This requires a new measurement between its body and the floor as they grow closer together with the expanding pile of paper. Control and communication of the machine are regulated by its internal structures; its programmed desire to measure. It has been created to act as a quizzical and curious entity that observes and interacts with its environment through a particular methodology of measuring and recording data. In other words, it acts and engages with the world through a specific type of access to being. The construction of its body and its software programming serve a specific purpose and circular logic.

The sound of the machine as it whirs slowly across the metal wires which support it, offer the sense that the machine is purposeful and determined. The clicking sounds of struggle expelled by the large cog that rotates the pencil across paper communicate the machine's commitment to the task of measuring its surroundings. With each new measurement it is as if the 'proud' machine expels its drawings before returning to check its data one more time, and then one more time as the growing pile of paper keeps altering the environment. The tedious process goes on until the machine is finally shut off.

The work invites the viewer to imagine the machine's motivation as it returns to the spot from which it initially recorded data to check its reading before retiring. *Device* methodically lowers its bob to check its measurement and to its surprise, the environment has shifted! This imagination animates the machine; increasingly, it looks like a be-wildered scientist lost in her own calculations and questions: have I moved closer to the ground or has the ground moved closer to me? *Device*, perhaps not knowing how to respond, continues its cycle of recording in order to catalogue its experience of the world around it. Though the scope of the machine's observation is limited, its ambition to collect data and catalogue its experience is strong. Its thirst for measurement will never be satiated as each measurement necessitates the next.

On a macrocosmic scale we can understand the *Device* as expressing some form of agency through its traits of expression; Deleuze and Guattari's preoccupation with metal's expressive traits stem from their interest in Gottfried Wilhelm Leibniz's monadology and discussion of substances. Leibniz's theory of monads, his best-known contribution to metaphysics, offers a definition for substance. Monads are elementary particles, the fundamental elements of the universe, which are not fully apparent or accessible to one another. They are eternal, indecomposable, individual, subject to their own laws, and uninteracting; each reflects the entire



Figure 4. Pencil and line drawing. Steve Daniels, *Device for the Elimination of Wonder*, 2015. Image courtesy of the artist

universe in harmony. Leibniz asserts that monads are centers of force - or substance - as opposed to space, matter, and motion, which are only phenomenal. The monads are not linked to or reserved for our sensory perception of the world around us. We cannot see, smell, taste, or touch monads - they exist without being perceptible to us. The monad is invisible and indivisible; it has no parts and is not located in a particular visible aspect of matter.

Now let us return to Deleuze and the undulating flowing matter-body as it unfolds its traits of expression in order to explore the self-contained monad as the fractal elements of the universe in all their complex relations. In his last major work *The Fold*, Deleuze foregrounds Leibniz's fractured universe of monads as they weave and fold amongst one another. This baroque conception of matter - characterized by the billowing layers and folds of baroque fabrics, and designs composed of smaller and smaller parts that spiral on infinitesimally - illustrates the flowing body as it changes states and traits of expression (Deleuze 1993). According to Deleuze's reading, "Leibniz's most famous proposition is that every soul or subject (monad) is completely closed, windowless and doorless, and contains the whole world in its darkest depths, while also illuminating some little portion of that world, each monad, a different portion. So the world is enfolded in each soul, but differently, because each illuminates only one little aspect of the overall folding" (Deleuze 1990; 157). While a monad may be pregnant with a multiplicity of expressive traits only a number of such traits may be actualized or 'illuminated' at a given time. Like the metal in its

soft liquid state, compared to that same metal hardened and formed into a sword, the monad (that represents all things in itself) may only be actualized in a particular form at a time. The infinite unfolding of the monad and its complex wealth of traits spill out and hug in to the compressed bodies of time and space. Each holding a self-sustained universe. A single self-sustaining thing. A closed system that can open its self-up at will.

Programmed Desires

In a sense, *Device* operates inside a closed system. It exists for, and is informed by, its own programmed desire to measure and record its environment. While it measures it also shapes its own experience without the provocation or necessity of any outside forces to interfere upon it. *Device* participates in its own closed network, thus the machine is autopoietic. Autopoietic machines are generative. The machine is able to reproduce itself. Their reproduction - of their own conditions, expressions, and materiality - transcends their original construction at the hands of a human agent (or maker). Autopoietic machines are closed, self-regulating systems that continuously spawn and specify their own bodies in an endless loop of creation; such as a living cell that produces its own components, continuously using them to manufacture more. The piling paper, which influences *Device's* operation, has a determining power on the next components that it will produce. For primary autopoiesis scholar Humberto R. Maturana and his collaborator Francisco J. Varela, an important characteristic of the autopoietic machine is that it produces and is affected by its construction. They also tell us that autopoietic machines are autonomous, as they function independently of intervening relations; they are self-contained and monadic yet they are unities, because they operate within their own constructed boundaries in a processes of self-reproduction, and finally they are constant in their self-regulating actions.

Device's physical being and the autopoietic system that self-regulates its actions limit the machine's engagements with its environment. It becomes bound and confined to its own impulse to measure and record. However, considering that its desires are programmed adds another element (a two-tier problem) to its construction. On one hand, the machine is a product of human design, in this case the artist Steve Daniels, which potentially implicates him in the system and troubles *Device's* self-contained appearance if not the

word desire itself. On the other hand, the notion of desire is often characterized in ways that are specific to human emotive and cognitive capacities. Can we speculate that perhaps the machine is compelled by a desire, which we can define in this case as the motivation to perform a specific task - that of measuring and recording - that it will continue to follow until it is somehow stopped by interference in the closed system? Is this a whimsical and wondrous though, or a jumping off point for theory?

The Beginning and End of Wonder

Wonder can be characterized in a multitude of ways; however, I would like to be specific in categorizing my understanding of the phenomenon. Wonder is a feeling of uncertainty or questioning that is incurred when confronted by an engaging thing. For Whitehead "If philosophy begins in wonder and ends in wonder then... its aim should be not to deduce and impose cognitive norms, or concepts of understanding, but rather to make us more fully aware of how reality escapes and upsets these norms" (Shaviri 2011; 67).

While some may consider the banal processes of measurement to be the antithesis of liveliness or agency, the object's apparent struggle provides the viewer with a feeling of empathy that grants a lively quality to the object. While the task performed by the object is uninspiring, the drawings it produces, the method by which it categorizes its environment, and the uncanny quality presented by a behaving machine all point to a wondrous inner life of the object. The object is engaged in an act of play with its components and the environment, through measurement, and with others through its physical movements and performativity in front of the viewer. The object expresses individual traits as it engages in the activity of measuring its surroundings from a particular vantage point and embodied experience of the world around it. The act of measuring is recreational in this instance in that it technically does not serve a serious or practical purpose - such as measuring the distance of a body of land in order to allocate its resources to a particular individual. This gives the actions of the robot an element of play, however banal we may consider it, and represents a whimsical quality within the machine. The quizzical being is obsessed with the play of collecting data. *Device* is interested in the site that it inhabits and uses its embodied actions of play - buzzing about on suspended wires, dropping a bob to measure its environment and sketching the data that it

collects - creating a visual narrative of experience for the viewer. A viewer can observe that the object is fixed within a system of behaviors that dictate its experience of the world insofar as there exist no outside forces to affect the object's life.

A World without Us

It is nearing the end of the day for the many employees, gallery attendants, janitors, monitors and security guards working at the Museum of Vancouver. Only a handful of visitors remain in the museum aside from all of the workforce who are required to remain in the museum until all of the lights have been turned off and the doors locked. The room that has become home to *Device for the Elimination of Wonder* is deserted. The gallery goers have all made their way towards the exit and are in the process of picking up their parcels and coats. So what is taking place inside the museum, apart from human interaction or spectatorship? We can imagine quite definitively that *Device* is still performing. It continues to struggle and strain across the parallel cables that suspend it in air inside the gallery. It continues to measure its environment. And it continues to draw line images representing data it collects as it acts and interacts with the space around it. Shaviri's reading of Eugene Thacker's nihilistic and pessimistic philosophy stipulates that "it is not enough to just consider the (objective) world-in-itself in its difference from the (subjective) world-for-us. We must also actively explore what Thacker calls the world-without-us: the world insofar as it is subtracted from, and not amenable to, our own concerns. We learn about the world-for-us through introspection and the world-in-itself through scientific experimentation. But we can only encounter the world-without-us obliquely, through the paradoxical movement of speculation" (Shaviri 2011; 67). Considering Thacker's view of the nonhuman perspective we can posit the experience and existence of *Device* whether we are standing in a room with it or we imagine its continued existence without us - with the underlying implication that while this object might have been created by humans it is already also entangled within a web of other, nonhuman factors that impart upon its existence.

How does the object exist outside of human interference? The object exists to perform a task that has been encoded into its behavioral system. *Device's* purpose, outside of the human and for itself, is the quantification and collection of data. We can "obliquely" read the

goal of the machine to pose a philosophical question that will pertain to both the human and nonhuman. What does the quantization or categorization of the machine's experience have to do with our understanding of history or temporality in an increasingly digitized age? As the past is virtualized, history is converted into material (or immaterial data) that is read and experienced by computational technologies - as opposed to the written word which is understood and relayed by humans - "erasing the material and cultural differences that constitute the differential rhythms of temporal experience" (Munster 2006; 94). As computational technologies proliferate and information is translated to computer-based communication through programming languages, which are designed specifically to prioritize objects such as object-oriented-programming (OOP), it may become easier for us to consider an existence outside of the world-for-us model problematized by Shaviri and Thacker. *Device's* physical production of drawings, which may mean more to it than to us, and function as a catalogue of experience, can perhaps draw us closer to understanding that there exists an ontology outside of our own.

The knowledge of nonhuman agency can enable us to develop a curatorial methodology, which considers robotics as evocative (and lively) entities and acknowledges their repetition, habits and behaviors. The activation of the object's functioning and their scope of opportunity and action may be used as a method of inquiry to explore human/ nonhuman relations through Speculative Realism. This method might also find application outside the curatorial discipline, with robotics being employed as an accessible access point to consider ethical, environmental, aesthetic, and political implications of our human-centrism. Sherry Turkle describes the computational object as evocative due to its ability to raise new awareness about the potential of aliveness in nonhuman beings (Turkle 1984). Using the example of a children's fascination with behaving objects such as robots, we can employ this methodology as an entry point to posit the agency of objects that do not always express themselves in ways that are obviously legible to us as lively behavior.

Re-Enchanting the Machine

Where does this leave us in relationship to disenchantment and the 'elimination of wonder'? Through the elimination of enchantment during the Industrial

Revolution we were left the modernist celebration of industry, rationality and grand narratives. Post-modernism saw the dismantlement of unified narratives in favor of pluralism and incompleteness; celebrating irony and social/political criticism. Today, have we seen a return to wonder? In relationship to modernism, post-modernism and the illusive post-post-modernist (any many other sub-categorical) movements where do we stand? Though there is little literature exploring the ‘metamodern’ era I would like to propose this as one possible movement that could explain, and be used to explore, our contemporary condition. In the Metamodern Manifesto of 2011 Luke Turner proposes that the metamodern is: “the mercurial condition between and beyond irony and sincerity, naivety and knowingness, relativism and truth, optimism and doubt, in pursuit of a plurality of disparate and elusive horizons” (Turner 2011). So what lies between irony and sincerity, naivety and knowingness, relativism and truth, optimism and doubt? I am interested in this ‘inbetweenness’ in relationship to the robotic objects presented in this thesis and my probing into the question of wonderment.

The metamodern condition celebrates simultaneity and the adoption of lenses that may criss cross, mingle and diverge in certain instances but can still be held in unison. A ‘making messy’ or troubling that is echoed in both generative methods such as Donna Harway’s staying with the trouble and harmful paradigm shifts such as the turn to ‘post-truth’ politics. In oscillating between perspectives in a liminal space these human and nonhuman, animal and mechanical, cold and biological, lively and robotic mechanisms may be celebrated for their reintroduction of wonder; a re-enchantment of the machine. In this instance art can be magical relief, wondrous future proposition or unbounded critique of our contemporary moment. Through *Device* I hope to have tracked a simplified narrative of major cultural shifts in the Western world that may allow us to point to the future through speculation. A speculation that is equipped with fantasy and wonder and a troubled sense of our present moment.

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Author Biography

Treva Pullen is an interdisciplinary researcher, curator, artist and PhD candidate in Communication Studies at Concordia University, Montréal, Canada. Her research explores the playful and agentic capacities of media art through the lens of ‘whimsical bodies’; a term she uses as an evocative metaphor for the lively, humorous and often reciprocally engaging nature of media art objects. Her doctoral studies merge critical theory and curatorial practice based research to explore methods of display for the whimsical bodies presented through bio art;

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Her work has been published in *The Senses & Society*, *InterARTive*, *JAWS* and *AlterNative: An International Journal of Indigenous Peoples*. She has also curated new media based exhibitions such as *#NATURE* (2016) and *Influenc(Ed.) Machines* (2015).

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Visualization of Climate Change in Internet

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Abstract

The *Climate Change* is a concept (CC) that has been changing in order determined by the incorporation of new knowledge and scientist evidence around it. Looking for effects mitigation in quality of human beings several efforts at an international cooperation scale have been made specially within the United Nations agenda. From the communication point of view, in Internet circulate many documents, pictures, drawings, infographics and simulations that represent such a problem in different grades of complexities in its accessibility. *Visualization* also is an emergent concept that has been defining its frontiers according to advances in representational computer processing of *big data* from reality combined to the necessity to understand it. This situation applied to any discipline brings about two regular study approaches: a didactic and an analytical one. So, this paper presents a methodology based on diverse artwork that traces organizational changes in the Intergovernmental Panel for Climate Change (IPCC) in up to now five informs emitted in Internet. In this way is possible to project a future scenario for visual representations and policies actions concerning CC communications.

Keywords

Visualization, Climate Change, Cybernetic Image, Digital Art, Science Communication, Sociocomplexity.

Introduction

The CC is a planetarium phenomenon which affects all living beings. If it is true that involved changes are measure in geological ages, science verify gradually more accurately that the main reason in this era is due to technological uses and its natural fossil fuel burning to sustain human society.

As well, to keep life of 7000 million human imply a massive production of food and services that exhaust and pollute finite natural reserves. [1] The CC is a concept that has come to problematize the mankind future.

Before such a big data on this issue it is an adventure to say that through art images situated in Internet is possible to interpret this sociocomplexity.

This happen around the cybernetic theory through we observe organization of knowledge and art as a form of reflexive communication.

As we'll see, visual art gives us synthetic information to visualize communicative momentums of international science organizational evolution around the CC.

Climatic Visualization

Various authors speak about images: Serge Gruzinski registers their strength to convey ideology, especially in a doctrinal way in the conquest of the indigenous America (Gruzinski, 2003); Regis Debray philosophizes on its history depending on the technical development of communication (Debray, 1994); Román Gubern immerses into the psyche perception qualities (Gubern, 2006); likewise, Ernst Gombrich finds in the art work an indicator of uses and customs of the time in encloses (Gombrich, 2003).

To mention apart is the Vilém Flusser (Flusser, 2011) ideas to understand images in a cybernetic form. He observes how it is projected through them society and foresees a future of images produced and governed by circumstance and probability.

However, the closest forerunner of visualization field is recognized in Edward Tufte (Tufte, 1990), a statistician figure that found in the image the power to represent complex data clearly. Together with the computer technics to produce and distribute images, funded the *visual design* studies. For, this capacity they should make abstract ideas visible or understandable, become didactical and analytical (Ballantyne, Wibeck, & Neset, 2016).

Within the academic transdisciplinary tendency, *climatic visualization* is understood as "research interactive platforms that use computer graphics to create visual images of the causes and effects of climate change and its options of mitigation and adaptation" (Wilbeck, Neset, & Linnér, 2013, p. 5).

In a more specific mode, different studies focusing on the interaction between gadgets and humans have been carried in Europe and in the US to sustain science teaching (Wilbeck, Neset, & Linnér, 2013); (Gilbert, 2008) and science popularization (Nicholson-Cole, 2005) to have an impact in program universities and persuasive public policies on cultural change (Moser, 2010).

In some of this scopes, are pointed out certain prevalent images related with CC (polar bears, submerged statues, catastrophic scenarios that are indicative of a cultural environment in a form of signs called metaphors (Ballantyne, Wibeck, & Neset, 2016). This kind of communication is valid for art as content to work with.

Searching form

In cybernetics words, here we talk about a third observation level. That's why we have two objects to observe: one, is the selected artwork which is regarded as a paralinguage that condense predominant ideas based on its circulation and recursion force (*clichés*); the second one, is the selected organization of the IPCC and its issues in science knowledge that produce communication.

This paper recognizes images and its circulation a data quality condition to explain a model about communication in Internet, applied to CC.

Following the same logic, the ideas circulate, stay and transform just as the “ecological” conditions may allow communication. Today, most of the social reproduction of signs happen in Internet, so the analytical nucleus is constituted by the way databased are organized and read.

[...] the very meaning of “survival” becomes different when we stop talking about the survival of something bounded by the skin and start to think of the survival of the system of ideas in circuit. [...] ideas, under further transformations, may go on out in the world in books or works of art”. (Bateson, 1987, p. 467)

Apparently, what here is presented as a paradox, indeed is the contingency selection capacity of any system before the disturbances of its own environment to cope with. In the field of Luhmann ideas, science knowledge couple with art-work to innovate selfprogramming. “The ‘essence’ of art is the self-programming of the artwork” (Luhmann, 2000, p. 204).

Art exists not only because of that; rather, it is confirmed the identity of art. And this give information to explain it as a phenomenon -in a cybernetic scope- in

the form of relationships among data.

Further, with this observation level, we introduce a reflection operation to the system, for “without context, there is not communication.” (Bateson, 1987, p. 410). It means to “map” those connections through “the propositional or informational aspect of the events and objects in the natural world” to give sense to organization (Bateson, 1987, p. 409).

So, at first place we look at the artist who observe the world and to himself (first-second order observation); and secondly, us who observe their communications as reflections of IPCC emitted scientific communications.

This third cybernetic observation level allow us to watch for models: a research model. Namely, to recognize those regularities (iterations) that mark changes in time of any organization (IPCC).

The next figures illustrate in a concise manner the last ideas: a cornerstone warning idea in newspaper set the statistical graphic as the main medium to represent scientific data of the phenomenon on CC (figure 1a). Through time this same idea is reproduced and actualized by artwork (figure 1b).

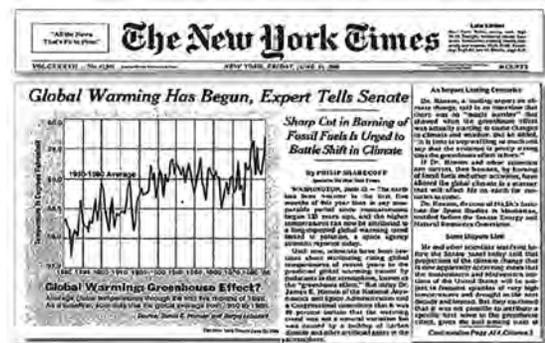


Figure 1a. Iconic testimony of Dr. James Hansen before United States Congress concerning CC, 1988. Retrieved from <http://www.ucsusa.org/sites/default/files/legacy/images/2015/06/gw-graphic-new-york-times-1988-hansen-testimony-front-page.jpg>



Figure 1b. *Landscape of Change*. Jill Pelto, 2016

Ecological Patterns

As just said, cybernetic images are considered circulating messages that set circuits. The iteration -redundancy- of images are forms which produce sense; they evolve as are informed with new knowledge or interactions.

In this context, images are indicators -sign marks- depending of its condensation gradient value. Specifically, trough variation, images accumulate communication capacity, in this case from a scientific vision of nature

The starting point of this research is to identify a meaning pattern. In redundancy terms (signal/noise) there are repetitive images in the “discursive universe” of Internet that produce a sense (Bateson, 1987, pp. 419-425). Therefore, the metaphorical contents are chosen from a cybernetic position.

Then, this patterning based on artwork (as a transit of iconic to metaphorical messages on ecological issues) is expected to reflect an “information economy” (Bateson, 1987, p. 467) of CC thematic issued by IPCC that represent a sense of organization change in its own communicative policy.

The unit of survival is *organism plus environment*.

We are learning by bitter experience that the organism which destroys its environment destroys itself. [...] If, now, we correct the Darwinian unit of survival to include the environment and the interaction between organism and environment, a very strange and surprising identity emerges: the unit of evolutionary survival turns out to be identical with the unit of mind (Bateson, 1987, p. 489).

A unity identified in actual interdisciplinary collaboration among media artists with science and consequently, showing the need to explore new

methodological approaches to innovate meaningful tasks for joint research (Forbes, 2015).

Communicative States of IPCC

As an application of this kind of ideas, a preview of methodological classification envisions three states: one, of transition set in the middle of two stables. We call the first, *em-bryonic*, when in 1998 IPCC was founded; and in the opposite extreme, the *cybernetic*, started in 2013-14 through 2022. It is a projected scenario derived from the evolution of technical images observed in Internet (figure 2).

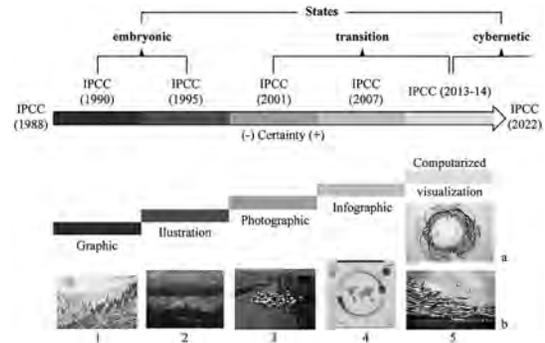


Figure 2. Events sequence. Own source

Briefly, these three evolutionary states are distinguished from the assumption that organizations learn from reflection in different “loops” moments when aesthetics bridges and connect patterns (Tosey, 2006). In this case, trough artwork observed images which synthetizes a problematic around CC.

Up to now, the five IPCC (1990, 1995, 2001, 2007, 2013-14) carried out are the institutional scenario debate that set-back the international political actions of United Nations on the CC issue. Since the “Assessment Reports” publications country negotiations are set to make agreements between them. Each one is compromised to modify or to adapt a legal regulatory frame and to diffuse knowledge on it among their citizens.

As shown, along this division correspond a specific image technique (graphic to infographic). There’s a close linking between the Internet and IPCC starting date development. Accordingly, as images computer manipulation capacities have been adopted through Internet, these techniques have been integrated and

diversified in a visualization emergent field.

On the bottom of the above figure we can see different marked moments using several techniques. Despite the states of this process are a consequence of complexity increment they are techniques overlapped by circumstance and rather what they represent here are the contingency possibilities that organization's communication have.

That's why the range between graphic and infographic limit the sense of complexity as information is transformed in knowledge and need to be understood.

The forms of representation stabilize understanding and socialize meaning:

The gradual processes are gifted with a powerful booster force. In this sense, is interesting the correlation between the scientific discoveries and the technical realizations. The biggest scientific ideas are, in a way, akin to art: its origin is like an explosion [...] the scientific ideas can come ahead of times (Lotman, 1999, p. 26).

Back to IPCC, this organization is aimed by its communicated production knowledge based on mathematical models to evaluate present and predict future climate scenarios. [2]

So, depending on those communications we identify the three mentioned states:

An embryonic state, has been dedicated to organize the scientific doubt around the climate physics with resonance in press and in the education system (figure 3).

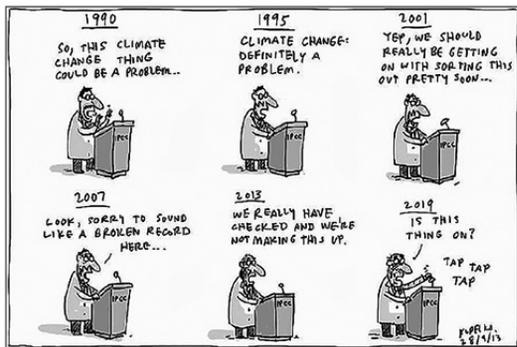


Figure 3. Jon Kudełka, 2013. *Non So Deaf*. Retrieved from <http://www.kudelka.com.au/tag/ipcc/>

The second, a transition period (2001 to 2013) where the accumulation of quantitative and existential data exposed in diverse climate models has verified gradually

the hypothesis -put it in doubt by economic interests- of the anthropogenic induction, but also when it has been recognized the necessity to act before the probable catastrophic scenario to mitigate or to adapt through consensual international policies (figure 4).

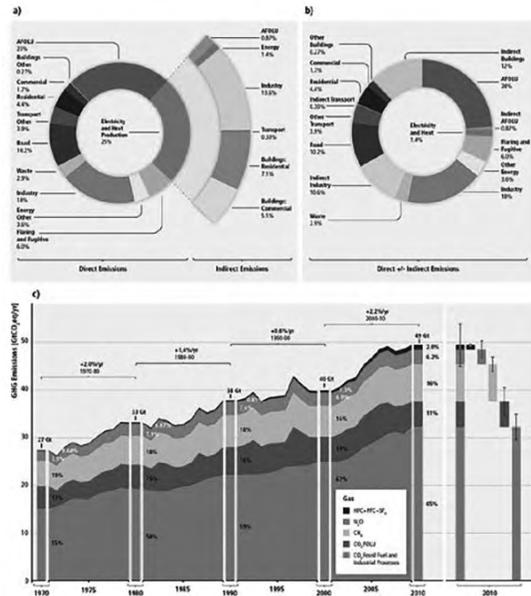


Figure 4. Accumulation and linking of observed data. IPCC, 2001

Ultimately, the yet incipient third one (cybernetic) when the previous actions are taken more precisely, but now emphasizing the social participation with the aim to reduce the risk-uncertainty factor influencing the institutional communicative policy and adopting capabilities available with computerized visualization (figure 5).



Figure 5. Video in YouTube IPCC, 2016. Retrieved from <https://www.youtube.com/watch?v=fGH0dAwM-OE>

As a matter of fact, for the first time the IPCC (AR5) produced a video of its *Synthesis Report* available in Internet (2016) and, unprecedentedly, a communicators meeting was requested by the mentioned panel to support them. On the other hand, public opinion has pressure on scientific arena to share information in a comprehensible manner (Geiling, 2014).

Although most of the referenced images contain a catastrophic view about CC, the relevance here was to illustrate with them a sequence change in communicative policies issues of IPCC according with time. We agree with Angus Forbes (2015) about the possibilities to “generate, augment, provoke and mediate” of media art in communication processes and through Internet make it an aesthetic resource to comprehend sociocomplexity.

Conclusions

This work suggests a mode to observe qualitatively artwork that visualize Climate Change as a methodological route to identify communicative status among organizations.

We assume that changes in organizations are observed through changes in the way information is visualized. This happen mainly from communication technological innovations. Each “level” is possible to identify from the overlap between the way art represents reality and the way organizations communicate findings. This occur in a timeline of a common public problem observed (CC).

Selected artwork construct “looping signs” that

feedback the cultural evolution in organizations. When they are observed as patterns, conjointly, besides to reflect different learning levels of organizations -not given in a sequentially order but rather in a parallel and reciprocal manner-, they aim toward a reflexivity communication goal.

Because of this reflection Science Visualization is an opportunity “to produce high quality images to use them in the histories e infographics, so emphasizing the key message of their assessment reports” (IPCC, 2016, pp. 184, 193).

We regard the above recommendation as the beginning of a change in the communicative politic of IPCC. In cybernetics words, the change of a system state depends on its adaptation to environment perturbations. The CC and Internet stimulate a change in IPCC organization and support the thesis that it is nowadays suffering a transition state toward a cybernetic one. [3]

The IPCC started with diffusion of images based on statistical graphics. The repetition of this visual resource with informatics technology has done it more complex increasing noise and taking distance from original message (figure 2). Art recovers this memory. However, as it is showed in the upwards sequence figures, communications produced by IPCC contains every time more complexity. A curious data is the origin coincidence with the commercial irruption of Internet (1988-1991); also, both are planetarium organizations. The announcement of the diminishing size of ozone hole (figure 6) verify the successful coincidences between politics, science and computerized visualization to get into the cybernetic era. Shall be art and science the future human coincidence to communicate digitally with earth.



Figure 6. Computer graphic of the recovering of ozone depletion area. Retrieved from <https://www.bas.ac.uk/media-post/30th-anni-versary-of-the-discovery-of-ozone-hole/>

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1. In 2016, 7433 million, in accordance with United Nations. Retrieved from <http://www.unfpa.org/es/world-population-dashboard>
2. Despite IPCC has based from the beginning its projections on data and scientific models, recognize the impossibility to prevent future events. “The knowledge is insufficient to say if there will be or not some change in the occurrence or geographic distribution of severe storms, for example tropical cyclones” (IPCC, 1995, p. 7). With the continuum collected data has increased the confidence grade to sustain its climate projections.
3. Understanding cybernetic as “the automatic conduction and command of complex systems to take advantage of the improbable coincidences to produce information.” (Flusser, 2011, p. 115). List of artworks presented in Figure 2: *Landscape of Change*. Jill Pelto, 2016. Retrieved from <http://www.jillpelto.com> *Smog City*. Murphy Mandisa, 2011. Retrieved from <http://01quilan.deviantart.com/Follow-the-leaders>. Isaac Cordal, 2009. Retrieved from <http://cementeclipses.com/works/>
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www.behance.net/valeriopellegrini

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Techno-Emotional Bodies

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Abstract

In terms of sense terminology, it is possible to make use of Digital Technology to expand and modify the perception of humans' environment. The approach to design Cybernetic Extensions to expand the senses of the Human Body is being analyzed throughout this article. Under the debates on the dialectical interaction between technology-body, species-environment, creation-biocreacion and human-bonding, the concept of Prosthesis presented by Tomás Maldonado is proposed as the starting point for the Cybernetic Organs design. It is predicted that these Smart Prosthesis will be designed by using 3D printers, and the patient's own cells, which will be created in Fab Labs laboratories. It will go from designing objects to designing the Human Body as an object.

Keywords

3D Scanning, Cyborgism, Contemporary Education, Interdisciplinary Industrial Design, Human Body.

Within the World of Objects: The Human Body as Raw Material

The academic world of Industrial Design, a discipline specialized in the design of products and objects, considers the link between people and objects as a broad subject of study. Highly regarded Design authors like Tomás Maldonado or Martín Juez consider that an object can be understood as a sensory extension of the body. For instance: a spoon could be the extension of the hand; a bicycle or car, an extension of the legs; a computer, an extension of the brain. Thus, we could make a comparison with each of the thousands of artificially designed objects we see every day. These sensory extensions are designed from the transformation of the human habitat elements and the needs this habitat evokes.

Prosthesis Concept

Maldonado establishes a classification that could be useful to understand how we link to Digital Technology

and what kind of relationship is developed with current and future objects of daily use. On the basis of this segmentation we can begin to understand that the world of objects is multiform and complex. He proposes 4 types of prosthesis: motor, sensory-receptive, intellectual and syncretic.

Motor Prosthesis

The hammer, the knife, the bicycle or the automobile destined to increase our strength, skills or movement.

Sensory-receptive Prosthesis

These are the devices used to correct hearing or vision impairments, or those devices that allow us to reach the reality levels we cannot access to, for example: the microscope or telescope.

Intellectual Prosthesis

They increase the human intellectual capacity by using devices able to store a large amount of data. This is the case of smartphones and computers.

Syncretic Prosthesis

These are characterized by the convergence of the three types of prosthesis mentioned above. Industrial robots can be considered as an example since they are automatic mechanical systems that do not require the operational participation of men.

Certainly, one of the Prosthesis that defines the beginnings of the 21st century is the "smartphone". We could consider that this element was created to make up for communication needs. However, this device began to evolve by "absorbing" technical functions of other objects, and generated a very intimate bond with humans. According to Maldonado's classification, the Cell Phone is an Intellectual Prosthesis: it stimulates and enhances the intellectual capacities, which are defined as the necessary abilities to perform mental tasks: memory, creative thinking and vocabulary. Activities such as observing, describing, explaining, identifying, analyzing, comparing, establishing relationships, valuing, interacting, etc. are intensified by the daily

bond of the use of this type of Prosthesis.

Two decades after the beginning of the 21st century there are several objects which belong to the Digital Technology we use every day. The Prosthesis classification by Tomás Maldonado describes a set of objects that behave in a peripheral way towards the human body. What happens if these peripheral objects happen to be carried inside the body?

Previous Definitions

This entire new paradigm of intimate relation between humans and Digital Technology has been classified since the middle of 20th century as the emergence of a new human species denominated Cyborg. There are also other types of classifications that are closer to the world of objects such as the “Wearables” (usable technology) and also related to the world of biology such as “BioHacking”.

Cyborgs?

The word Cyborg was first used in 1960, the term was coined by Manfred E. Clynes and Nathan S. Kline. These scientists, in the context of the arrival of the man to the moon, were in need of naming the emergence of an intimate relationship between humans and machines.

In 1985, Donna Haraway published the Cyborg Manifesto in the Socialist Review magazine, in which she defines: “A cyborg is a cybernetic organism, a hybrid of machine and organism, a creature of social reality and fiction. Haraway clarifies: “The culture of high technology challenges dualisms in a curious way. It is not clear who is the maker and who is made between the human and the machine.” (Haraway, 1985)

From a Transhumanist perspective, the Cyborg is one of the new species that would arise as from the application of biotechnological modifications on the contemporary human body, in order to establish new parameters of human abilities.

Other predicted emerging species would be: The Bio-orgs, Silo-orgs and Symbo-orgs. Defining the Cyborgs generically as cybernetic organisms conceived as biological and mechanical hybrids that would live not only in the natural environment, but also in the near stellar space. Bio-orgs would be protein encoded individuals. Silo-orgs would be organisms made of silicon, designed through an artificial DNA. The Simbo-orgs would be self-reflexive symbolic organisms, living programs whose habitat would be supercomputers (Hector Velazquez Fernandez, 2009)

Today we can determine that a type of Cyborg is

an individual hyperconnected to the network and its environment. It does not necessarily look like an android or a robot; it is a human that makes use of technology for different purposes. Today’s Cyborg uses a device called cell phone and exclaims “I’m running out of battery!” when this device has 5% of energy left (Harbinsson, 2016).

Wearables?

Wearables belong to a special group of objects; these could be interpreted as some kind of Soft Cyborg. These are soft accessories for our body which blend into it and generally provide us with information about the environment or the body itself. They are usually linked to the internet or the cell phone. Just like some item of clothing, these devices can be used whenever you want; it is a way of wearing the digital world over your body where and when you wish to.

The term refers to the set of equipment and electronic devices that are incorporated in some part of our body and that continuously interact with the user and other devices with the purpose of performing some specific function; smart watches, sports shoes with incorporated GPS and bracelets that control our state of health are some examples of this technological genre.

Biohacking?

The Biohacker Manifesto was written less than a decade ago by Meredith Patterson and it was called “Biopunk Manifesto”. In this Manifesto, the scientific literacy of society is demanded in order “to be active contributors to their own health, to the quality of their food, water and air, to their interactions with their own bodies and to the complex world around them.” (Patterson, 2011)

The term biohacking is an amalgamation of the words “biology” and “hacking”, which contextually refers to the management of biology itself by using a series of medical, nutritional and electronic techniques with the aim of expanding the physical and mental abilities of the individual. Somehow, they can be considered as the Do it Yourself Cyborgs.

Neil’s Story

Neil is the first Cyborg case recognized by a government. The anecdote came up at the time of renewing his Passport: Neil has an antenna implanted in his head. This device, which translates color frequencies into sound frequencies, was conceived, designed and uploaded for free to the network by Neil himself in collaboration with Adam Montandon in 2003. Britain did not allow him to have a photo using an electronic device in his passport.

He replied that the device was part of his body and that he did not make use of technology. On the contrary, he states: *“I am technology and this antenna is a part of my body”* (Harbinsson, 2014).

Neil’s antenna is called “Eyeborg”. It is technically a cybernetic implant. The creation of this device arises from Neil’s need to perceive color.



Figure 1. Cyborg Neil Harbinsson shows his “eyeborg” at Robotronica. August 2015. (s.f.)

He claims that he comes from a world where everything is black and white, making reference to his biological characteristic of having achromatopsia.

Although this implant is permanent, its creators think that in the future electric power will be no longer needed, and that blood flow will be used to power this device. They also assume that they will be able to add an eyelid to hear colors when the user decides to. At the moment, Neil is permanently connected to the visual environment through the sound he receives in the form of musical notes through the antenna.

After 10 years of testing and development it is now connected to the internet and he receives images from 5 authorized people in different parts of the world. He also perceives the sounds of the colors of space by connecting to the International Space Station. Neil says that he was once hacked and that he enjoyed it. This means that non-authorized people sent information to his antenna.

Smart Prostheses Design

The main and traditional idea of Prosthesis in Industrial Design presented by Tomás Maldonado, was improved by a new field of application and study of technology: The Human Body itself. Being conceived as raw material, the human body can be the main supply and

the material basis of its own transformation.

Classification

To continue with Maldonado’s classification I suggest calling this emergent group as Intelligent Prostheses, described as objects of Digital Technology design that are attached to the Human Body in a physical or emotional way.

Smart Prostheses of Physical Union

They are devices that are physically attached to the body. In this case the skin, organs, bones and cells are the base material where the device is attached and / or inserted, as in the case of Neil’s antenna. The transgression of this type of Prostheses is that their use modifies certain brain abilities, considering the brain-software union as the most severe case. There are two types of physical union Prostheses: full permanence and partial permanence. Full permanence prostheses are those which cannot be disconnected, such as the pacemaker. Those of partial permanence are able to be disconnected, such as the case of Wearables.

Smart Prostheses of Emotional Union

They suggest that there is wireless link between the person’s body and the object, such as the smart cell phone, the laptop, and other objects defined previously as Wearables. In several cases the use of these devices causes addiction behaviors on the users. For example, people who cannot stop checking their cell phone, or feel afraid and insecure if they lose it or run out of battery. This situation would be solved if, as predicted, these devices became permanent in the body after the adaptation period we are currently going through.

Within Maldonado’s classification, Smart Prostheses could be considered as the evolution of Intellectual Prostheses, those which intensify the intellectual abilities. In addition to being Smart, these Prostheses modify the behavior of the individual amplifying the perception of reality. Besides, due to the strong bond they have with humans, they can be interpreted as organs with senses. Therefore, the debate in question is: do we design objects or organs?

Cybernetic Organs Design

The case of Neil Harbinsson is an example of a type of Smart Prosthesis of Full Permanence Physical Union. In several occasions, Neil has mentioned that the sensation of feeling as a Cyborg is not created by the device implanted in his skull, but by the union between the device and the brain generated by the software.

En 2010 Harbinsson funda junto a Moon Rivas la *Cyborg Foundation*. It is an integral proposal whose guideline shows the connection of the human body with the environment. Through the concept “*Design Yourself*” a virtual platform was created, this platform helps those interested in initiating an intimate relationship with technology to increase or improve the interaction of body and mind with the environment as from the transformation of three possible core ideas:

Skills: Expansion of the body’s ability to express itself and interact with the environment. For example: an exoskeleton, and a bionic arm or leg.

Cognition: Expansion of the way in which the surrounding information is absorbed and processed. For example, a bracelet that counts the number of steps you walk per day.

Senses: Expansion of the way in which the environment and the brain’s behavior is perceived. For example, being able to see at night, sensing the magnetic pole of the earth and improving our sense of direction. (Neil Harbinsson in: *Cyborg Foundation*, 2010)

At some point, there is the possibility of designing, under the Open Source - Open Hardware philosophy, new senses of technological and cybernetic matrix to expand the perception of reality. It is possible to consider these devices as adapters, translators and regulators of the physical-sensorial environment that we perceive as a species increasing and modifying the interaction with the environment.

When Neil is asked about the design of these devices, he replies:

“We do not sell cyber extensions, we believe that cyber extensions must be treated as parts of the body, not as devices and therefore they should not be sold. Instead, we encourage people to create their own sensory extension. We do not intend to repair people’s senses; we do not see any difference between “disabled” and “non-disabled” people. We believe that we all need to expand our senses and perception. We are all “disabled” when we compare our senses with those of other animal species.” (*Cybor Foundation*, 2010)

Design Major Considerations: The Object is a Means and a Message

As previously mentioned, when planning the Design of Cybernetic Organs, classified as Smart Prostheses, it must be taken into account that an object is stronger than a political, artistic, and / or technical expression since it carries all these aspects with it though it cannot be noticed with the naked eye. It is also important to become aware of the macro areas that influence and shape the design of objects: the morphological, technological and sociological areas. The resulting object of the design process is an element with technical function, symbolic function and it is known as a communicative as well as a cultural good. In a broad sense, the object is a message.

The Technical Function, Technological Area

It defines how it works, under what type of energy it moves, what biodegradability or material configuration it has, what its practical utility is, etc. For example, in the case of Neil’s antenna, it is used for listening to colors. It is made up of a webcam connected to his skull, where some software translates the visual information of the environment into audible vibrations that slide through the occipital bone to his ear.

The Symbolic Function, Morphological Area

It characterizes the sensations that it generates in the human perceptive environment. What color, shape and texture the device is and what it makes reference to. Regarding design, this object was inspired by insects that communicate by antennas, as for example the ants. However, in the cultural imaginary, it can refer to science fiction characters.

Social Function, Cultural Area

These are the aspects related to the object’s entire historical framework: its socio-historical context, the ideology of its creators and the use value it owns. In Neil’s case, this new organ (which works mainly through a chip, has color and resembles an antenna), was created at the beginning of the new millennium, and he is socially defined by it as a Cyborg.

Technological Reach

Within the current technological reaches, 3D printing is in full development. This is a kind of technology that allows manufacturing pieces of diverse materials and forms through a digital drawing generally designed in a computer program.

While many innovative systems that print such dissimilar materials (ranging from stem cells to

thermoplastic polymers) are being developed, one of the key steps for any printed piece to be a success is its prior design. The modeled piece that is to be printed can be obtained in two different ways: it can be modeled by a Computer-Aided Design (CAD) program or scanned in 3D from a physical object and with a scanning device. This combination is known as a process that goes from “bit to atom and atom to bit”.

3D Scanning

The insertion of the 3D scanning system into the world of inventions is highly significant. This tool allows generating a three-dimensional record of a three-dimensional object or environment. It allows for the recollection and storage of culture in graphic format. In its most primitive conception, it is the technology line that follows photography, since it generates a visual record on the desired object.

The information the 3D scanner obtains consists of a cloud of points, which must then be processed, in order to determine the way these points are linked and to obtain the model. 3D scanners can be very accurate and can even capture information about color.

Scanned Bodies: Digital Raw Material

The term raw material refers to a natural or artificial substance that is industrially transformed to create a product. Potentially, it serves to create something. It is characterized by being susceptible to all kinds of forms and to undergoing changes; it has a set of physical or chemical properties perceptible through the senses. Understanding the human body as raw material also expands the conception we have about the body; that means we can modify it. However, the term characterizes tangible material, therefore, could the Human Body be considered as digital raw material?



Figure 3. 3D body scanning and rendering. November 2016. Ph. Jessica Roude

To go into detail about this concern, I carried out an

experience on body digitalization. I called Mario Astutti, a technologist specialized in 3D scanning and Digital Technology. Mario is an interdisciplinary developer who unifies art, engineering and design. As own resources he uses visual, tactile and macroscopic observation and exploration in high definition through the 3D scanner. The artist says that scanning an object in 3D is a process of collecting points in space data; he claims that there is a reinterpretation of the Human Body from the scanned person, since it can be look over in 360 ° as if someone else was looking at it. He considers it as a virtual reinterpretation of a tiny portion of reality in a span of time.

Regarding the idea of characterizing the 3D Scanner as a Smart Prosthesis the specialist makes a very interesting analogy when he mentions that the use of the Scanner turns his body into a vehicle which transcends a portal from tangible to virtual. Mario describes a connection with the object where, somehow, the use of the scanner transforms his body. When asked “What kind of connection do you feel with the scanner?” He reflects:

“As with most tools, I consider it as an extension of my body; this type of scanner, specifically, as an accessory to the sense of sight. A machine for observing, memorizing and documenting.”¹

One of the last scanning works by Mario is part of a project titled “The Willy Crook Experience.” This was developed at the Mingalab-LEIDI, “Laboratorio de Experimentación e Innovación en Diseño Industrial” with its office in Centro Interactivo de Ciencia y Tecnología de la Universidad Nacional de Lanús “abremate”, Buenos Aires, Argentina.

Eduardo Guillermo Pantano Crook, better known as Willy Crook is a distinguished Argentine musician with a three-decade career. He generates different types of mixed compositions that result from his personal history in an abstraction and a humor field. Currently, Crook explores and experiences with compositional possibilities that provide new digital tools.

Through this project, Willy decided to experience an approach between digital technologies and music, understood as a multiform, massive, visual and mutable whole. The idea of having his body on the internet was attractive to him. Somehow, this represents a perpetuation

¹ Entrevista realiza por Jéssica Roude al Diseñador Mario Astutti en el marco del Proyecto Experimentación Interdisciplinar con Artistas en el Laboratorio MINGALAB - UNLa- Lanús Argentina 2016.

of his image and his digitized body scattered throughout the world on the network and to be forever downloaded, printed, mechanized and/or virtualized. While the postproduction possibilities provided by the scan are endless, Crook was interested in his body being in the network. When he was asked, after being scanned, about the relationship between art and technology he replied:

“Art and technology are closely related, it seems unthinkable that technology is not used to go further, that is what both disciplines are about, to go further.”²

Conclusion

“Techno-emotional Bodies” refers to the link we have as a species with Digital Technology and how it affects our body and emotions.

Cyborgs, Wearables and Biohacking, are some of the definitions that describe the analysis of what in Industrial Design could be called “Cybernetic Organs Design” classified as Smart Prostheses.

When designing these Smart Prostheses it is necessary to consider them as a means and a message, and to previously analyze the macro areas in which an industrial design object of classical methodology is comprised: technical, symbolic and social functions.

The current technological reaches allow us to explore different and new ways of interpreting the environment, which is conceived as composed of information. Digital Technology is a social product that makes us more human, and this already stimulates a reinterpretation of what it means to be human as a species.

This new concept of Smart Prostheses proposes to design in order to obtain a social stabilization with the Digital Technology, which leads us to a collective balance of universal thought.

The relationship between art and technology is an articulated space that allows us to go further.



Figure 4. Mario Astutti y Willy Crook. Detailed process of 3D scanning. Ph. Jessica Roude

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²Entrevista realiza por Jéssica Roude al Músico Willy Crook en el marco del Proyecto Experimentación Interdisciplinar con Artistas en el Laboratorio MINGALAB - UNLa- Lanús, Argentina 2016.

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Jéssica Roude belongs to the international movement of Experimental Industrial Design. This movement is defined as different and complementary to that established by the current education, market, and economy. The Designer transforms the methodologies, processes, and materials of Classic Industrial Design into an Interdisciplinary production and research plan. Roude proposes alternatives of scientific analysis in Industrial Design. She establishes links between current technological innovations and the efficient use of human habitat resources. Jéssica has recently received a Special Mention at the XV International Image Festival 2016. The presentation titled “The importance of interdisciplinary experimentation in the academic field of Industrial Design and Technological Scientific Development” was presented at the academic design forum in Manizales Colombia, May 2016. She is currently a professor, researcher and designer at Lanús National University, Buenos Aires, Argentina.

Design of Pictographic Signs for the Educational Area

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Abstract

The text documents the process and the necessary conditions for the design of pictograms during the 'Signage' university course at the Design Department of Guanajuato University, taught as the IV semester design workshop. During this course the student applies visual techniques and specific concepts that conduct to the graphic design of pictograms. These pictograms are used in a product for the educational area that the student must also design.

Keywords

Graphic Design, Signs, Pictograms, Education, Game-Based Learning

Introduction

A different focus to commercial graphic design is that of the educational area. The commercial activity of design is probably the most dominant, yet not its only one, given that design can be applied to multiple knowledge areas. This article shows two cases that were designed by students from the University of Guanajuato in Mexico, both works were classroom exercises applied to the educative area. The first corresponds to the design of signs to teach the study of the bible and the second example uses sign design to learn which objects used in a chemistry laboratory at the middle school level.

The symbols as pictograms are used for the design of signs, nevertheless, the use of these symbols is not an exclusive property of signs they can in fact be used for other purposes. Using Miles van der Rohe's concept, less is more, when the intention is to communicate only with images and without text. Some examples can be found in the label of a t-shirt, in the dashboard of a car, etc. Although there is no specific model for pictogram design, a couple of pictographic systems do exist that can be regarded as prototypes and models of non-verbal communications. One of these was developed by the American Institute of Graphic Design (AIGA), while the second one corresponds to the design of pictograms for the Munich 1972 Olympics designed by Otl Aicher.

Both show visual characteristics that became standard due to their simple forms.

Ives Zimmermann in the site www.foroalfa.org describes three basic elements to define a pictogram: 1- The name pictogram signifies image- word, that is, a meaning that can be expressed in a single word. 2- All pictograms are self-explanatory, without the use of words; they do not entail any kind of interpretation as, for example, in the case of a symbol. 3- Shapes in pictograms are extremely synthesized and reduced to its most basic expression in order to be immediately comprehensible in any linguistic or cultural context.

Shape and Style in the Design of Pictographic Signs

Style is detached from the shape, nevertheless, the shape defines the main characteristic from which to identify the designed sign. Style, on the other hand, defines the uniqueness of the shape. In the design of pictographic signs, the shape is allied with the visual representation technique (shape and background), and the synthesis of the shape aids the exact identification of a sign. A simplified shape is not equivalent to simplicity: for example, a black square over a square white surface is synthetic and simple at the same time; still, an image formed by tiny squares can be as complex as it is synthetic. The synthesis of an image, leaving aside most of its features and keeping its most important ones, acquires simplicity, and identifies an object excluding all others. In other words, the features and the shape make a cat be a type of cat and not a type of rabbit. Simplicity can be a fragile balance that depends on a degree of complexity. For example, the pictograms for the 1968 Winter Olympics in Grenoble designed by Roger Excoffon still maintain the value of visual synthesis due to their form, but because of their style, they acquired a high level of complexity.

The design process

I will now speak of the teaching experience focused on

a method that considers the relevance of style and of the shape for the ideation and execution of pictograms in a bachelor's degree course.

In my program under the indication of shape and style, the student must design 25 signs with the shape-background technique. This task has the following conditions:

1. The student has to pick a topic that gathers a group of objects of the same nature, for example: musical instruments, endangered species, independence heroes, etc. In some cases, the set must be reduced; for example, the students chose the musical instruments theme and proposed four subcategories of wind instruments, strings, percussion, and electrics. These groupings allowed that each of the four groups could be codified with a particular color at the end. To avoid choosing a theme that does not represent a high degree of difficulty is a restriction in the design of the exercise. For example, the theme of Mexican wrestling masks does not represent a valid scope of application because they are synthetic and would only require reproducing the same shapes.

2. The object represented must be synthesized and reduced to its basic shapes, just as previously mentioned and it must keep just the elements that make it the object it represents and not another. Typography cannot be used, the signs must be descriptive.

3. Students must design the set with a unique style.

4. Students must draw the strokes over a grid.

5. Students must apply color without losing the original contrast.

6. Students will apply the signs to a project.

The Projects

History of the Salvation. Educational Material. During the design process, students must become aware of several aspects that favor the fulfillment of the objectives. The student starts the sketching process and outline drawing; in this moment one must explain that it is not necessary to use the regular life drawing or copy stroke. The technique that offers the best results is the shape-background one because it favors ample zones of black or white tone and because it produces a closing effect that evokes an additional figure (or more) from a single shape.

Even if students apply the simplification process successfully, using the shape-background they come to produce similar images to figurative drawing of black and white contrast areas instead of an outline drawing.

In this moment the professor must intervene to avoid the inertia and stagnation and explain the concept of style and its purpose to reach an original result. When this is resolved, a new design set emerges. Many designs were obtained from applying the signs that allowed to invent ways to expand their uses and shapes towards the fields of education and games.

The first work shown was created in 2015 by the student Karla Yessenia Ríos Jiménez during the university course named "Design Workshop 3." The student is a bible study teacher for children and for six years she has imparted a course called "History of Salvation" in the San Martín de Porres parish in the city of Irapuato, Guanauato in Mexico. Karla Yessenia decided to design pictograms for the teachings of the religion of which she is catechist in a parish of her home town. The exercise begins when the student draws the first sketches in a brainstorm and little by little solves the strokes, searching for a specific way that determines the first features towards a specific model (prototype) from which the rest of the signs can be reproduced. This first stage requires that the student adjusts the strokes to a grid to control the size, the space, and the stroke so that all the other pictograms repeat according to this first prototype. This is how the notion of a set becomes evident. The student determined a basic grid structure of 6x6 units over which all the pictograms would be designed (Figure 1).



Figure 1. Basic grid

35 pictograms were created in black and white, the characters were represented using basically geometric shapes, the head is a circle without a face, and the rest of the boy is based in rectangles.

All the characters follow a similar pattern and its identification is not achieved through the degree of detail, but through the main characteristics that label them; for example, the Adam and Eve pictograms have prototypical male and female shapes. Nonetheless, the representation of certain pictograms is associated with a biblical passage. (Figure 2)



Figure 2. Adam and Eve

For example, the pictogram that represents David and Goliath is represented by the event that narrates their confrontation. David is represented in a smaller size than Goliath, with the slingshot in his hand and Goliath with a sword in hand. To represent Judas Iscariote, the student picks 3 symbols that determine the meaning of the pictogram, the event narrated is the hanging of Judas after betraying Jesus of Nazareth, the number one symbol is the three, the second one is the rope and the third is dead Judas, hanging from the rope. (Figure 3)



Figure 3. Judas Iscariot

The use of color as a code is very important in each pictogram, the color blue signifies the sky, the water and the clouds, the color red, blood and fire (hell), the color pink shows in each character to identify the color of human skin.

The pictograms were used as a game- based learning resource so the children learn by playing. The game of *Lotería* is very popular in Mexico, it is played using 54 cards and four to six templates or more, each with 16 images. There is a person in charge of showing one card at a time and show it to the players. Whoever has the image on their template marks it and the first player with a complete template wins the game and yells *Lotería!*

Originally, this game is illustrated with traditional images of real and fiction characters widely recognized in Mexican culture such as *el mariachi*, the Moon, the mermaid, the watermelon, the dame, and many more.

Chemistry Lab. Educational Memory Game

This work was produced in 2015 by the student Israel Hiram Ávila Zamudio during the course Design IV Workshop ‘Signage’ in the fifth semester of the bachelor’s program in the Graphic Design department of the Guanajuato University, Mexico. It shows us 50 designed signs that represent 50 different accessories and tools used in a chemistry lab (Figure 4).



Figure 4. Pictograms samples

The intention is that these pictograms are used like a didactic resource by a professor in the middle school level. Just like the previous project, the student had to draw over a geometric grid, but in contrast to the latter project, each square of the grid was divided by four axes, the horizontal, the vertical and two diagonals, one to the left and one to the right. This subdivision allowed greater stroke precision (Figure 5).

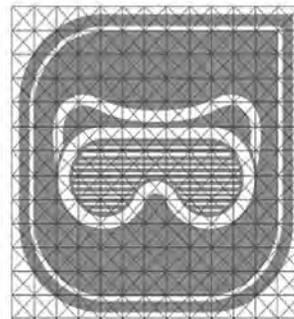


Figure 5. Basic grid

The student organized the accessories in categories as well:

- Volumetric tools
- Separation tools

- Heating tools
- Glass general use tools
- Other general use tools
- Holding tools
- Safety and cleaning tools

Lastly, the student applied the pictograms to the well-known game memory, which helps identify and memorize each of the lab utensils. Unlike the traditional game that involves finding two cards of the same kind, this game has a greater degree of difficulty, as it divides each pictogram in two so the player searches and finds the part that coincides with its other half (Figure 6 and 7).



Figure 6



Figure 7

Conclusions

This sample of academic work shows how graphic design can positively influence the creation of didactic materials that can be applied in different educational topics. These classroom exercises do not simply fulfill the objective of basic design principles for pictogram design, but also, at the end of their studies, students can show them in their professional portfolio. They

also have the opportunity to present them as marketable proposals and lastly, this work can become the topic to obtain the bachelor's degree.

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Artistic Brain: A Complex Nonlinear System as Advanced Neuroesthetic Research

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Abstract

This paper explores brain systems that neuroesthetics and brain-wave art have experimented, in order to consider a complex non-linear system of a brain in terms of art, science and technology.

Semir Zeki created a field of neuroesthetics by trying to study the relationship between art, aesthetics and brain through fMRI technology. Since then, neuroesthetics has attracted the attentions of cognitive neuroscientists and elicited the vigorous discussions of aestheticians and artists. Nevertheless, recently neuroesthetics confronts lots of criticisms and skepticisms. It is involved in a problem that regards a brain of the most complex structure as a functionally specialized linear system. In contrast, artworks that use brainwaves view a brain as a nonlinear system rather than a linear system. In particular, brainwave sonification experiments a brain as a complex nonlinear system, focusing on sound generated from neural impulses caused by the complex interactions of neurons in a brain. Interestingly, EEG and auditory feedback are appropriate elements for exploring a complex nonlinear system of a brain.

Keywords

Nueroesthetics, Specialized Linear System, functional Magnetic Resonance Imaging (fMRI), Brainwave Art, Brainwave Sonification, Complex Nonlinear System, Encephalography(EEG)

Reconsidering the Neuroesthetic Turn in Art History

Most neuroscientists have thought that there is no reason for them to study aesthetics, or aestheticians have opposed introducing neuroscientific research into aesthetics. But in the 1970s, Daniel Berlyne emphasized the role of physical arousal in experiencing aesthetic conditions (Berlyne, 1971). Then, the emergence of functional Magnetic Resonance Imaging (fMRI) in the 1990s triggered combining neuroscience and aesthetics. Above all, Semir Zeki created a field of neuroesthetics by trying to study the relationship between art, aesthetics and brain through fMRI technology (Miller & Miller, 2012). He was originally a neuroscientist studying the

visual brain of primates, but since the late 1990s he has studied the neurological basis for the perception of beauty in the arts. As a result, studies of Vilayanur Ramachandran and Margaret Livingstone as well as Zeki were able to draw public attention to neuroesthetics related to creating art and appreciating artworks (Son, Lee, Jung, Jee, & Jung, 2013). Furthermore, some art historians have applied the research results to their own topics and amplified the public interest in brain science. Barbara Stafford urged scholars of visual culture to confront the core concepts of the humanities using the questions presented by neuroscientists and induced artists to engage in this humanities-sciences debate (Stafford, 2007). Even David Freedberg studied with Vittorio Gallese who is one of the discoverers of mirror neurons. Emphasizing that most 20th century art history and art criticism neglected the neuroscientific evidence for emotional responses, they propose a theory of empathetic responses to works of art that has a definable material basis in the brain. (Freedberg & Gallese, 2007).

However, as neuroesthetics is recognized as a successful interdisciplinary research field, more and more nueroskeptics are criticizing it. They regard the perspective of neuroaesthetics on art as reductionism or essentialism. Above all, their views have some validity in that most results of neuroesthetics are based on neuroimaging such as fMRI. The researches of Edward Vul and Eric Racine point out the methodological and technical shortcomings of fMRI. Vul thought that fMRI studies of emotion, personality, and social cognition show extremely high correlations between brain activation and personality measures. He investigated how the non-independent analysis overly inflates correlations and disclosed how the data from the fMRI studies could be reanalyzed with unbiased methods (Vul, Winkelman, & Pashler, 2009). On the other hand, Racine criticized the public tendency of blind faith in neuroimaging data. In general, the public cannot recognize the methodological

and technical limits of using neuroimaging data in accounting for concepts such as human subjectivity or consciousness. It is apt to create an illusion that neuroimaging such as fMRI can clearly answer complex questions about motion, emotion and perception (Racine, Bar-Ilan, & Illes, 2005).

Despite neuroskeptic's persuasive criticisms of neuroreductionism or neuroessentialism, neurological aesthetic effects cannot be ignored in art history. As Zeki said, the problem of the nature of art has attracted the attentions of cognitive neuroscientists and opened the field of research called neuroesthetics (Zeki, 1999). Conversely, such movements have attracted the attentions of aestheticians and artists and led to vigorous discussions (Onians, 2007). That is why this neuroesthetic turn is meaningful in art history. Nevertheless, the recent criticisms and skepticisms of neuroesthetic research results make us reconsider neuroesthetic turn in art history. As Kate Mondloch said, brainwave artworks such as Mariko Mori's *Wave UFO* are at the heart of such reconsideration (Mondloch, 2016). We will look into the works of brainwave sonification among various brainwave artworks and discuss the significant differences between the system that brainwave sonification has experimented and the system that neuroesthetics has built up.

Neuroesthetics Focuses on the Specialized Linear System

Zeki is the first person to coin the term "neuroesthetics". He presented a creative model for our visual brain. In a process where specific visual signals are divided into specific visual areas, each area is specialized. For example, V1, located in the occipital lobe, is the area of the cortex where the information processed from the retina arrives first. Cells with selectivity for specific stimuli such as shape, color, and movement are gathered in the specific compartment of V1 region or the related visual area of the peripheral cortex. In addition, the regions from V2 to V5 process the visual information received from the visual area and perceive an object or a space. Likewise, each visual region is specialized due to the intensive distribution of cells with special functions. Thus, functional specialization, which is an important characteristic of the visual brain, is derived from the extremely selective reactions of cells constituting the visual brain (Zeki, 2003). The visual brain system presented by Zeki is eventually a system that aims to find

unchanging features (that is, constants) in the context of various objects and environments. It includes the process of blocking unnecessary stimuli from a number of visual stimuli, in order to express the most appropriate characteristics of visible things (Torabi & Ashayeri, 2011).

Here, in order to clearly find out the visual brain system, it is necessary to understand a thermodynamic system. In thermodynamics, the term "system" cannot be used strictly because the movement path of energy and matter changes depending on how the system is defined. The system in thermodynamics refers to a precisely specified macroscopic region of the universe, and the rest of the universe except the system is regarded as the surroundings. It is largely divided into an isolated system, a closed system, and an open system. The isolated system does not exchange both energy and matter with its surroundings, and the closed system exchanges only energy, but not matter, with its surroundings. On the other hand, transfers of both energy and matter occur between the open system and its surroundings (Resnick, Halliday, & Walker, 1988). The aforementioned Zeki's visual brain system processes the necessary stimuli extracted from objects only in specialized brain areas. At first glance, it seems to correspond to an isolated system. But, considering a more extended system in which stimuli in one specialized area are electrically or chemically processed and then moved to other specialized areas, it may be reasonable to assume that Zeki's visual brain system corresponds to a closed system or an open system. However, it often involves only linear one-way flow of information, not bidirectional flow. At present, neuroesthetic researches do not deviate much from the functionally specialized system proposed by Zeki, even though they elaborate the art appreciation processes, refine the research methods, or diversify the art genres (Kim, 2015).

Such focusing of neuroesthetics may be a source of concern. It can be seen by comparing the study of Zeki and Kawabata with the study of Freedberg and Gallese. First, Zeki and Kawabata presented various forms of paintings, allowed participants to classify paintings into beautiful, neutral, or ugly, and then recorded their brain activity by fMRI. The results showed the increased activation of the orbito-frontal cortex is associated with the perception of beautiful stimuli and the increased activation of the motor cortex is related to the perception of ugly stimuli (Kawa-bata & Zeki, 2004). Freedberg and Gallese, on the other hand, took Michelangelo's

incomplete work *Slave called Atlas* and Lucio Fontana's *Atteza* as examples. When the beholders watched these works, they sometimes found themselves automatically simulating the movement or the emotional expression. The result showed that the activation of the motor cortex is involved in simulation occurring in response to figurative artworks and architectural forms (Freedberg & Gallese, 2007). But the results of Zeki and Kawabata as well as Freedberg and Gallese confuse us, in that it is doubtful whether it is correct to accept the perception of ugliness and the embodiment as the operation of the same brain area. In a situation where nobody knows exactly what happens in each specialized brain area, it might be oversimplified to accept only the outputs resulted from a linear one-way system. Even though neuroesthetics hitherto has encouraged scholars in various fields to take a transdisciplinary approach to the nature of art, now it needs to expand or change systems that have been built around neuroscientists.

Cubists Explored the Complex System of Brain?

Zeki said that "the artist is in a sense, a neuroscientist, exploring the potentials and capacities of the brain, though with different tools. How such creations can arouse aesthetic experiences can be fully understood in neural terms.

Such an understanding is now well within our reach". That is because he believed that the way the brain works is very similar to the artist's way of expressing the world and objects (Huang, 2009). However, since Zeki's brain machinery is grounded on a specialized one-way system that seeks to find unchanging features in the changeable context of objects and surroundings, it is not so simple to conclude that the way of brain machinery is similar to the way artists express the world and objects. For example, Cubism artists such as Picasso did not try to find unchanging features from objects and surroundings, but intended to express the stimuli derived from various perspectives. That is why Cubist painters vaguely expressed objects. However, based on Zeki's brain machinery, Picasso, one of the greatest artists, might have been an incompetent artist who did not fully understand the brain machinery involved in integrating and organizing distorted information (indeed, Zeki evaluated Cubism as failure in terms of neuroscience) (Zeki, 1999).

Here, acknowledging Zeki's belief that an artist can be a kind of neuroscientist, we need to reconsider that

Cubist painters may express the brain operating system which is different from the intention of Zeki. Ironically, Zeki said that even though the functional specialization is regarded as the first step to grasp the essence of attributes in sophisticated brain machinery, there is little known about what happens in each specialized system (Zeki, 1999). It implies that each brain region may not correspond to a linear one-way system and that the brain machinery may include extremely complex processes before being functionally specialized. It can be easily understood by considering the example given in complex science. Although a trillion of water particles in a river interact in complex ways, the large volume of water usually flows into an estuary. At first glance, the flow of the river seems to belong to a simple linear system, but the actual processes of the flow belong to a complex nonlinear system. Even the brain belongs to a more complex nonlinear system than a river (Greschik & Schnyder, 1998). Thus, Cubist painters may intend to explore and express the complex processes that are happening in each specialized area of brain. With regard to this speculation, neuroesthetics, which mainly uses fMRI to analyze brain activities, has yet to discover some clues. Rather, in artworks that use brainwaves, we see the possibilities for such speculation.

Brainwave Sonification and the Complex Non-linear System

Mondloch said that Mariko Mori's *Wave UFO* led a genuine neuroscientific turn in art history. In *Wave UFO*, the visual data is composed of three interlocking rings. Yellow lines in the outermost level represent eye movements. Six egg-shaped objects in the second level signify the right or left brain activities of the three viewers. Each color symbolizes neural states such as blue alpha wave, pink beta wave and yellow theta wave. Small twin silver balls at the innermost level stand for the degree of synchronization of each individual's right and left. Mori, using neuro-imaging techniques tactically, made screen-based representations respond to the viewers' collective cerebral and corporeal activity. That is why Mori's *Wave UFO* shows the neurofeedback loop extended beyond the brain activity of a single participant (Mondloch, 2016). While Mori's *Wave UFO* showed visually the dynamic neurofeedback loop, some brainwave artists have experimented auditorily the dynamic feedback systems of brain.

Brainwave sonification was tried for the first time by

the encounter between physicist Edmond Dewan and composer Alvin Lucier. In the brainwave composition *Music for the solo performer* (1965), Lucier's brainwaves were recorded from his scalp, transformed into sound and delivered to loudspeakers scattered in the room. In addition, various percussion instruments were activated by means of vibration derived from his brainwaves (Straebel & Thoben, 2014). Since then, following Lucier's *Music for the solo performer*, various experimental artists tried to introduce the ideas of neurofeedback into their brainwave compositions. For example, David Rosenboom's *Portable gold and philosopher's stones* (1972) incorporated the brainwaves of four biofeedback musicians into a single music texture. In the composition, a sound producing system was set up by using a circuit that processed not only brainwaves but the body temperature and the skin response of four performers (Rosenboom, 1990). Further, technological developments and decreasing costs of brainwave equipment gave rise to brain-computer music interface (BCMI) research as an interdisciplinary field of study. The BCMI researches have sought to transform brain signals into music rather than sound. Some of the efforts to transform the brainwaves into music resembled *Music for the solo performer*. For example, BCMI-Piano, developed at the University of Plymouth, was an experiment in which users can control the style and the tempo of the composition resulted from their own brainwaves. The performers can change the musical characteristics by changing their brainwaves from beta to alpha or opening and closing their eyes. In particular, alpha can make music by activating the hammer inside a piano (Miranda, 2014).

The hitherto mentioned brainwave sonification makes sound in the process of recording the brain's electrical activities over a period of time. In fact, they show real-time communication in neural networks. All information processing in the brain relies on single neurons sending and receiving neural impulses. The generation of neural impulses depends on the movements of chemical substances and electrical potential differences inside and outside the neurons. That is why the brainwave music experiments a brain as a complex system, in that the audible sound is generated from neural impulses caused by the complex interactions of neurons in a brain. But the aforementioned works of brainwave sonification mostly used the fine-tuned alpha activity. That is because, with closing their eyes and focusing on

their brainwaves, performers can produce sound based on alpha activity that represents a state of psychological stability. Meanwhile, some brainwave artworks use various kinds of brainwaves and mix various senses with auditory feedback to generate sound.



Figure 1. Brainwave Music LAB, *Performative Experiments on Human Test Subjects*, physical interaction between the participant and the performer. ©2010 Brainwave Music LAB

Brainwave Music LAB (BMLAB) explores a more complex brain system by transforming the complex interactions of neurons associated with various senses and environments into music. Several interactive works of BMLAB experiment the relationship between a brain, its surroundings and art. *Performative Experiments on Human Test Subjects* show how the various sensory stimuli change the electrical activity of neurons through real-time sound synthesis. As seen in figure 1, the participant is exposed to physical interactions. Various sensory stimuli create a variety of responses in the brain, which in turn create the real-time brainwave music of the participant. In the process, the invisible events happening in the brain of the participant are used as the aesthetic material of the performance, and they stimulate imagination of viewers. On the other hand, the performer, who is physically interacting, is exposed to the brainwave music produced by the participant, and it cannot but influence the performance. The performer chooses actions in tune with the brainwave music (Alastalo, 2009). The other work *Brain Karaoke* is a comfortable interactive environment in which a participant and two live musicians participate in creating sounds in real time. Listening to those real-time brain sounds of the single participant, the two live musicians improvise with their own instruments. In the process,

they do not only react to the brainwave sounds, but also give the participant different musical impulses, which have an influence on the brain activity of the participant (Alastalo, 2009). Thus, the result is a complex musical neurofeedback interaction loop, in which the participant can affect the entire music and let his brain freely react to the sounds. It also means that the participant takes part in the building process of the aesthetic result of *Brain Karaoke*. While the performer chooses actions in tune with the participant's brainwave sound in *Performative Experiments on Human Test Subjects*, the live musicians control performance in tune with the participant's brainwave sound in *Brain Karaoke*. In fact, they show the complex interactions of neurons in the areas of sense, thought, and emotion as well as in the auditory area. It eventually means that the neurofeedback loop generated by the collective cerebral activity of the participant and performers or musicians becomes increasingly complex and work nonlinearly.

The other brainwave artist Lisa Park transforms brainwaves into sound waves, in order to understand how the brain works. *Eunoia*, meaning beautiful thought in Greek word, explores complex brain activities relating to states of consciousness. The brainwave data is translated to modulate vibrations of sound in real time. The resulting sound waves make it possible to vibrate pools of water in metal plates placed on speakers. As seen in figure 2, the performer monitors his/her own brain activity during meditation and transposes the frequencies of brainwaves into vibrations of water in metal plates (Park, 2016). As a result, bringing about the sonified and vibrated neurofeedback loop, the interaction processes generate the complex interactions of neurons in a brain. Visual and auditory sensory stimuli derived from interaction between the performer and the object make the interactions of performer's brain cells more complicated, and the interactions of neurons are transformed into sound vibration. Thereby, the performer's neurons accept new stimuli, activate themselves, make new sound vibrations, and influence performer's neurons again. Such a neurofeedback loop becomes nonlinearly complex.



Figure 2. Lisa Park, *Eunoia*, detail of the performer transposing her own brainwaves into vibrations of water in metal plates ©2013 Lisa Park

Interestingly, encephalography (EEG) and auditory feedback used by brainwave sonification is considered to be appropriate elements for exploring a complex nonlinear system of a brain. First, EEG has a better temporal resolution than fMRI, which is more suitable for exploring a complex system of a brain. Many neuroscientists consider the blood-oxygen-level dependent (BOLD) signal used in fMRI a reasonable alternative to confirm brain activation changes, but blood flow and nerve activity have no direct relationship. Time interval between activating neurons and increasing the volume of blood with high oxygen saturation is at least 2 to 5 seconds. That is why if the neural activities change rapidly, fMRI cannot detect actual actions of neurons. On the other hand, EEG senses the electrical activity of neurons at a fast rate and produces data around every 1/4000 second (Satel & Lilienfeld, 2013). Thus, EEG can directly represent the events that occur in our brain cells. The aforementioned example of the complex system can be compared to EEG and fMRI. While fMRI corresponds to showing the appearance of the river flowing from upstream to downstream, EEG corresponds to demonstrating the real-time processes of complex interactions of water particles in a river. Next, the reaction time of auditory feedback is important to explore a complex non-linear system of a brain. Because its response rate is faster than visual feedback, auditory feedback can directly enhance participation of auditory stimuli in the interactions of neurons (Shelton & Kumar, 2010). In the interactive works of brainwave sonification, the participants' EEG sound influenced performers and musicians as well as themselves in real

time. That is why the fast responding sense can form a more reliable neural feedback loop between a brain and surroundings, and can make the performances more dynamic. Ultimately, by using EEG and auditory feedback, brainwave sonification makes it possible to explore a complex nonlinear system of a brain more realistically, and intends to demonstrate nonlinear processes and dynamic interpenetrations happening in neurons of a brain in real time.

Conclusion

This study neither deny a specialized linear system on which neuroesthetics focuses nor advocate a complex non-linear system experimented by brainwave art. As mentioned previously, it should be acknowledged that neuroesthetics as a transdisciplinary research has had an impact on art, philosophy, science, and technology as well as art history. That said, some brainwave artworks attempted by artists and scientists can be a meaningful alternative to explore the brain machinery, in that neuroesthetics led by neuroscience recently confronts a lot of criticism and skepticism.

Human brain is more complex than human genome. In a cerebral cortex, there are approximately 125 trillion synapses, and one synapse may contain 1,000 molecular-scale switches. It means that a single human brain may have more switches than all the computers and Internet connections on our planet (Moore, 2010). Neuroscientists seek to identify the complex human brain as a more specific and specialized machinery. However, neuroscientists sometimes make errors due to their desires to clarify complex phenomena in the brain. It can be easily understood by considering the example that Neil Johnson presented in his book *Simply Complexity*. Suppose that someone always sleeps at 10 pm and wakes up at 6 am, but the person has a lot of activity while waking up. On the other hand, a certain alien, who has no prior knowledge of human life, comes to Earth only between 10 pm and 6 am. Supposing that the alien observes the person only during that time, he may conclude that humans will always go to sleep without much activity (Johnson, 2009). This means that when we regularly observe an object, we can believe mistakenly that the object is always in the same state. In other words, it is a case where the actual complexity is lost because the observed temporal interval is not appropriate.

Such an error can be also found in neuroesthetics.

The aforementioned specific examples such as a contradiction between the study of Zeki and Kawabata and the study of Freedberg and Gallese or a devaluation of Cubism by Zeki may also be the case of missing actual complexity. Basically, the results derived from using fMRI are difficult to capture actual interactions of neurons. In that context, the complex nonlinear system experimented by brainwave sonification so far has great implications for the brain system constructed by neuroesthetics. Since Zeki began to study the relationship between art, aesthetics and the brain through fMRI, neuroesthetics has relied mostly on fMRI and other neuro-imaging technologies. It is involved in the basic premise of neuroesthetics that brain areas are functionally specialized. However, the functional specialization of brain areas shown by the fMRI cannot include all the complex interactions of the neurons captured by EEG. In addition, neuroesthetics has focused on paintings in many areas of art. It is because, compared to music having temporal characteristics, the information processing of the brain related to painting is linear. It implies that, compared to the visual feedback, the auditory feedback can show remarkably the nonlinear information processing (Wogan, 2013). Therefore, for advanced neuroesthetic researches, it is necessary to experiment a brain as a complex nonlinear system with various technologies and genres. It can eventually be connected to the theme *Bio Creation & Peace*, in that it makes art, humanity, neuroscience and neurotechnology to become partners in advancing our understanding of the human complex condition.

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On The Cohesion of an Electronic Device Ensemble

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Abstract

The use of DIY methods in the guidance of students in their own computer music formation processes are just as important as any of those focused on studying an academic text; the access to open information and technology are growing at a fast rate and with a bit of a tinkering mind, the periods of time it may take to build your own embedded acoustic instruments (Berdahl, 2014) comes more at hand with the resources you may find on communities like **instructables** or **thingiverse**. Contemporary practices like net-work music become also more accessible thanks to the advance of the possible communication protocols and device robustness; in less than 40 years if we count up from those experiments with low level assembler for hacking a chip and serial protocol for its communication with others (Gresham-Lancaster, 1998) to interfacing a couple of raspberry pi's throughout OSC protocol; the proliferation of technology also comes with some problems like the losing of an intimate relationship between interpreter and instrument or the unknown that can be the manipulation of timbre by audio processing techniques or interpretation instrument possibilities to a composer.

This paper summarizes the process of cohesion of an electronic device ensemble where students and researchers live new expression practices throughout the use and misuse of technology, such practices have brought up questions and possible ways to enrich the study of electronic music, as well as music language itself.

Keywords

Ensemble, Electronic Instrument, Network Music

Introduction

We're living exciting times, as exciting as the times lived when big changes in the conception of music took place i.e. pass from counterpoint techniques to rigorous classical structures or the technical expanse it brought the arrival of new timbre and instruments such as the **intonarumori**, these big changes also denote a change in the periods of time: Baroque, Classicism, Futurism.

Technological advance has made possible from hobbyists to academics a more friendly relationship with the implementation of technology, all thanks to

open communities such as **Arduino**, **Raspberry Pi**, among many others; to *build your own alien instrument* (Ghazala, 2005) is a common practice in an ensemble and the complexity of possible ways of interaction with your instrument can be over-whelming (Miranda & Wanderley, 2006), the fast growing rate of technology can put a large distance between interpreter and instrument, a lot of the electronic interpreters now days lack the relationship a violinist has with his instrument; you can find a performer tinkering and tweaking his instrument 10 minutes before a concert, "...Constant technical improvement means eternal unfamiliarity with the instrument"(Perkis, 2011), and the more complex the more possibilities the instrument may have either to generate and organize timbre or to interface with it throughout diverse controllers; the amount of practice time an interpreter should have with its instrument in order to be able to express him or herself is no small matter, taking Tim Perkis's experience performing network and electronic music is a perfect example of how the practice with your electronic instrument should be, he has not made changes to his instrument for several years (Perkis, 2011); his relationship with his instrument is for sure that of the violinist, so the music he expresses through it can communicate with the rest of the ensemble a lot better with musical language.

We see electronic devices as someone may see a violin or a bassoon, as instruments for artistic expression, and like with any other instrument electronic instruments have had an evolving process in its luthier activities (Jordà, 2005) as in the orchestration, composition and interpretation techniques used in the performance with new interfaces for expression; but as the proliferation of technology grows also grows the need for documenting it's uses and generating tools that ease the dirty work for composers and music interpreters, so that they can build up a more intimate relationship with electronic devices and their characteristics as instruments for musical expression.

We are indeed living exciting times; lately many of the founding fathers of computer music have been passing away, not many years ago Max Mathews left us with the gift of unit generators, Jean Claude Risset passed recently, leaving us a lot of the techniques used for sound synthesis, how exciting is a period of time where its biggest exponents are either alive, or have died when you are alive?, what must have been the feeling a composer had living in 1730 while Bach was alive, and music was living a huge evolution with the counterpoint?.

In order to shorten the gap technology may bring into the performers and composers and work around the idea of a collaborative group that can document and develop tools to pass the know hows to newcomers and that “technical background” (Ogborn, 2012) may be lessened, we’ve defined some aspects of methodology that can be useful, and have started to develop the resource documentation so participants may use or take it further in their computer music practice.

Some approaches were made before choosing a path that could achieve what we were looking for. Students come to the ensemble with little or no knowledge at all of what they can use or how they can use it in order to express themselves, their passing through the ensemble are long hours in front of a computer learning **pure data**, **chuck** or **super-collider**, or building prototype circuits on protoboards so they have less time for their musical interactions with the rest of the group; we started to need a set of tools, ready-made and out of the box, so students could learn as they interact musically with each other as well as starting to build their own instruments, and for the ensemble to start implementing a way for documenting developments that could be used or improved later by anyone to either perform with an instrument or compose for it; let’s say we have a group of light control interface modules, We can catalogue the light control interface, from its building to its calibration and mapping algorithms so they can be uploaded to an arduino board and plugged to a laptop out of the box, to its technical control capabilities, let’s say the module can only manage long time envelopes -this for composing purposes-, as the catalogue grows bigger with resources for newcomers and subjects to study deeper for old members, you can enhance the practice flow with technical studies and ensemble musical practice; the inter connectable module idea may be similar as the ones lived in some laptop ensembles

like PLOrk (Smallwood et al, 2008).

We took a gigantic step and started to develop stomp-boxes using the **beagle bone black**, and open CAD software for both the casing and circuitry design.

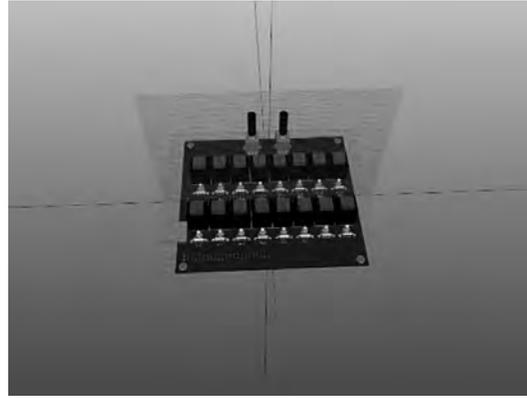


Figure1. Final model of a sequencer control interface using the software KiCad and FreeCad

This approach of course excluded newcomers and developing time left very little for musical practice, although we wanted the idea of having homogeneous sets of instruments that could be added and sorted as classified families of electronic instruments, depending on their type, of controllers, generators, software, hardware, etc.

We decided then to look elsewhere for an electronic device everyone in the ensemble had or could have access to in an easy way, and start from there; smartphones were those devices: electronic devices that fit in your pocket, that already can connect themselves to a network, that already have plenty peripherals like accelerometer, tilt sensors, proximity sensors, among others, and saw it as a nice way to introduce newcomers to computer music.

At the same time the search for a solution of the sound system characteristics was done keeping in mind, that we wanted to be as free from complex technical raiders as possible while maintaining sound quality and to get as much mobility as possible for the ensemble. The International Association of Laptop Orchestras (ialo, n.d.), is a wonderful wiki that hyperlinks some of the most important ensembles around the globe, PLOrk is one of them; seeing their implementation of a half dodecahedron speaker gave us our own approach. A

dodecahedron style speaker takes the form of the regular twelve face polyhedron, each face has a speaker (half dodecahedron speaker has six faces); this brings the sound of an electronic device closer to how sound is propagated by an acoustical instrument, enhancing the way an electronic device may sound and bringing us closer to a fully mobile ensemble; working in collaboration with the acoustics research group, comprised also of teachers and students a dodecahedron speaker model was implemented to finally bring cohesion to our idea of an electronic ensemble.



Figure 2. Final prototype of the dodecahedron speaker

Smartphones sending OSC data to an audio server whose output goes to a dodecahedron speaker is our first possible orchestration as we want it's characteristics to be; mobile like an acoustic ensemble, with the capabilities of connecting to a network and with the use of electronic devices for musical expression. Cellphones became the first family of electronic instruments to start theorizing with; this will be widened further in the paper.

About the First Family of Instruments

Smartphones are a very powerful mobile technology that is already at hand, and it may be easy to overlook this due to their daily use, but these devices, depending on their hardware characteristics already integrate gps, sensors like accelerometer, gyroscope, magnetometer, proximity, and the list goes on, although it would possibly take some tweaking to access them all; and let's not forget their networking, Bluetooth and

microphone. Since the idea was to live processes of the sort exposed earlier, we began with how to integrate OSC protocol to the ensemble, in this activity some of the students started their OSC and networking studies while others went further as we defined a standard osc addressing style guide for the messages each could send to communicate with a member of the ensemble or with another performer from another ensemble when it happens. So it would not get to fuzzy for newcomers we defined a simple address structure that could later become more robust, id's were defined for each performer and messages should start by the /id address followed by the type of instrument and its value so a possible osc address would be /id/marimba/i. Being the id usually the name of the performer, marimba a percussive instrument and one integer to define the note, if the instrument is sending more than one parameter then new addresses are added like so /id/synth/env/i i i i, for a synthesizer that's sending frequency and ADSR information; defining the style guide on that very important protocol for the ensemble, allowed newcomers to start learning about addressing through a network and the ones that already knew how, simply could take it a little further by packing their addresses in a bundle for instance. Finally a simple application gui was developed using **Processing** and was installed on each smartphone before finally moving on in to a ready-made tool developed by Iglesia Intermedia, **MobMuPlat** (Iglesia Intermedia n.d.); is an app that can be easily found in the app store or play store and with it you can create controls for whatever pure data patch you have on your computer, or uploaded on your phone if you wanna use your phone as the instrument itself, it also deals with a big load of the connection and package loss issues that comes with handling osc data (Ogborn, 2012) implementing some features of its own to handle osc protocol; finally a pure data patch was developed to receive the messages and send them to each member's subpatch, now we could start practicing some music with networked smartphones; over the practice each could tune up how they sound or how they used their controllers (percussions, envelopes, delay times).

The change in music paradigms throughout the last 100 years has been very exciting also, like defining any timbre (synthesized or not) as being interesting material for expression is one, this brought a ships horn and all those “noises” to be taken into account in the musical practice; the idea that music is an art of time and space is another, now we see the space where the musical phenomenon is occurring to be an important part of music, i.e. sound sculptures, the plastics of sound; these are some of the concepts and forms derived from this notion. Cage’s ideas on the activity of sound happening in a temporal space can give you a view of the importance and on the contribution the concept of time-space brings to music -we now have the way to experiment with time-spaces-.

Using high speed interconnections to send the sound generated by a violin in a concert hall will also have in its stream the characteristics of the hall itself; the importance of the resonant room, or better, the resonant object, was demonstrated widely by Alvin Lucier in his work “I’m Sitting in a Room”. The idea of being able to experiment with a big time-space comprised of different spaces is what makes network music a must do practice in our ensemble.

Although this type of concert is not even a monthly activity, due to the long periods of time it may take to produce one presentation: preparations, musicians, institutional bureaucracy, rehearsals, networking configurations required, can be some of the issues one may encounter difficult in order to prepare this type of concert, at least in our local context; not everyone can afford a connection that handles those high speeds, it cost a lot to stream audio from one place to another not only monetarily speaking, but computationally. **Jack** is the most robust tool to achieve this at the moment, and its best implementation would be on a Linux based distribution, configuration problems may arise in Windows or OSX; but even with the problems that may arise in the practice of this type of network music, we see it as one of the most exciting fields in the current contemporary music practice.

With a growing popularity you can find peers which whom you can practice it in several countries, in Latin America, our geographic location you can find network music practice in countries like Brazil, Colombia, Peru or Chile; the tool commonly used for it is **jacktrip**, a tool that handles audio streams between nodes through JACK; currently a live usb with a Linux distro is being

cooked to offer those who would like to test an out of the box system configuration in order to practice network music, the live usb is based on the Ubuntu based flavor distribution maintained by **KXStudio** (“KXStudio”, n.d.), this was done to bring musicians closer to network music practice and are not well familiarized with the required tools and configurations, also is one of those ready-made tools We were discussing earlier.

Conclusions

The amount of technology at hand now days is overwhelming, and the need for those out of the box tools comes even stronger, take jacktrip for instance; jack’s best implementation is on a Linux based operating system some problems may be encountered on Windows or OSX, this makes it harder for people that wants to practice network music and does not work on Linux, a live Linux based usb with all the configurations ready can bring closer musicians of any sort to the practice of network music.

The types of electronic devices that can be used for musical expression being sound generators or control devices is quite overwhelming as well, by the development of shields, stompboxes, etc., that a computer music student or an electronic music hobbyists, may use for their electronic music practice and experimenting can be of great aid for bringing closer the relationship between instrument and performer so the person can also concentrate on the artistic part.

Finally, the need for starting to design orchestration information for electronic devices takes more importance with each new device that appears on the market, it’s very exciting to see a pouring sea of information and technology that you can find by a click; a way for the ensemble to become more consistent would be to construct a method for composition and interpretation purposes, a possible structure for this method is, and for each type of object:

- Type of object: whether it is a control object, generator object, software, or hardware
- Object capabilities: ranges, interpretation possibilities -trigger controller, envelope generator, etc-, timbral or controlling examples
- How-to: either how to build it, or how to use the existing object in the ensemble’s instrument warehouse
- Repertoire examples

Let’s say we want to implement a 555 timer chip touch

sensor we read about in Forrest Mims's electronics notebooks, its integration in the ensemble's method could be:

- Type: controller, analog, hardware
- Object capabilities: Trigger, piano style keyboard. Examples: piano and sampler software being controlled by the touch sensors
- How-to: printed PCB circuit to make a printed board using one of the existing diy techniques to do it, how to plug the developed module to an arduino and upload the software algorithm and connect it to a laptop.
- Repertoire examples: examples of existing works, or works composed members of the ensemble

Like this the ensemble may build a method that grows in time with collaborations made from members through computer music practice in the ensemble, bringing it closer as a standard musical method can be, and stimulating a more fluent relationship between musicians and technology

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Production Processes of Mexican Digital Artists

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Abstract

My hypothesis is that the observation of processes, products and context of Mexican digital artists' activity reveals common patterns that define Mexican Digital Art as a distinct artistic area. Through a qualitative research which included semi-structured interviews applied to eight artists, I was able to gather and analyse data that confirmed my hypothesis. No other virtual or physical documents address this issue with the perspective shown in my research. The interviewed eight artists use different expressive materials and media, like sound, robotics, free software programming, laser and obsolete technologies, and internet. Notwithstanding their formal differences, they share several common aspects like interdisciplinary approach and poor funding. The robotics project, for example, uses bioremediation, water supply and decontamination technologies. All of them, with one exception, started their artistic activity with no funds and operated in precarious conditions.

Keywords

Digital Art, Creation, Process, Artists, Methods, Production.

Introduction

This paper investigates the production processes of Mexican digital artists and their work, on the understanding that commonly these processes are enveloped by a halo of mystery, that is, the processes of creation are unknown, and more often than not, it is only possible to see it through the finished work, either by the artist himself or the public. Therefore, the need to investigate these processes are essential for the development of Digital Art; on the understanding that in Mexico to date research has not been conducted on this issue.

The development of this investigation is based on a logical and inductive process (exploring and describing, then generating theoretical perspectives); that is, from the particular to the general, the data to generalizations, the typical features of qualitative

research (for example, interviewing a person, analyzing the data obtained, and drawing conclusions; afterwards another person is interviewed, the data are analyzed, results and conclusions are reviewed; in the same way more interviews are conducted to understand the object of study: i.e. the research proceeds case-by-case, data by data, up to a more general perspective). With the data collected, we have gathered the perspectives and views of the participants (priorities, experiences, and meanings) as well as the analysis of interactions between individuals, groups, and communities. Thus, the type of research that is chosen focuses on understanding and deepening phenomena, exploring them from the perspective of participants in a natural environment and in relation to the context, which is selected when seeking to understand the perspectives of participants on the phenomena that surround us, deepen their experiences, perspectives, opinions and meanings, i.e. how participants perceive their reality subjectively.

What is Digital Art

Digital Art (DA) has become a discipline that brings together all artistic demonstrations carried out with the computer. Works of art can be made with digital media and can be described as an electronic series of ones and zeros. A work of this type is also produced by artists who use computer media prior to the materialization of the work or its display steps. DA combines Art, Science, and Technology, but not everything produced with these resources is considered DA, we can say that the border is unclear, but it is because of this that the DA is a hotbed of new ideas, and, therefore, research around the production process is indispensable.

Stages of Idea Production Process

Here it is worth considering whether steps for forming a creative product exist and whether they are applicable

to any individual who has produced any innovative and original object. Reality suggests that everyone has his or her own concept of development of this nature. However, even though everyone has their way of working, some threads could constitute what we call phases for the realization of a creative product.

These stages are not linear, in other words, the order cannot be taken literally, actual creative processes are interwoven, they can be in the assessment stage and during have intuitions, or even during incubation. Or, as has been discovered in this investigation by Mexican digital artists: one project may trigger other projects, so we are left with the impression that there are no conclusions but a constant and continuous flow of work; it all depends on the subject, who may have incubation periods that last for years.

Either way, dividing the creative process into five stages, although oversimplified, offers a valid and simple way to organize the complexity of such a process, the following steps are the conjunction of the vision of Mihaly Csikszentmihalyi, Manuela Romo, and the Mexican Mauro Rodríguez Estrada¹ on the creative process, which have been brought together because they are considered complementary.

I. Preparation. Conscience or sub-conscience, it is a set of problem areas that generate curiosity. There is a questioning, something perceived as a problem, a result of intellectual inquisitiveness, curiosity, habits of reflection, to perceive beyond appearance.

II. Incubation / Intuition. Ideas bubble beneath the conscious awareness of the individual, and unexpected combinations emerge, therefore the logical conscious side does not operate at this stage. Intuition is when the puzzle pieces fit together. Incubation and illumination are closely interrelated, such that they are considered parts of the same process. Incubation is a period of apparent calm, but ideas are brewing inside the mind.

III. Evaluation. When we put weight on whether intuition is valuable and if it's worth paying attention to. Emotionally, this is the hardest part of the process, when the creator feels more uncertain and insecure. It is when we seek the opinion of others.

IV. Elaboration. It is the longest phase and involves the hardest work. Execution occurs in this stage.

V. Communication. The essence of creativity is the element of novelty and value; both concepts contribute

to original objects. However, the result of creativity demands to be seen and recognized by others and its creators for validation. This is understandable, as we need a “judge” who opines whether the result is valuable or not; with difficulty, the creator of something can be the same person who assesses an idea or object.

Methodology

In terms of production methods used in MDA, we find different methods (exclusively in the elaboration phase) to those employed in traditional art, since they have different conditions that make other processes feasible in this area. Such conditions are: the use of electronic devices, the use of various energy sources, and the use of the computer in the process or the work itself, among others, which requires some advanced planning in the development of artistic work. It would be very difficult to improvise MDA due to the elements involved in creating a piece, i.e. MDA works investigated in this text have complex work processes. Therefore, the work process requires timely and specific steps that more often than not demand collective work coordinated between professionals from various disciplines.

Development in the knowledge of research methodology is broad, in the case of artistic production, the artists themselves have documented their own processes², or they have undertaken and research them, resulting in proposals useful for other artists. For example, in the case of Bruno Munari and his projective method, which consists of a series of necessary operations, sorted logically according to experience, in order to achieve maximum results with minimum effort, these stages are: Problem, Problem definition, Elements of the problem, Data collection, Data analysis, Creativity, Technological materials, Experimentation, Models, Verification, Construction drawings, Solution. It is worth mentioning that the above methodology is valid for design in general, not just for DA.

Mexican Digital Artists

The “stages of idea production” analysis herein is based on two Mexican digital artists (note, this article is part of a broader research project, which was conducted on eight Mexican digital artists), whose creative processes and idea triggers were analyzed later to make Concept Maps of these processes, in order to establish similarities in generating MDA artist ideas, and thus assist in the

¹ Rodríguez, M. (1985). *Manual de Creatividad. Los procesos psíquicos y el desarrollo* (1a. Ed.). Ciudad de México: Editorial Trillas, p.p. 39-47.

² In notebooks, diaries, manifestos, computer files, etc.

creation processes of new generations of digital artists.

Arcángel Constantini

Creative process

I. Preparation. General characteristics: the artist conducts an (occasional) registration of ideas; these are, as he affirms-, of various kinds, such as art projects but also business ideas, and social and political issues, among others. Subsequently, it ensures the realization of such ideas from the whole.

Problems that generate curiosity: there are many topics that interest Arcángel Constantini, such as the parallels between the media and production; the historical parallels of the first mass production, such as photo, film and graphics processes, science fiction; the experimental exploration of the network and computers; computer *Glitches* and computer materiality; the link between earlier and later stages in analog and digital; the human side of technology, Glitches-for example, the artist says: "...are mistakes of the machine that are generated randomly or intentionally; to err is human, if the machines make errors that humanizes them"³; aesthetic, formal, non-discursive review processes on specific phenomena; the concrete dreamlike digital (theory of the artist); personal perceptions of space and its relationship with the resilience of the people; the lucid and experimental, and chance and chaotic processes.

II. Incubation / Intuition. Resources for generating ideas. The artist refers to working in a lucid dream, or what is commonly known as "daydreaming". Participation in workshops on perception of the environment through dream, linking digital spaces of concrete representations of reality in the wake of the dream:

"Making you aware that the space you are experiencing is of your own construction and may be moldable, modified..."⁴ it is also considered an effective way to generate ideas. The practice of meditation as a resource (some of his works are inspired by meditation). The emergence of ideas from a whole: consumption of, for example, science fiction books, such as Philip K. Dick, Bradbury, Asimov, Stanislaw Lem, and consumer society in general.

III. Evaluation. The artist practices analysis; looking for the why, the how, the reasons situations

are developing; it delves into a reflection that leads to understanding and knowledge of the problem (artistic practice as a habit). In general, he describes his method as visceral. That, in terms of the theory of creativity, it operates through intuitions, artists like Arcángel Constantini intuit the value of their ideas in charges of experience that result in intuition, i.e., it is not free or magical, but due to years of experience of the artist, which decant into the confidence of his intuitions.

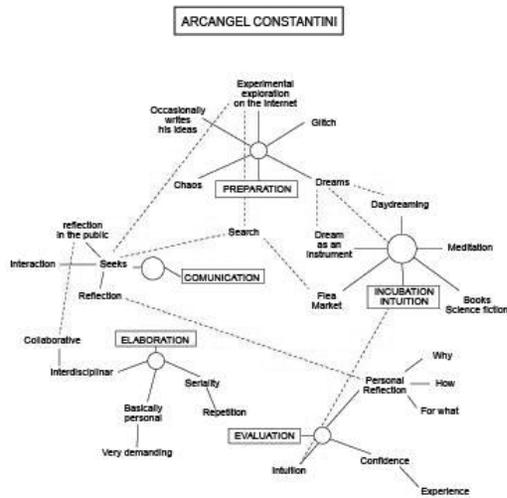
IV. Elaboration. Due to the technological nature of his works, his work method in the implementation and construction stages are the same, in most cases it involves interdisciplinary collaboration with other professionals: engineers, manufacturers, and so on. When expressly asked about collaborating with designers, (as was the case of Alejandro Magallanes in a facility for *Bacteria*) he notes that he does on occasion, but not very often because he is considered a complicated and demanding artist⁵. The development also rests on the following conceptual axes: The theoretical *loop* (in sound it is a repeat of a constant pattern, the same is true for aesthetics); the continuous *loop* (the idea remains the same, the same idea is repeated, but the form of each repetition changes); seriality, applied like a practice within the production process and multiplicity. Everything designed to obtain a response from the public.

V. Communication. Arcángel Constantini's processes are aimed at finding a reaction in the public and/or interaction with the execution of some action in the piece (such as works on the internet), such as reflection on urban, social, and cultural aspects through computers, photography, animation, video, building from pixels of digital graphic exposed in dynamic visual and sound works, installations, advertising, audiovisual performances, hacking physical computing hardware, sound art and Net Art, among others.

³ Interview with Archangel Constantini by Cynthia Villagómez at the Fonoteca Nacional, Coyoacán, Mexico City. October 1, 2011. Video Interview Length 00:21:43.

⁴ Ibid.

⁵ Ibid.



Model of Artistic Production Process. Arcángel Constantini.

In conclusion, after analysis of the work of Mexican digital artist Arcángel Constantini, who after almost two decades of continuous work has been established within the Mexican art world as one of the most known and prolific artists of his generation. Lover of technology, Archangel Constantini, to date, has found in it the resources necessary for the expression of aspects which he considers essential to record; with the use of repetition and constant reiteration, he creates continuous sequences of images and sounds very similar to those experienced in the context of the major cities, where the individual does not escape their daily lives, which is analogous to the continuous *loops* of the artist, who does not escape environmental concerns, excessive consumerism translated into mountains of garbage in the flea markets. The artist's obsession with re-use is evident in his work, by classifying, not resigning himself to the obsolescence of the objects by trying to revive them through cardio-respiratory massage with despair, but with a dramatic view of the subject, nostalgic and lucid, yes, without doubt.

Thus, we have the study of the work and the artist's creative production process, which sheds light on procedural ways of imagination and ideas, so the context that has surrounded the artist since childhood, such as their aesthetic and conceptual preferences are crucial to the realization of the work itself, a reflection and

manifestation of his time.

Regarding the process of creating Arcángel Constantini, we find that artistic practice is a habit. The preparation of the problems to be solved belongs to a series of work that is leading the artist to one or other development, but may also arise in works with very few links with his previous work. Case in point is Nanodrizas, where his interest in space and science fiction is explored. However, that project essentially includes many aspects not covered before by the artist or by the MDA, such as Bioremediation.

Leslie García

Creative process

I. Preparation. Among the artist's interests we include physics and mathematics, anthropology, philosophy, biology, and language. She indicates having many friends who are writers, which she considers a personal "frustration," so her pieces have an implicit literary aspect.

Prior to performing digital work, Leslie García used painting as a means of expression. The topics dealt with in her paintings were terrestrial maps or people on the move; she traced routes over time, so her paintings are strongly related to what she currently does in her digital work, especially about observing patterns.

What she discovered when in Mexico City, and making a review of her work in "Dreamaddictive" was her interest in consciousness and what she calls *the construction of the alchemist in the arts*, which she refers to as -according to comments- the ability of the human mind to transform reality from acquired knowledge, which relates to her personal case and her love for learning about biology, mathematics, or acupuncture, has extended her ability to perceive the environment overall, holistically, that is, with a new perspective, where the artist points out that if the individual is able to be more acute in observing their interior, then they will also apply this to their external reality⁶.

II. Incubation / Intuition. The artist believes that any work derived from personal searches, states of strong confrontation - she comments- her works are a way to test hypotheses about an issue that is presented in the way, Leslie García is perceived as a person who problematizes everything, even including for this reason she is constantly in therapy (particularly Gestalt), plus combining these therapies with acupuncture treatments.

⁶ Interview with Leslie García by Cynthia Villagómez (video conference), January 15, 2013. Duration 01:09:41..

So, the artist considers that this way of being and living translates into her work: firstly, with the use of generators, with effort, with programs that emulate and emit processes, which simulate something alive through something technological⁷.

So again, we found in Leslie García a form of work detected in other digital artists: the processes of continuous work, a central line of research from which small projects or “appendices” are derived or “come about” from that center line or lines.

When expressly asked whether there are artists who work with technology who she considers interesting or as a form of inspiration, she answered Nam June Paik (1932-2006, Korea) and her work Fluxus as an indispensable piece of reference⁸. In this sense, it refers to the publication of the influential community of video makers of the early seventies called *Radical Software*⁹, in which Paik collaborated. In the first issue, Paik paraphrased Hegel:

“What is more educational is more aesthetic, and what is most aesthetic is most educational.” For the artists who collaborated in this publication, *Radical Software* was a platform for the exploration of alternatives to the dominant media structure; it constituted a form of social activism, rather than an art magazine. The motivation of the publication, according to David Ross, was

“... technology has probably taken us to the brink of global destruction and has likely enabled the alignment between power and money that kept us on the verge of destruction, but the technology is not it is our enemy. In fact, if developed and managed humanely, communication technologies have the power to release something revolutionary ...”¹⁰. One of the intentions of digital art and art that incorporates the use of technology is to humanize technology through art, which is also

⁷ Ibid.

⁸ Ibid.

⁹ Other artists who collaborated in *Radical Software* were: Douglas Davis, Paul Ryan, Frank Gillette, Beryl Korot, Charles Bensingler, Ira Schneider, Ann Tyng, R. Buckminster Fuller, Gregory Bateson, Gene Youngblood, Parry Teasdale, Ant Farm, among others. Full numbers are on the internet, and were scanned from the complete collection of Ira Schneider (690 pages) as an initiative of David Gigliotti with the support of the Daniel Langlois Foundation. *Radical Software*. <http://www.radicalsoftware.org/e/index.html>. Accessed: January 24, 2013.

¹⁰ *Radical Software*. <http://www.radicalsoftware.org/e/ross.html>. Accessed: January 24, 2013. Article *Radical Software Redux*, David A. Ross.

addressed above.

Other characters in the world of art that seem interesting are the musicians, such as the electronic music pioneer Raymond Scott who developed his own synthesizer, or the French composer Pierre Schaeffer¹¹. In paintings, Leslie García sees a basic reference in Chagall, and among the current artists of her field of digital art she recognizes the work of artists such as Brazilian Guto Nóbrega¹². The artist believes that all ideas have already been thought of and reflected on from different angles, though her work is in re-contextualizing these ideas in contemporary reality¹³.

III. Evaluation. The artist mentions that the assessment of her work is done through what is called an effective probe. Also, she refers to her truncated education as a designer, where she indicates her liking for the idea of creating objects of desire in art, as is done in design. She points out that at the time an idea comes to her, she begins to sketch. Furthermore, she talks about her idea with members of her immediate circle, and she seeks and reads literature on the subject. The way she perceives whether the subject has any real resonance, she says, is when you start having more ideas and you realize a need to discuss the issue. It is at that moment when you start to consider the work relevant on that aspect. In her case, she explains that her ideas are of two types, she feels an affinity towards them or she considers them unworkable¹⁴.

Leslie García is always questioning *what ‘s next, why, what resonates*. Guto Nóbrega has said and applies it in practice: “You have to ask yourself whether the resonance of what you’re doing is stronger than the resonance of silence ...”¹⁵. If the answer is yes, then make the project happen.

¹¹ French composer (1910-1995), composer, writer, broadcaster, engineer, musicologist and innovator in acoustic communication made art works into music and literature after World War II, as well as anti-nuclear activism and cultural criticism, which garnered widespread recognition. All Music. <http://www.allmusic.com/artist/pierre-schaeffer-mn0000679092>. Accessed: January 24, 2012.

¹² Guto Nóbrega holds a Ph.D. in philosophy from the University of Plymouth, and an artist with developments focused on interactivity, telematics, and superorganism theory. Guto Nóbrega. <http://cargocollective.com/gutonobrega/#Sobre-mim-About-me>. Accessed: January 24, 2012.

¹³ Interview with Leslie García. *Op. Cit.*

¹⁴ Ibid.

¹⁵ Interview with Leslie García. *Op. Cit.*

IV. Elaboration. The artist develops solo pieces alone when it is the product of very personal searches; but she says she likes teamwork a lot, as she performs within the *Collectivo Astrovandalistas*, which she founded in Tijuana in 2010, initially she was its only member.

Her collective work is almost always literary; it deals with a literary presence. In this process, all ideas are analyzed; discussed; proposals arise; there is a search of intentions and interests, there is always a discussion on what is appropriate work. The artist believes that collective work is always looking for a very specific function of social impact, i.e. that the work “detonate possibilities,” she says, in such a way that it has a social echo (such as the work *Arma telemática* operated from the social net-work Twitter to a sound metal tower located outside the Campo Marte in Mexico City, the Mexican army headquarters where, in 1968, many people disappeared). In *Astrovandalistas*, Leslie García says that collaboration works in different ways: sometimes she does programming work, sometimes hardware; another friend of hers, called Rodrigo Frenk (also a young artist), is the strong arm of the group; hence the participation of other professionals diversifies according to the project from designers, animators, communications specialists, among others, who identify with the group’s position.

Within these forms of the employment relationship, in the preparation stage of the creation process, Leslie García affirms that some relationships are generated in experimental spaces. In the workshops, she was a tutor in the event *Interactivos*¹⁶ within a MediaLab Prado program. The artist mentions having tutored twice in 2008 in Mexico City, once with Zach Lieberman (director of *Open frameworks*, artist, and developer) and another by the Colombian artist Alejandro Tamayo (who works in biology labs). Leslie García said that although she finds working with these two artists strange -because she barely hovered for 25 years- realized that it was her collaboration in spaces such as *Eyebeam*¹⁷ in New York, her communication with

¹⁶ A research and production platform for creative and educational use of technology, whose main goal is to expand the use of electronics and software as art tools. Interactive. <http://interactivos.marginalialab.com/en/>. Accessed: January 23, 2013.

¹⁷ Center for Art and Technology located in New York, dedicated to exposing different audiences to new technologies and *media art* at the same time stable and shows the new media as a significant genre of cultural production. *Eyebeam*. <http://www.eyebam.org/>. Accessed: Janu-

Miller Puckette (developer of *Pure Data*) and contact with the *Computer Science* thinking of the United States (due to its proximity to Tijuana), which led to her invitation as a tutor with such artists¹⁸.

The artist considers these parts of the manufacturing processes, under the mentoring model, absorbing, because as a tutor who determines and defines the work process of a group of people, which constitutes an experimental space *per se*. Leslie García seems to enjoy talking with other artists and individuals interested in production processes, mentioning asking them about the way they work (if they work without interruption or take breaks, for example). She is also interested in knowing the ideal moods for creativity, which she considers essential to produce better, that is, if you are in a good mood, you are more productive: you understand faster, you are more creative, she notes. In these workshops where she has participated, she says that she talks a lot with students and tutors about forms of personal and collective creation, which is essential to understand that the duality of “being good and being evil” is inherent in every human, which drives us to be humbler, not think that we always have excellent ideas, and learn to not cling to them¹⁹.

In relation to collaborative work, García poured imperative ideas about involving cutting-edge knowledge, adapted to our present reality. She supports the concept of the whole man, what is called the *Cosmopolitical tactic*²⁰. She describes it as the way the entire man can be responsible for all areas of knowledge of the world, i.e., in small fractions, he says, people can contribute to solving problems in their community, the more aware they are of the circumstances, the solutions will be more comprehensive and environmentally friendly. The artist

ary 25, 2013.

¹⁸ Interview with Leslie García. Op. Cit.

¹⁹ Ibid.

²⁰ *Cosmopolitical tactic*: “Specialization confines problems as much as it defines them.

Despite how hard the task may be, we all need to become biologists, activists, artists, and theorists. It is possible and imperative.” University of California, Davis. <http://sts.ucdavis.edu/summerworkshop/Workshop%202009%20Readings/Dumit%202008%20Foreword%20Biological%20feedback.pdf>. Accessed: January 23, 2013. Text *Tactical biopolitics, Art, Activism, and Technoscience*. Beatriz da Costa and Kavita Philip. The MIT Press, Cambridge, Massachusetts. London, England, 2008.

expresses an interest in troubleshooting from any area: "... working for me is this need for harmonization and the role of the artist is paramount as a sort of satellite, monitor [...] trying to capture [gesture of "what is"] and bring it down so that it becomes something tangible"²¹.

In relation to art schools *versus* self-teaching, and that maturity that building your own mind provides, her working method and the use of the registry as a resource, tells us that intuition is what approaches to solutions, and for her, it is in this aspect where the importance of people who like her are self-taught radiates, because their activity is based on well-documented searches, making a record of exploration. Therefore, in her case and the other self-taught artists, there is an obsession to record everything going on: thoughts, mistakes, successes, all mark the path to find a solution to a problem posed; the artist considers this process a work methodology²².

Another way to work on the development of pieces, from concept and from the beginning of Dream Addictive Labs, has been building relationships with the outside or with institutions outside of Mexico, such as *Eyebeam*, in addition to the close relationship she has with Medialab-Prado, Madrid (as mentors), to participate in working groups in Colombia, with *Librepensante*²³, *Cartografias Sonora*²⁴. She points out that the sound aspect is present in most of her pieces. Hence she works with artists who favor this aspect. For this reason, Leslie's contacts were external; however, today there are many artists in Mexico that use sound as an essential part of their work (per information provided by Gilberto Esparza for this research).

On her current processes, those in which she is working right now, says that she is exploring the idea of a mobile laboratory, one that not only allows not her the space to produce, but enable work anywhere, allowing her to arrive adapt for work. She considers that this adaptation will also determine the size and complexity of her pieces. For Leslie, it is important that the piece reflects the conditions under which it occurred, because it is part of the circumstances of the artist; and she insists much they should reflect the limitations and conditions of austerity, because these works produce empathy with other artists in similar circumstances, so you can improve the processes themselves, through working

together. She cites the case of working with Brazilian artist Thiago Hersan, who, collaborated with Leslie García in *Cráter invertido*²⁵ (an autonomous group that has a space) for fifteen days in Mexico City in 2013 without a specific goal in mind, with experimentation as the way: an exercise in flexibility, mentions the artist²⁶.

V. Communication. Leslie García indicates that the reaction of people when reaching a piece varies greatly, some people do not seem to understand anything, while others reflect on it. What the artist seeks through her works is the reflection, which is why she builds her pieces as archetypes (in the psychological sense of the term, namely, as a representation that is considered a model of any manifestation of reality and/or images or diagrams with symbolic value as part of the collective unconscious"), i.e., the piece as an empty container which is filled with expectations, wishes, and concerns of the beholder or who interacts with it, depending on the case comments the artist²⁷.

In the aspect of communication, García believes to have inherited issues of her studies in design, she mentions aspects of function and form, and how in her pieces' interactivity must be dictated by the shape of the piece, so that the viewer intuits how to relate to it. For example, in her work *Deep Thought*, the artist invites people with instructions such as "take a deep breath," "allow chance to happen," which she uses to sensitize the person and start a relationship with the piece²⁸.

The artist considers this process interesting while planting concerns in the viewer about her pieces. On occasion, she has left the place where the piece is on display and listens from behind to the series of questions about the work from the public: "If that happens with two people out of a thousand" for her it is perfect. It means that there is a relationship with the piece. She has even watched very entertaining children *playing* with the works, like a computer game; then muses: "... if you can capture the child's attention and manage to generate a question, a challenge, a need and a response it means that they have a pretty clear communication process: return".

²¹ Interview with Leslie García. *Op. Cit.*

²² *Ibid.*

²³ *Librepensante*. <http://librepensante.org/>. Accessed: January 25, 2013.

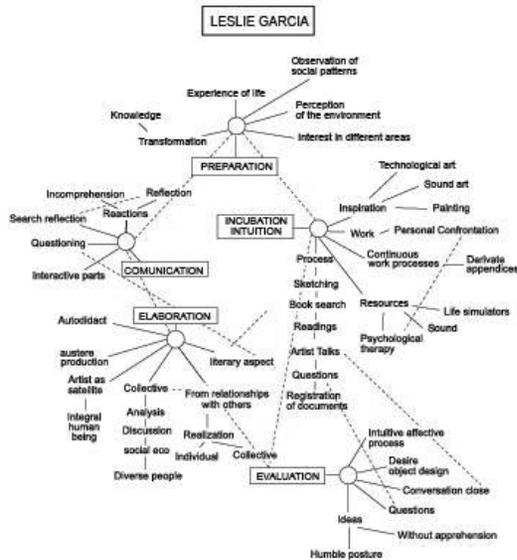
²⁴ *Cartografía sonora*. <http://cartografiasonora.blogspot.mx/>. Accessed: January 25, 2013.

²⁵ *Cráter invertido* <http://craterinvertido.org/>. Consultation: January 25, 2013.

²⁶ Interview with Leslie García. *Op. Cit.*

²⁷ Interview with Leslie García. *Op. Cit.*

²⁸ *Ibid.*



Model of Process of Artistic Production. Leslie Garcia.

Conclusions

Those who describe the broad spectrum on which Mexican digital art (MDA) rests, while at the same time transforming the field, also indicate the path that has been followed and the issues addressed. Artists delimit and improve the definition of the medium, which characterizes and simultaneously makes them unique. Thus, we have the genealogy of digital art in contemporary Mexican art, reflecting the need and curiosity of some artists who dare to involve emerging technologies in their artistic work. It was not until the artists created their own channels to reach the public that they began to recognize that the desire to experience went beyond what institutions accepted as art.

Currently, in Mexico, there are exhibition, creation and knowledge generation spaces about art with the use of technology, although they are inadequate and are overwhelmed by the gaps generated over decades of omission of digital art in public spaces and institutions, the future is promising for efforts invested by all those involved in disseminating knowledge of the Mexican digital art.

As it relates specifically to the production processes of Mexican digital artists and their work, we find that MDA is currently performed by a group of artists, mostly devoted entirely to this field. Although this factor is not

decisive in the way they produce, nor the fact that they are women or men, a common denominator can be set in most participants of the rubrics discussed: preparation, incubation, intuition or insight, evaluation, elaboration, and communication.

In the first phase, preparation, (or prior training of the creator whose effect on the process is relevant), including the context and a rich cultural environment in which various stimuli have nourished the mental corpus, we observe an innate curiosity in the artists, interest in different areas of human knowledge, and not only regarding digital art. Apparently, the artists seem not to be overly attentive to their field, and more interested in the various scientific and technological discoveries. The opposite is true: they have become researchers find value valuable and ultimately satisfies their curiosity.

In the group of artists studied, links or similarities are apparent in all phases of the creation process, in the case of preparation, common interests are music, reading various texts, intended to humanize technology, to find historical parallels, in the perception of art as a process of knowledge that enables questioning, but also social reflection. One of the most significant findings of this investigation is perhaps the detection of artistic work on “continuous work processes,” that branch into various sub-projects that may accrue in appendices or construction. Most artists have shown a record of their ideas, which they retain and make use of during the process of creation.

It is noteworthy that the artists make fascinating reflections on digital art and their pieces, which corroborates the intellectual vein that artists of this study possess, and therefore states that there can be no artistic creation without rational reflection and/or search for it through the work.

As for intuition and insight, we found that good ideas do not come by chance, but are the product of time and the training of the artist, a process which in all cases has taken several years. In this sense, the quality of ideas is not random, it owes its appearance to training, the preparation phase, and the context of the artist. Considering the above, the use of facilitating resources for the generation of ideas is also mentioned by MDA artists: dreams, meditation, and inducing a high level of concentration through various means.

It has been said that the artists studied find inspiration in science, technology, philosophy, science fiction, obsolete technology, politics, aspects of social issues

such as injustice, in art itself, -generally, although not exclusively- and resort to fantasy or fiction, in the same way they contemplate their national, technological, cultural, and social reality. Some of their ideas come quickly as occurrences, but others take years to emerge.

We observe that they make use of the principles already studied in the theory of creativity intuitively, such as combination, association, and returning elements unrelated to the subject to promote fundamental approaches around them, producing “forced” associations that further them from trite or common solutions.

About the evaluation of the generated ideas, the fascination with the process of acquiring knowledge (produced and acquired) *itself* is common in all cases. A general feature in the MDA pieces is that the results are all indeterminate cases, not predictable. The research processes and knowledge gathering that artists initiate can last for months or years and may not necessarily result in an artistic work. When these processes result in a piece, it is not the end of the road, but possibly the beginning of others. So, the work is concatenated and assessment of an idea: if it is feasible to be performed or not is complex, given that the initial idea is behind us in time or simply because the artist knows what should be produced.

The evaluation of an idea the artists of this research project relates to carrying it out by intuition, but always respond to personal or group discussions. In other cases, the feasibility of an idea to be conducted or not depends on technical and technological limitations, as well as the lack of financial resources for production.

As for the elaboration, decisions about the refining or adaptation of works (in technical respects in relation to the site, etc.) are more often than not carried out by groups of collaborators (not and ideation, which is performed by the artist in the case studies). So, the idea of performing a solo work, most of the time, disappears in this scheme of the development of ideas within interdisciplinary groups.

In this sense, it is important to mention that the lack of exhibition spaces and support, coupled with the ignorance of the scope of MDA, makes the growth in the number of artists difficult. However, interest is growing. In a conversation held with Christa Sommerer in the *Insects Solar* workshop at the Laboratorio Arte Alameda in 2013, she asked the researcher responsible for this project if it considered that in Mexico there was a *boom* or boom in digital art, to that is answered yes, however, this only applied to some cities (such as Mexico City, Guadalajara, Monterrey, Puebla, San Luis Potosí, Tijuana, and León,

among others that have centers and / or related digital art events). The predominance of traditional arts remains in the country in artistic practice as well as in cultural, educational, and exhibition spaces, such as painting, sculpture, and printmaking. Even when art has greater reach because of technology, this is not the case with digital art.

The digital artists analyzed emphasize the physically and mentally intense work involved in preparing the pieces, which is why the artists of this area have a high capacity for interdisciplinary work in teams with professionals from various areas of knowledge, where the work is open or undetermined until the end. The duration of these is variable; the artists say that work can take hours, weeks, months or even several years.

In the communicational aspect of the results of research processes and knowledge acquisition, we observe that there is a concern about the public reaction, i.e., the way the viewer participates in the work is part of the aspects that the artist considers to be performed; even where the work is left *open*, whose intrinsic possibilities the public gives the “final form” to the work, or in some cases that the piece offers a variety of “final”. Through the piece the artist seeks: sometimes a reaction, at times the interaction, but usually unexpected reactions.

Thus, we conclude that this investigation in the preceding pages has generated knowledge about Mexican contemporary digital artists and their production processes, since to date there are no virtual or physical documents that address this issue from this perspective. We have studied the processes of reflection and conceptualization around the artwork, from the point of view of the embodiment as well as the intellectual process carried out by the artist. We reflect on the new production processes involved in Mexican Digital Art, their sources of inspiration and how they have transformed artistic practice in the field. Through the analysis of production processes of each of the artists of this project we have formed a model for the interdisciplinary methodological approach, derived from the study and analysis of the production processes of Mexican digital artists, which is included in a larger study, i.e., greater and deeper investigation of the subject matter from which this article was derived.

Therefore, in these pages, the reader has found part of the explanation and reasons for the once considered mysterious process of artistic creation, and elucidated the ties of an important and fundamental part of the scenario of Mexican Digital Art of our times.

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Motivation in Design Strategies for Behavior Change

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Abstract

Motivation is a key factor that determine behavior change. In this paper, the researchers study how people is motivated when interacting with two strategies that aim to change grocery shopping behaviors. The strategies are similar but with differences in mindfulness and nudging elements. Researchers collected qualitative data with observations and interviews from 12 user participants. Motivation categories of Fogg's behavioral model were used in the data analysis. Findings show that the strategies can trigger pleasure, pain, fear and social acceptance. People that used the reflective strategy with mindful processes were able to better express their motivations.

Keywords

Motivation, Design for Behavior Change, Behavioral Economics, Persuasion.

Introduction

When designers address behavior changes as the main outcome of an artifact or system, the challenge is not only related to usability but also to motivation and timing. Fogg (2009) introduced a new model about human behavior, which present three factors: motivation, ability and trigger. Each with subcomponents, three core motivation, six elements to define simplicity (ability) and three types of triggers. This model intends to support the analysis and the prescription of persuasive systems. This paper is a report of a study of motivation of people when interacting with two behavior change strategies.

Researchers have distinguished between reflective and automatic strategies (e.g. Sunstein, 2016). For example, John, Smith, and Stoker (2009) compared “nudge” and “think” strategies and suggested that designers integrate nudge and think strategies to achieve successful behavior change. “Nudge” consists of interventions that guide people’s decision-making without limiting their choice and exploiting automatic thinking processes. “Think” strategies focus on the transformation of behavior that arises from the deliberation and reflection.

The strategies used in this study target shopping behavior in the grocery store. One strategy focused on activation of reflective thinking (reflective strategy) and the other on nudging the automatic thinking (automatic strategy). Both strategies are similar because both are interactive shopping lists for tablet devices, but each one provides different supplemental information.

The reflective strategy starts with a challenge, asking participant to sort two sets of cards in two piles: (a) products with added and not added sugars, and (b) ultra processed and minimally processed foods (see figure 1). After that, they saw videos that explain things about health.



Figure 1. Activity with cards

Then, participants are invited to plan their shopping in the interactive lists (see figure 2). Notice that this interface provides information about level added sugars and industrial processing. Participants then can take the tablet while they make decisions in the store and return the device after they pay. In this strategy participants are expected to be reflective and be more mindful in their shopping decision-making.



Figure 2. Shopping list in the reflective strategy

The automatic strategy starts showing participants two personas, one normal weight and one obese (see figure 3). Then, participants are invited to plan their shopping in the interactive lists (see figure 4). This list includes a simulation of effects of selected items in the weight of an adult. Participants then can take the tablet while they make decisions in the store and return the device after they pay. In this strategy participants are expected to be nudged to buy items that help the persona have less weight.



Figure 3. Personas in automatic strategy



Figure 4. Shopping list in the automatic strategy

Theory of Motivation

There are multiple theoretical approaches to motivation. A practical theory that includes the concept of motivation is Fogg’s behavioral model (Fogg, 2009). This model is applied in design of persuasive systems. He proposed that a behavior needs three conditions: ability, motivation and a trigger. In the design of persuasive systems the triggers are key; it should be visible, related to the behavior and given in the precise time. A given trigger distracts when motivation is low and frustrates when ability is low. Fogg explained that motivation can be triggered in three categories: pleasure/pain, hope/fear and social acceptance/rejection. Last, Fogg distinguishes between three types of triggers: spark (for low motivation), facilitator (for low ability), and signal (reminder when both motivation and ability are high). In this study Fogg’s categories of motivation were used as a theoretical framework.

Methods

This is a qualitative study that is part of an ongoing larger research comparing instructional and behavioral design strategies for health behavior change. In this study, the researchers selected participants who are part of the randomized trial comparing those strategies, directly observed them acting while using the artifacts that belonged to the strategies, and interviewed them in depth to find out how were their motivations.

A convenience sample was recruited inviting participants who finished their purchases in the supermarket. These participants previously accepted to use one of two design strategies (reflective and automatic) and were invited to respond to the interview

immediately after their finished their participation in the larger study. The sample was composed of a total of 12 participants with overweight of which half belonged to reflexive strategy and the other half from automatic strategy. They ranged between 18 years ago and 60 years ago.

To collect the data, the researchers took notes in the direct observation and audio recorded the interviews overweight and. During the application of the instruments were identified the main aspects that Fogg establish as motivators (pleasure/pain, hope/fear, social acceptance/rejection). The researchers paid attention to gestures, the way of expressions, the acting and answers. In the direct observation, everything was narrated with detailed about participants and their stayed in the store. For the interviews, only one participant rejected audio recording; in this case, the researchers took notes of answers.

Data was analyzed in software for qualitative analysis (ATLAS.ti). This tool allows order and regroups the material in a systematic way. Also accept analysis of audios of interviews and images of diary notes. The tool facilitated data coding and categorization. Categories were created based on the Fogg's motivation concepts (Fogg, 2009).

Findings

This section is a report of the findings based on the observations and interviews.

Related to pleasure/pain:

Finding 1. The people who used the reflexive strategy (4 of 6) showed more enjoyment and satisfaction about using the prototype than the people who used the automatic strategy (2 of 6). These people in both groups (6 of 12) related the satisfaction with the benefits for health. Participant 4 (reflexive strategy) said "yes, very good, very good, because in this way we can learn new things [...] there were unclear things for me, whether [if some items] had sugar; there I learned a lot, it was very good." P. 3: "No!, very cool, because when I selected things [...], there were things that we didn't know, such as this things were in certain ranges, and [...] with this, very cool, then we learned many things and things that we didn't know, for example how to sort the food and that." Participant 8 (automatic strategy) said "yes, it is good, it is also useful to see what products the family consume and which ones help us in health or are healthier."

Finding 2. While the majority of reflexive group (5 of 6) expressed interest with knowledge, just some of automatic group (2 of 6) did it, for example: P. 2 (reflexive strategy): "[...] good, you know that we bought sometimes like that and we didn't realize and with this we put more attention in which things we will buy [...] is like I told you, before we didn't be conscious about which are processor or which are better for our health, instead with this experience we pay more attention in this things." P. 7 (automatic strategy): "No, the system that you are implementing is very good, because we are more conscious about that, is not what we want and [...]] to become aware, become aware about health... truly, is a little bit, it's about what we want at the moment or what we want to eat, but for health issue we are more restricted."

Finding 3. Half of the participants of the reflexive strategy (3 of 6) expressed ideas related to the motivator of pain when they talk topics to address issues related to health by the death or illness of a close relative. For example participants 4 said "my dad's dead, from there we decided to eat with less fat and sugar. That made us change." P. 10 Made comments such as: "I buy chocolate powder because my mom is diabetic". Or at the time of selecting the products on the shopping list said: "I would buy cookies but whole."

Related to hope/fear:

Finding 4. Some participants of the automatic strategy (2 of 6) showed fear and felt uncomfortable to be reflected in the obese person. This was identified through instrument notes and interview. For example, participant 7 said, "Yes, [it can help me make better healthy shopping] because I saw the image there very fat I would like different food. One questions oneself."

Finding 5. All participants (12 of 12) gave contact information with confidence to the researchers, which happened after started the activities and made the grocery shopping. This was identified through instrument notes.

Finding 6. Half of participants of the reflexive strategy (3 of 6) showed fear at the moment that they had to do the activities, because they thought that it would have a note or they don't like to show that they didn't know something. It was identified through the notes of the instrument.

Related to social acceptance/rejection:

Finding 7. The majority of the participants of reflexive strategy (5 of 6) said have been influenced by our expectatives. Participant 2 said "Yes, maybe,

[researcher expectations influenced] in a positive way.” Participant 9 said “[this activity influenced] a little bit because one does not pay attention to eat vegetables and stuff like that.”

Finding 8. Some participants (3 of 12) did not use the tablet while they were in the aisles; they only updated the list at the end before they returned it. This was identified through the notes of the instrument.

Finding 9. All of participants (12 of 12) showed comprehension about information, although some more than others, but in general it is evident that all of them had a significant learning. This could be deducted through all the process and every moment of each activity and in the interviews people repeat all the things that they learned. Participant 12: “I help to not lean towards some unhealthy products. The activity reinforces previous information that one has.”

Finding 10. The majority of participants (8 of 12) said that with this activity they are more conscious. Participant 2 said “well, as I said, one does not buy consciously what is processed, what is not, what is healthier; instead, with this experience one pays more attention to this stuff.”

Discussion

This section is organized with Fogg’s motivators in behavior change (2009). Regarding pleasure and pain, the first three findings show that the reflective strategy triggered these motivators more. For example, participants of this group were clearer to show satisfaction or showed pain related to death and illness. One possible explanation is that the language related to added sugars, natural foods, and processed food is somewhat familiar for people and reminds them of health conditions. This motivation shows also that people is more mindful using the reflective strategy. Participants of the automatic strategy could also have this motivation; however, the strategy may be more abstract for them and, thus, they have a harder time identifying their own pain or pleasure when they are interviewed. The alternative explanation is that participants see the simulation and personas as a playful feature and motivations of pain are not triggered.

Regarding hope and fear, all participants felt hopeful about the activities because after the first minutes of planning shopping they were happy to share their personal data. This means that the researchers were successful in creating a calm environment for people to not feel fear of the activity. Designers could make sure

that people have no fear of the strategies, which could lead to better user experiences and facilitate change.

Participants in both strategies showed fear but for different reasons. While in the reflective strategy some participants were afraid to have make knowledge mistakes, in the automatic strategy some participants expressed fear related to the depiction of the obese persona. For the designers fear was the intention only in the automatic strategy: to trigger fear of obesity and motivate change of purchasing behaviors. This visual strategy could be explored further to take advantage of this motivator. A more refined simulation could show personal effects of shopping habits.

Regarding social acceptance/rejection, participants in both groups said that they learned and were more conscious about their grocery shopping. Social acceptance/rejection may have a role of putting pressure on people to do well the activity. There is one difference in the groups; participants in the reflective strategy identified that the researchers were putting some pressure on them. The explanation here is the same of pain, the language clearly links the activity to health and participants easily say that they feel influence. Social pressure to perform better could be present in the two strategies, but the clarity of the reflective strategy facilitates the acknowledgement of the influence.

Conclusion

The paper showed the study of motivation as a determining factor in the application of strategies to influence behavior change, specifically in grocery shopping. Aspects reflecting motivational relationships such as pleasure-pain, hope-fear and social acceptance-rejection are evident in both reflective-mindful and automatic-nudge strategies.

Direct observations and interviews at the place of purchases can affect users responses by acting as triggers of fear and social rejection. It is evident that the participants of the reflexive strategy felt more comfortable to express their motivations because they seem to have a clearer understanding of the strategies. It is recommended for future research in design for behavior change to include the study of triggers that affect motivation of people.

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Panels

Bio-creation of Informatics: Rethinking Data Ecosystems in the Network Economy

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Abstract

The evolution of the information society has seen 'data' becoming the most important economic resource of the networked economy, mediated by the collocated and instantaneous access, dissemination and sharing of information amongst people across vast distances. Central to these various transactions that occur in our network culture, there exist numerous policy propositions that seek to regulate the archiving, access, sharing, use and dissemination of data. These policy propositions are often enforced upon users as encoded rules of the informatics of bio-creation, rather than being modeled by the very participants of the network who created the data in the first place - bio-creation of informatics. Furthermore, the design of most policy recommendations that have deep socio-economic and political implications have been restricted to reflecting the views of legal scholars and members of the technology industry, giving little or no room for a larger public discourse that is fueled by multi-stakeholder approaches. This panel seeks to explore how transdisciplinary media practitioners and creative art and design practitioners in tandem with information policy activists can address the context of data ecosystems to reimagine them and at the same time engage members of the general public to reflect and contribute to a larger inclusive discourse that can help re-shape public policy surrounding data ecosystems

Introduction

The relevance of data is not as much because of its value as chunks of information, but because of the ecosystems where data is created, transformed and disseminated that makes it possible to use pieces of information to achieve larger goals. Data ecosystems have the potential to become spaces for positive economic, social and cultural adaptations. However, current ecosystems tend to respond to particular interests that challenge democracy, and radically transform our reach

as autonomous individuals, citizens and members of socio-cultural groups. We will look at these scenarios through the lenses of ownership, privacy, transparency, openness and choice of individuals. Furthermore, we will elucidate the role of creative practices in designing data ecosystems that are inclusive and allow the public to contribute. Cultivating cultural participation in collective electronic spaces and shared knowledge in the networked realities of hypermedia meshwork is the foundation for an ecology of information.

Provocations for the panel

The Panel situates itself across transdisciplinary modes of enquiry, shifting gears between policy and design factors that influence infrastructural and informational aspects of the network society while dealing with multiple provocations: How can we shape ecosystems that mediate flows of information and data in a decentralized and self-governed manner? How can we create mechanisms for data ecosystems to be mutable and capable of infinite expansion? Can there exist different networks that are mutually incompatible with each other, encoded by specific group of users? How can the often concealed inner-workings of infrastructural components and processes behind user interfaces be exposed, so that best practices of data sharing, privacy, and intellectual property decisions be encoded into the design tools for creating data ecosystems?

Further, the panel underlines the importance of developing an informed art and design practice that takes into account communication policy recommendations needed to tackle and comment on the desirable state of data ecosystems. A set of provocations

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to this end includes: How should we rethink the right to participation in the digital age? How can we balance notions of privacy and transparency while understanding the involvement of users in a data ecosystem? What are the implications for data policy, when shaping networks that involve users with access to digital devices and code literacy and those without? What are the socio-cultural implications for technology policy law and data protection laws, and how often are they considered by top-down replications in global policy? These are but some of the provocations that the panel seeks to answer across four papers that give ample room to invite diverse points of view from the audience.

Civic Media & Data (h)ac(k)tivism: Environments, Tools and Practices for Critical Data+Code Literacy and Visualization

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This paper is one of the contributions to an academic panel titled: “Bio-creation of informatics: Rethinking data ecosystems in the network economy”. The panel seeks to explore different approaches for trans disciplinary media art and design practitioners in re-imagining data ecosystems and at the same time engaging members of the general public to reflect and contribute to an inclusive discourse that may re-shape public policy surrounding data ecosystems , from the lenses of ownership, privacy, transparency, openness and choice of individuals. The panel is moderated, co-authored and edited by Catalina Alzate.

Abstract

A responsible data-driven environment must consider data as a political human construct, and be spaces for empowering citizens. One important aspect of citizen empowerment involves prototyping of tools and practices that challenge hierarchies, by blurring binary constructs like author / lector, developer / user, document / data, binary application / source code. On this line of thought, a set of tools and practices will be described that look at data from a critical perspective, contrasting the neutralized “Hello world” approach to technology learning, and allowing the emergence of diverse communities of authorship. The tools blend code, document, data, query and visuals, and propose strategies to make the source code and history of all digital artifacts open to share, for improving the traceability of data and data derived arguments. I call them “pocket infrastructures” because they are self-contained, work online and offline and run on modest common technologies, from USB thumb drives to modest laptops and anything in between and beyond. These infrastructures try to put data in “everyone’s pocket”, contrasting sharply the exclusionary ‘cloud’, ‘big data’ & ‘always connected’ discourses, where infrastructure can be owned only by the ones with “deep pockets”. This tool and its related practices are in dialogue with other approaches like the feminist data visualization (D’Ignazio and Klein 2016), literate computing (Perez and Granger 2015) and reproducible research.

Keywords

Citizen Empowerment, Prototyping tools, Open Infrastructures, Data visualization, Data Narratives, Data Activism, Hacker Spaces, Democratization of Technology, Knowledge Commons.

Introduction

With the aim of exploring reciprocal exchanges between communities and digital artifacts, and using design as critical enactive knowledge, I have been iterating on the question “How can we change the digital tools that change us?” or how to enable the reciprocal modifications between digital tools and communities? Approaching that fuzzy problem from a design research perspective implied to inhabit a particular community, in my case, HackBo in Bogotá Colombia, and to use prototypes to explore and communicate the problem (Saikaly Fatina 2005). Aiming to explore the direct relationship between design epistemologies and enactive knowledge (understanding by doing in a context), this text will present a historic development of that understanding process in dialogue with other theoretical approaches (design research as a reflexive practice). This reflexive trace of history would hopefully bring light upon this kind of contextual research by de-neutralizing the results and connecting them with the process that create them. At the end some provocations will be provided to connect these particular experiences with areas across bio-creation, data and power.

Historical Perspective of HackBo and the Beginning of Grafoscopio

Hackbo is a hacker space in Bogotá exploring the community meant to propose from inside a set of iterative digital artifacts and practices around them to challenge the deconstruction of the binary divide between those who made them (“coders”) and those who use them (“end users”), and to find out if such processes were relevant in a hackerspace where most people are familiar and proficient with coding.

In the beginning (from late 2010 to early 2013) I tried building digital habitats (Wenger, White, and Smith 2012) by using web technology (wiki and customized Content Management Systems CMS), but the HackBo community's approach to them was mostly operational: the most used feature of the CMS was the one that allows to schedule face to face activities in the hackerspace. Some other parallel explorations about using CMS to publish data notebooks were made from 2013 to early 2014 with some participants of the hackerspace (Luna 2014b, 2014a)

But at some point in late 2013 the HackBo hackerspace was a focal point of resistance against gentrification of the hackathon (a prototyping by coding marathon) by the private and public sectors, with the implementation of the now common and oversimplified "social problem solving hackathon" (Lilly Irani, n.d.) the HackathonGEL. The proposal of a counter-hackathon (the Gobernaton (Luna 2013)) contextualized the hackathon as a performative act of civic critic and dialogue with public and private sectors and from there the idea storytelling with data (particularly the integrity codes called hashes, of the contracts for the execution of the HackathonGEL), brought some light over these alternative ways of data activism that could survive the volatility of hackathon prototypes. Techniques, infrastructures and knowledge to support data storytelling as a form of critical dialogue to deconstruct power, will last longer than the "app" or "social network" or "uber for" monocultural approach that has been built in the "social innovation" hackathon model.

Grafoscopio, a moldable tool for literate computing and reproducible research evolved from there with the companion Data Week, a recurrent hackathon/workshop where attendants learnt how to use and modify Grafoscopio to create data visualizations and tell stories with data. Both can be seen from the duality of experience (participation/reification) proposed by Wenger (1999): participation produces artifacts that enable (or not) future ways of participation and introducing feedback in the design cycle. The participation in the HackBo and Pharo communities created Grafoscopio¹, (as detailed on Luna (2014)), and the existence of such an artifact allowed for the creation of the Data Week, to extend and deconstruct Grafoscopio and other digital related artifacts. The design issues behind such a duo are considered below.

¹Pharo provides the Technology ecosystem behind Grafoscopio.

Critical instances of Grafoscopio

Grafoscopio crystallizes design positions belonging to the free 'libre' open source software (FLOSS) communities that are in dialogue with several authors: technologies as political devices (Langdon Winner 1989), code as an exercise of freedom of expression (Coleman 2013), knowledge as commons (Ostrom and Hess 2006), and software as a craft that embodies design experience and allows research through design (Blackwell and Aaron 2015). This way of embodiment draws on several sources and concerns reflected in the activities that Grafoscopio supports: deconstruction and extensibility of tools, open educational resources, alternative educational practices, non-hegemonic places, discourses and practices for knowledge, activist objects, reproducible research, garage and citizen science (early documentation of them are in (Luna Cárdenas 2014)) Grafoscopio is also 'a pocket-infrastructure' (explained in the abstract of this paper) and is based on Pharo Smalltalk, an environment that blends together source code, application, software development environment and adds/blends in the idea of interactive notebooks. On the other hand, Grafoscopio tries to mix ideas of Leo Editor, Jupyter/IPython notebook and Mathematica, by creating an interactive documentation environment with a tree-like (outliner) interface that organizes the document, giving it sequence and hierarchy.

Iterative design circumstances in the Data Week

Given that the Data Week was related to data activism, storytelling and visualization, participants were generally interested in acquiring new symbolic and visual languages and knowledge to represent their concerns. Attendants came mostly from outside the core community of HackBo, including increasingly diverse lines of practice: journalist, teacher, philosopher, researcher, student, philologist and activist.

The roots of data activism from the Gobernaton were evident in the deployment of a critical approach to data and code literacy by choosing themes related to government transparency, like the political public discourse on Twitter and awareness of our own Twitter discourse with the implementation of Twitter data selfies (Luna Cárdenas 2016).

The above practices and artifacts took a critical approach to data, code literacy and visualization. Our curriculum included: a historic approach on computational traditions (comparing the Unix tradition

and the Smalltalk/Dynabook ones), design as the study of bifurcation points (Jonas 2007), linking tradition to our present understanding of computers as cognitive devices that can help us into putting into dialogue different representations to understand and express a problem—particularly symbolic (code), graphical (visualization) and quantitative (data) representations, the relation between technology, politics & power, mouldable tools, Smalltalk/Pharo learning from basic syntax to medium scripts to finally tackle an open problem (the Twitter data selfie).

Participants consistently reported a change from understanding technology as a given, to recognizing how technological systems can be constituted by more fluid devices. The idea of coding as storytelling instead of a practice to build apps or websites seemed more plural to most of them, although they recognized that as a form of literacy it does take time to acquire. Some questions remain to be used as future provocations, and have been outlined in the next section.

Provocations on Bio-Creation, Data and Power

How can we foster a dialogue around socio-technological artifacts and practices in a permanent and powerful way, including institutional setups in academia, government and enterprise, without being co-opted by them? Is data at the service of bio-political forms of surveillance and control, the quantification of existence and the creation of equivalences between what exists and is visible, and between what is visible and what is measurable? If this is the case, how can alternative metrics, dark information (as a metaphor/analogy with dark matter and the relation between visible and invisible), and data activism propose alternative ways of governance, fluid power structures and hierarchies for a more plural and common world?

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Author Biography

Offray Luna-Cárdenas is a long time hacktivist for knowledge and culture as common goods and digital technology as a particular embodiment and enabler in several fields: Free Open Source Software and Openness in Data, Science and Reproducible Research, Educational Resources and Government & knowledge management. His undergraduate degree was in Informatics-Mathematics, Masters in Education and a PhD(c) in Design and Creation. He is a founding member of the HackBo hackerspace in Bogotá (Colombia) and is working on the reciprocal modification between communities and digital artifacts, by building and bridging critical code+data literacy and visualization, as well as community practices with moldable digital artifacts and pocket infrastructures. He works as a consultant, coder, teacher and researcher.

Data and Public Policy: An Approach to Data Ecosystems from a Human Rights Perspective

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This paper is one of the contributions to an academic panel titled: “Bio-creation of informatics: Rethinking data ecosystems in the network economy”. The panel seeks to explore different approaches for trans disciplinary media art and design practitioners in re-imagining data ecosystems and at the same time engaging members of the general public to reflect and contribute to an inclusive discourse that may re-shape public policy surrounding data ecosystems , from the lenses of ownership, privacy, transparency, openness and choice of individuals. The panel is moderated, co-authored and edited by Catalina Alzate.

Abstract

The public policies that encourage the implementation of infrastructures for data management are mostly adopted by governments with great technological enthusiasm, leaving aside the notion of human rights and potential effects for freedom of expression, privacy, inclusion and security of citizens'. The government of Colombia encourages spaces for citizens' participation like public consultations, in order to include people in the design of policies that can dramatically modify the way they interact with other citizens and with the state.

In this paper two examples that look at policy for data infrastructures will be discussed for researchers and information artists interested in public interventions and engagement. 1) The discussion around the copyright reform, as part of the implementation of the FTA (Free-Trade Agreement) of Colombia with the United States. 2) The implementation of cell phone registry as part of the strategy against mobile theft in Colombia.

As a civil society organization, our advocacy strategy has included creating or taking advantage of participative spaces to introduce new narratives into public policy.

Keywords

Internet Policy, Human Rights, Data Infrastructures, Freedom of Expression, Privacy, Inclusion, Copyright, Cell Phone Databases, Citizen Engagement, Advocacy.

Introduction

The promises and benefits of Information and Communication Technologies (ICTs) and particularly the Internet, are gaining special attention because of their potential to enhance interactions between the citizens and the state. However, when it comes to analyzing the design of infrastructures that support such interactions, the impact of ICTs regarding human rights are either underestimated or governments fail to estimate the degree of consequences that in many cases entail hindering the very access of people to governance and their possibility of achieving full citizenship.

In Colombia, where the most prevalent relationship with technology is instrumental, meaning that technology is used but not created, and that knowledge is transferred but not appropriated, the scope of introducing ICTs on society is not predicted and the impact of such technologies is not measured. A common belief is that introducing technologies in the *citizen - state* equation, will benefit people and the system in evident ways: less time spent in legal procedures, less use of paper and greater control of official processes. These assumptions reveal the general lack of knowledge both in governments and in the society about the design of technological platforms, the management of information and the roles that these platforms suppose people to adapt: merely as passive users.

There are particular manual requirements for the generation of public policies that take into account the necessary discussion about the design of infrastructures and platforms that manage large amounts of information of citizens, as well as the inclusion of participative mechanisms for citizens to contribute to the evaluation and the design of requirements for these platforms. In the general framework of these discussions a frequent reference is made to 'the *respect and promotion of human rights*', but what this implies for the construction of public policies is still uncertain. Beyond introducing

analysis of security and privacy risks, the design of public policies in Colombia suffers from a profound gap in terms of approach to human rights, that could allow governments to measure impact and evaluate the scope of the introduction of ICTs in the interactions between government and citizens in the short, medium and long term. Above all, it is necessary to re-think the future implications of collecting, storing and managing vast amounts of information that circulate through these platforms.

This paper introduces two case studies where it is possible to trace the need to explore the relationship between the design of the platforms and human rights challenges emerging in a digital context.

Case Study 1. The Discussion on Copyright, Access to Knowledge and Culture and the Challenges to Freedom of Expression.

The right to freedom of expression contemplates not only the possibility of individuals to express their opinion, but also the right to access information to understand the world around us. This dual character of freedom of expression is permanently in tension with other rights. This is the particular context of copyright.

In its conception, copyright is born as an exception to the right to access knowledge and information, recognizing the role of authors and artists in the creation of culture and granting them with the monopoly of commercial exploitation of their works for a limited period of time. In theory, after the lock-in period determined by law, all works become part of the public domain and therefore of the universal cultural baggage. Once the works are located in this realm, they can be freely used by anyone. Some of the concerns for public policies developed in copyright laws include: when and how works move into the public domain, in which cases or under what requirements can such works be used by others before being in the public domain and how can authors and artists control access to their work when they are still under their ownership? Even though the issue of access should be central to the discussion of these policies, the commercial interests and the heavy lobby of large corporations that own the title of the works (and therefore the rights of commercial exploitation), have tipped the balance towards protectionist policies of the rights held by authors, harming the open access to knowledge, which is a central aspect for achieving freedom of expression.

Designed for the world of atoms and not for the world

of bits, control and access in the digital world simulate the depletion of the tangible by creating mechanisms of artificial scarcity, as it is in the case of the technological measures of protection. The extensive use of these measures is encouraged through their incorporation into the copyright law in the United States (Digital Millennium Copyright Act MCA) and the exportation of this model through free-trade agreements (FTA) to countries like Colombia.

As in all negotiations, there is a margin for local implementation and the adaptation of national laws. This particular process could be highly enriched with active participation of citizens. In the case of Colombia, the implementation of the free trade agreement with the United States includes the need to adapt the national copyright law and incorporate on it a chapter on technological measures of protection that without proper balance can result in a huge barrier for accessing knowledge. There have been two reforms to the copyright law in Colombia: On the first case, the law was approved by the congress but declared unenforceable by the Constitutional Court. On the second occasion, the law was archived without debate.

For the second reform, Karisma Foundation requested the government of Colombia for a space of participation where citizens and experts from different disciplines could contribute to the debate. The request was made by the collective “RedPaTodos” and was effectively opened up by The Ministry of Commerce¹². After providing feedback and comments, the same copyright project was proposed again a couple of years later by the government, without the comments being addressed. Even though it is possible to open up spaces for discussion, there is scope for creative practitioners to intervene in communication strategies that can involve more citizens, and come up with strategies to escalate the comments and increase the effectiveness of the feedback between civil society organizations and governments.

On this line of thought, there are also several fields of investigation and dialogue where artists can adopt active roles of participation and contribute to the gathering of detailed information to model public policy. Given that current policies are being designed without considering

¹ The request to the government can be found on this link: <https://redpatodos.co/blog/mesas-de-trabajo-con-mincit-para-leylleras4-apuntese/>, and its results on this link: <https://redpatodos.co/blog/mesas-de-trabajo-con-mincit/>. The comments to the several versions of the copyright law can be found here: <https://redpatodos.co/blog/vuelve-la-burra-al-trigo-leylleras-5/> (all the links are in Spanish).

their consequences, there is scope to explore with citizens the balance between copyright and freedom of expression.

There is also a clear need for collecting data to clarify the following provocations: What are the effects on freedom of expression of increasing the term of copyright protection?

How does protection time affect the dynamics of production of new works and how does it affect growth and use of the public domain? How much public money is spent on paying for access to information that should be publicly accessible (such as research results or state-funded educational resources)? What is the scope of promoting access to community information such as libraries and cultural centers and how much of the budget is spent on licensing?

Elucidating answers to these provocations through artistic and public engagement will greatly contribute to discussions regarding public policy and copyright, and to support arguments on favor or against particular regulatory proposals.

Case Study 2. Cellular Databases in Colombia: Underestimating Their Scope as Massive Surveillance Systems.

The cellular registration system in Colombia is considered a strategy to prevent cell phone theft. However, due to its design and characteristics, it can easily become an instrument for massive identification and surveillance of citizens, available to the reach of any authority.

In order to use any mobile device in Colombia, the International Equipment Identification Number (IMEI) must be registered on a centralized database. Each mobile phone operator not only registers this number to the database, but also includes a set of personal information about the user: the number of the operator's subscription (IMSI) and the line number (MSISDN). Mobile phone operators also create a database of the mobile phones that have been reported as stolen or lost, in order to disable such devices. These two database bases are delivered from the Mobile phone operators to a third private party called "Informática El Corte Inglés", which is commissioned by the country's operators to centralize, store and manage all the databases provided by the operators. As a result, there are currently two centralized data bases: Positive (contains information of all devices that can be used in the country) and Negative (devices that have been disabled). This same company, by law, must give access to this information to any authority.

The databases described are used for a variety of purposes like controlling the legal validity of devices that are being used by people, and other processes that require the operator to disclose phone numbers that are making or receiving a call, location and time of particular calls. The centralization of this information is highly problematic for ensuring privacy and security of cell phone users: from the databases, it is easy to infer the name of the user and other personal information. As a result, the ecosystem does not allow for anonymous communication amongst citizens, violating the right to self-expression, for which anonymity must be protected.

According to the current regulation, any authority can access information from the databases without an order from the Court. This provision is not constitutional, since access should be authorized by a judge, and granted only in cases of criminal investigation. In addition, the verification procedure uses very sensitive data and metadata that can be used to profile a person's activities and preferences. Even though it has been established that access to communications metadata enhances the state's capacity of surveillance, the lack of control over access to this information opens up the possibility of abusing the infrastructure especially as it is centralized. In terms of spaces for dialogue with citizens, the regulations regarding cell phone databases in Colombia have been subject to numerous modifications which makes it difficult for civil society organizations to find the time and space to hold public debates. On this scenario, Karisma Foundation has invited delegates from the Commission for Communications Regulation to join the conversation about particular research projects conducted by the organization. On this regard, as it was established on the first case study, there is a need for joining efforts of different practitioners to create spaces for socialization and for effective communication of public opinion.

As creative practitioners, artists and members of the general public, we need to be less complacent with technological solutions and more critical and reflexive about their consequences, especially when it comes to protecting the privacy of citizens and favoring the access to information and culture.

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she has been engaged in several strategic projects on access to knowledge, privacy and security, internet governance, Social Innovation, freedom of expression, and gender perspectives.

Author Biography

Pilar is a physicist by training and activist by vocation. Pilar is a free software, open technology and open culture enthusiast, working in areas related to education and technology. As project manager of Karisma Foundation,

Signal Territories, Infrastructures and Intermediaries: New Interfaces for Art Science and Communication Policy

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This paper is one of the contributions to an academic panel titled: “Bio-creation of Informatics: Rethinking data ecosystems in the network economy”. The panel seeks to explore different approaches for trans-disciplinary media art and design practitioners to re-imagine data ecosystems and at the same time engage members of the general public to reflect and contribute to an inclusive discourse that may re-shape public policy surrounding data ecosystems, from the lenses of ownership, privacy, transparency, openness and choice of individuals. The panel is moderated, co-authored and edited by Catalina Alzate.

Abstract

This paper shifts the critical focus away from the aesthetics of fetishized interfaces of access amplified by today’s networked consumer technologies, towards invisible broadcast infrastructures and data ecosystems that exist in demarcated ‘signal’ territories that harness the natural resource of the wireless electromagnetic spectrum (Parks, 2013). At the outset it calls for the need to revisit the role of the public as an active contributor to conversations in the broadcast media sphere and how as a practicing transmission and information artist, one may contribute to this goal. It takes a closer look at the nature of media infrastructures to bring to focus new trans-disciplinary fodder that exist for rigorous art-science interventions that explore the role of broadcast archives, network intermediaries and the transnational lines that they traverse. In the first section, it presents the history of contentions that the science and practice of public transmission is embroiled in. Next, it looks at other opportunities and hooks for public engagement with broadcast media that provide various entry points to engage in public discourse. Finally, the paper makes a theoretical contribution by introducing a new transdisciplinary lens to look at network intermediaries in order to explain various dynamics that occur in the physical and social transmission and mediation of information.

Keywords

Transmission Art, Spectrum Policy, Broadcast Media Archives, Intermediary Liability, Art-Science, Public Engagement.

Signals, Transmission and the Public

The wireless spectrum, unlike other exhaustible and geographically specific commodities is an infinite natural resource of the commons, currently circulated as a mobile currency ‘guaranteed’ and produced by owners of communication infrastructures, who play a central role in mediating data transactions as well as media dissemination in the public sphere.

Walter Benjamin in his 1930 reflections on the medium of broadcast communication infrastructures (Benjamin, 1999) underlines the fundamental separation between the practitioner and the public that the system had perpetuated, thereby alienating individuals into passive listeners rather than active contributors to a real-time conversation - “...the public has become quite helpless, quite inexpert in its critical reactions, and has seen itself more or less reduced to sabotage (switching off). There has never been another genuine cultural institution that has failed to authenticate itself by taking advantage of its own forms of technology - using them to create in the public a new expertise.” It was in the interest of broadcast media he claimed, to empower the public to contribute to conversations in which anyone might have a say. Heavy regulated ever since its tactical use in war communication, large chunks of the wireless spectrum have been administered through various licensing mechanisms for human telephony, broadcast media, satellite communication and military systems. However, to celebrate the spirit of open science by early wireless experimenters who fostered inventions and innovations in the field of wireless communication, a number of licensed as well as de-licensed frequencies have been designated to these science and citizen communities. These include reserved bands for radio-astronomers in various Shortwave and Microwave spaces as well as bands of 1420Mhz and 1667Mhz where the Universe’s neutral Hydrogen line is transmitted. Amateur radio (HAM Radio) bands, including the de-licensed citizen

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band at 27Mhz are reserved for the community of licensed amateur practitioners where some of the most groundbreaking innovations as well artistic works continue to happen. With old technologies like analog TV and commercial FM radio being discontinued, previously allocated frequencies have been di-licensed and given for industry players for commercial and artistic exploitation. One such phenomenon is ubiquitous computing (also dubbed ‘the internet of things’) that has gained wide-spread attention creating large scale mesh networks of micro nodes that transmit information on many delicensed frequencies. The central question being asked by policy makers who prefer dynamically allocated spectrum using universal machine protocols to facilitate multiple transmitters requesting to access the spectrum when it free, rather than top-down service specific allocation by spectrum auction.

While bringing aboard the practice of working directly with the medium of broadcast to create experimental interventions in the public sphere does reduce the gap between practitioner and the public, the question is to seek ways or hooks by which members of the public play a primary active role in contributing to the larger discussion on communication policy and media. The ecosystem of Broadcast News media provides us with one such opportunity for public engagement with art, data science and policy, which has been dealt in the next section.

Nature of the Broadcast Medium (and of Archival Propensity):

The journal of radio broadcasting entering the field of journalism and dissemination of News created what came to known in the 1940s as the Press Wars between radio broadcasters and print media publishers that included newspapers and magazines. Ephemerality and co-located simultaneity are central to the nature of broadcasted media (be it television or radio) -- a feature that markedly differs from the permanence of print, further underlined by the creation of such temporal hooks for public engagement such as ‘Prime Time’, ‘News Night’ and ‘Late Night Live’. As with any momentous event or fleeting occurrence is born a need for physically storing and remembering its immediacy, it can be argued that a similar need is felt by a discerning viewer or consumer to negotiate the immediacy of an eventful media broadcast (Newbold,2013). By this act of archiving, he transcends into a new role as an invested

consumer of the medium and a custodian of the stored broadcast content.

The most substantive instance of this, apart from the ‘selfie-archives’ of today, dates back to the early 1950s when there emerged a band of creative practitioners who engaged in what has been called armchair photography or TV video portraiture, a widespread trend overlooked by most media historians (Newbold,2013). Articles related to photographing television broadcasts appeared across many popular magazines and newspapers since



Figure 1: DIY Decametric antenna for SW news broadcast reception (Chandra, 2014)

the late 1940s, elucidating techniques to acquire the best ‘live’ image and how to display TV photographs as markers of technical excellence and sociocultural value. Around the same time, emerged a new generation of hobbyists dubbed ‘SWLs’ or ‘Short Wave Listeners’ who used inexpensive World Band Radio receivers to listen to and archive news and entertainment broadcasts.

In order to gain a well-rounded perspective of an issue, it might be necessary to be able to access and analyze connected artifacts present in a media archive over a period of time. This is partly due to the opportunistic nature of the medium in which sound bites of broadcast news are delivered in fragments and does not allow the public to comprehend the meta-history of complex issues and all the different points of view in a single instant. This fact is well elucidated by Geoffrey Baym in his seminal book that covers the evolution of the broadcast medium (Baym,2010). Baym cites media historian James Carey’s allusion of news media being ‘hot light’ and just as the same object appears different

in varied lighting conditions, so does the ‘hot light’ of different news items create varied interpretations of the same issue.



Figure 2. Digital archiving of Local Analog TV Transmissions for Media Analysis using Machine Vision (WYDSIWYG, Sharath Chandra Ram, Video Vortex XI @ Kochi Biennale 2017)

What might be the design of a broadcast archive that facilitates this sort of large-scale content analysis and opinion mapping to extract narratives from broadcast media into the contemporary information arts and society context? What other modes of interventions in virtual sphere and offline contexts using communication technologies maybe used to gather public opinion and encourage the social transmission of information within communities?

Fuelling Maxwell’s Demons in the Networked Society

The role of intermediary induced bias in a neutral network is now the center of the net neutrality debate. The author has previously outlined (Chandra, 2013) the role of intermediaries in communications networks marked by the significant invention of the Automatic Telephone Exchange (Strowger switch) by Almond Strowger, an undertaker by profession, who came to realize that the reason he received fewer phone calls was his business competitor’s wife who was a telephone operator, preferentially routed all callers seeking Strowger’s funeral services to her undertaker husband instead. The advent of packet switching followed by the rise of the Internet started a long drawn feud between owners of services that generate packets of information and the underlying physical infrastructure that facilitates the seamless routing of information bits amongst nodes connecting users.

This paper contributes to a new lens of art-science and policy enquiry by drawing a parallel

between the dynamics of transactions occurring within intermediaries (that consist of both physical infrastructures as well as social infrastructures) and the thought experiment of Maxwell’s Demon from the literature of information, entropy and thermodynamics. There is always a ‘cost’ related to reducing entropy in a system, and in the ‘self-routing’ communication networks of today this has come to bear an ‘informational cost’ required for the temporary storing, transmission and erasure of networked data. At times when the cost of temporary storing and erasure of transactional data is not justified, an accrued value is created by mining patterns from a long-term storage of big data. Opening the potential of big-data analysis to public reduces its hoarded value in the hands of owners of network infrastructures, but on the other hand has the potential for new knowledge to be mined.

An example of this is the author’s media art project titled ‘Traffic’- Traffic Dabolim/Traffic Jogja 2015 contrasted the time synchronized nature of data transmission seen in the wireless spectrum employed by intermediaries (navigation of military acrobatic pilots at 118Mhz AM Band, and the navigation of civilian aircrafts in aerospace at 1090Mhz by human operators in the air and ground control station). This data archived over a long time, reveals statistics such as peak time of arrival and departure of aircrafts, and airspace occupancy patterns, that is useful for the future of aviation transport policy as well as optimal logistical planning of high value cargo services.

Further exploring alternative forms of information access, networked delivery of information and reappropriating communication technologies into new contexts, has the potential to disrupt established intermediary driven power imbalances. For instance, alternate low cost community owned ‘offline’ infrastructures using open spectrum devices and antennas to access and archive GIS satellite climate imagery within fishing communities (Chandra 2016), was found to compete with the subscriber based weather update and market delivery systems promoted by mobile phone operators to profiled individuals in the same community.

In conclusion, this paper calls for new approaches in Critical Making methodologies that take into account the intersection of law, technology and society to facilitate art and design interventions that expose and disrupt the

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role of intermediaries in our data driven ecosystems and also engages the public for influencing policy makers. This paper is being written at an important time when the 2017 US Senate has voted against a 'broadband privacy law' that will soon enable Internet Service Providers to sell user data to advertising companies without the permission of users, a turning point in the way bio-created data ecosystems will lead to a self-perpetuated transnational undermining of human rights and media consumption.

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Author biography

Sharath Chandra Ram's (Sharathchandra Ramakrishnan) practice and research interests lie at the intersection of law, technology and society with a focus on Open

Education (Open Science and Open Hardware), Open Spectrum, Citizen Science and ICT4D. As a licensed amateur radio broadcaster (callsign: VU3HPA), he is actively interested in communication policy research, radio astronomy, extends his art-science practice as a transmission artist and has installed his sound and multimedia work in several national and international avenues. He is currently Faculty at the Srishti Institute of Art Design and Technology at the Centre for Experimental Media Art and the Information Arts and Information Design Practices (IAIDP) Program.

He engages actively with the local open source and policy research community at the Centre for Internet and Society and organizes the annual NASA International Open Data Challenge at Bangalore. Previously, he has worn many trans-disciplinary hats from being a cognitive neuroscientist, a Software Engineer to being a radio journalist.

Democratization of Data: The Case of Internet of Things (IoT)

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This paper is one of the contributions to an academic panel titled: “Bio-creation of informatics: Rethinking data ecosystems in the network economy”. The panel seeks to explore different approaches for trans disciplinary media art and design practitioners in re-imagining data ecosystems and at the same time engaging members of the general public to reflect and contribute to an inclusive discourse that may re-shape public policy surrounding data ecosystems, from the lenses of ownership, privacy, transparency, openness and choice of individuals. The panel is moderated, co-authored and edited by Catalina Alzate.

Abstract

Given the rapid adaptations of technology and the heavily corporatized world that manages data at large scales, users, especially those without technical knowledge, are losing control over the decisions they can make when interacting with digital devices, amplified by recent phenomena such as the Internet of Things. However, there is a lot of potential in allowing spaces for users to create or adapt their own technologies as a way to reclaim control over their data. Analyzing and discussing the role of the user as a creator, and not only as a consumer, is crucial for creating discourses of empowerment and democracy. Treating technology as if it were autonomous is the ultimate self-fulfilling prophecy. There is no difference between machine autonomy and the abdication of human responsibility (Lanier, 2010). As a result of the interest on this subject, the Hypermedia Laboratory of Technologies for Communication, at Fundación Universitaria Los Libertadores (Bogotá, Colombia), earlier this year began a research project ‘Controller for IOT devices’. A free and open-source authoring tool, that allows users to control content, data or electronic devices from a web browser or mobile application making use of a low-cost Wi-Fi module. The aim is to democratize this technology, so it can be used by people from different disciplines including design, art, journalism and other social and human sciences rather than STEM (Science Technology Engineering and Mathematics) disciplines only.

Keywords

Internet of Things, Authoring Tools, Open-Source Software, Responsible Data Collection, Interoperability, Wi-fi Modules, Low Cost Infrastructures, Creative Practices.

Introduction

The aim of the ‘Controller for IoT devices’ project is to empower non-expert people to use the Internet of Things technologies as an actionable alternative expression of their creativity with the potential to influence data management and control. The project expands to the creation of free and open-source environments and authoring tools with intuitive interfaces. Concepts and methodologies of Citizen Science, Do It Yourself and Do It With Others are an effort to contrast the monopolization of data from the hands of big corporations and government bodies, being also potential tools to influence policies regarding data ecosystems. As pointed out by the renown media theorist Kurenniemi: “Technology won’t take control as long as man can misuse it” (Kurenniemi, 2003).

Motivations

The intention of this paper is to elucidate alternatives to current closed source authoring tools that are primarily targeted to people with knowledge in programming, leaving little or no room for non-programmers to adapt and explore the potential of such tools. By challenging the notion that considers the creator and the user of technology to be two separate entities, the authoring tool project brings together both aspects of technology production and consumption to the hands of creative practitioners without the need of in-depth knowledge of low level programming. The outcome is to facilitate understanding and engagement with custom IoT applications for controlling content, data and electronic devices remotely.

We have identified particular needs in the academic sector of Colombia, which calls for an integration

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of conceptual, creative and practical skills in order to enhance current interaction design and strategic design metaphors in the fields of information and communications technologies. The challenge for the implementation of our project in an academic environment is to cultivate the values of open innovation as a premise for the generation of knowledge, and move towards the seamless transfer of technological skills and information within a community of makers.

We see great potential in including these tools as part of communication strategies, where artists, designers, journalist and related fields can make use of this technology as raw material for the development of communication projects. This project is based on the model of open innovation that happens to be the main philosophy of operation at the Hypermedia Laboratory of Technologies for Communication.



Figure 1. Recreation of the demonstration by Ilett (2015) in his project: “Web Enabled LED - WiFi Internet-of-Things IoT” Using the LUA programming language, he was able to control from a web page, electronic components connected directly to ESP8266 low power low cost module.

Expanding the Scope of the ‘Internet of Things’

One case study of the ‘Controller for IoT devices’ was deployed under the name of ATOMIC Authoring tool in 2009, a free software for Augmented Reality developed by Cuartas (2009), for non-programmers to create Augmented Reality applications in a few steps. At the time of deployment, these tools challenged mainstream modes of production which required vast amounts of programming. The ATOMIC Authoring Tool is a multi-platform software, written on the Processing platform and licensed under the GNU GPL V2.

Borrowing from this experience with Augmented Reality, the current ‘Controller for IoT devices’ project focuses on the Internet of Things and the ubiquitous computing phenomenon as the area for intervention

that has a wide range of applications for citizen science as well as art and design. While controlling devices at home, and receiving data from sensor networks in ‘Smart Cities’ are mainstream applications, we propose to the use of this technology in creative practices to transform traditional ecosystems like journalism and public communication systems, and other artistic and creative projects that require designing infrastructures for collecting data.

Investigating Closed, Open and Interoperable Architectures

The open source ecosystem has always contributed to the implementation of interoperable architectures that allow for two disparate entities to communicate, as Golan Levin in his critical making research saw the need for ‘universal building blocks’ to link and make interoperable toys made by LEGO and another competitor with a different design patent. Similarly, democratization of essential firmware is needed to co-operate ubiquitous computing architectures, for artists and designers to explore more possibilities and interconnections.

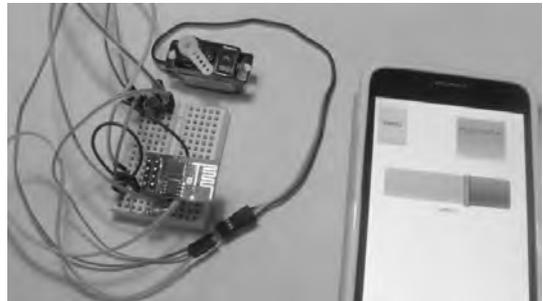


Figure 2 (Above) depicts a project inspired by the simplicity of the demonstration made by Ilett (2015) in his project called: “Web Enabled LED - WiFi Internet-of-Things IoT.” In which using the LUA programming language, he was able to control from a web page, a lightbulb connected directly to ESP8266 module, a breakthrough in low cost Wi-Fi modules with an inbuilt microcontroller (as detailed in Follower (2014), that has transformed the role of art-scientists ranging from bio-hackers to the balloons of astrophysicists working in transdisciplinary teams.

Another parallel movement that has gained global participation is the LoRA Alliance. LoRaWAN™ is a Low Power Wide Area Network (LPWAN) specification intended for wireless battery operated nodes in a regional, national or global network. Operating on a

variety of delicensed wireless frequencies they are able to form a mesh network of distributed sensors and interface nodes in a city.

While many countries are currently planning on standardizing M2M (Machine-to-Machine) protocols as part of nationalized grids and smart cities, others including HongKong, who have an active cyber-security program and strict telecom policy and spectrum allocation have displayed caution and deemed such implementations illegal. The problem of privacy encroachments and cyber-security is even more amplified with the use of closed source hardware and firmware as is seen now in various Chinese manufactured phones that have an inbuilt hardware trojan in its hardware design that sends user data back to servers in China. The recent Mirai IoT Botnet and more sophisticated attack vectors being planned, further raises questions about the security of IoT networks and devices, even if they may have been built upon open standards of trust and assumed negotiations between intermediaries in goodwill.

The IoT ecosystem is currently an inevitable behemoth catalyzed by the IPV6 roll out that allows billions of devices to be assigned IP addresses to allow them to be connected onto the internet. Most deployments by the State (in tandem with commercial startups) have been top-down implementations with a revenue generating model that is heavily dependent on the mining of Big Data. This paper points out to future directions for artists, designers and creative practitioners to be well aware of dynamics of data exchange that occurs at IoT interfaces, as well as intellectual property regimes that control the use of IoT hardware and software, in order to effectively contribute human centric design decisions that are democratic and inclusive – a process that is completely lacking in the silicon-valley ethos of technologically driven innovation today.

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Latin American Forum Legacy

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Abstract

The Latin American Forum was a platform for transdisciplinary and trans-cultural discussions concretized in series of panels, workshops, roundtables, presentations, lectures, and exhibitions. The forum was operational for four years in the framework ISEA, International Symposium on Electronic Arts: ISEA2010 in Germany, ISEA2011 in Turkey, ISEA2012 in the USA and ISEA2013 in Australia. Since the conception of the Latin American Forum, one of the goals was to prepare for hosting an ISEA colloquium in Latin America. Thanks to the efforts of a group led by Universidad de Caldas finally ISEA is hosted for the first time in Latin America, this year in Manizales, Colombia.

The Latin American Forum was a series of venues that intended to articulate a diversity of proposals ranging from topics such as digital culture, technological art, critical production and historical analysis. The forum also addressed the science and technology studies (STS) field, questioning geographical, cultural and critical perspectives. Latin American Forum participants came from: Argentina, Australia, Australian Aboriginal Communities, Brazil, Chile, Colombia, Germany, Mexico, Navajo Nation, Peru, Uruguay, USA, and Venezuela.

This paper is divided in four sections; the first one is a historical recount of the different Latin American Forums. The second one is a reflection about the importance of the local references in the field of arts and technology. The third one presents a theoretical framework that is a response to Media Archaeology and the last one focuses on the concept of fragment in order to describe and understand Latin American reality.

Keywords

Latin American Forum, Latin America, Variantología Latina, Cybematics, Media Art, Media Art History.

Introduction

The first Latin American Forum was hosted by ISEA2010. There, the idea of “Variantología Latina” was introduced; it was presented by Siegfried Zielinski in the following way, the quote still represents well the

conceptual starting point of the Forum: “The southern part of the two Americas was baptized Latin America in early modern times. By importing academic Europe’s Esperanto, Latin thus became the label to characterize South American culture. This culture was defined from the perspective of the Latin-Christian civilization. Active in the center of this intellectual colonizing process, were the elite troupes of the Vatican, i.e. the congregation of the Jesuits. They were sent away from Rome by the pope in order to universalize the world in a single faith. Even the great GWF Hegel still understood South America’s identity solely in relation to Christian Europe. Variantología Latina as an experiment is working in an opposite direction. It proceeds from the assumption, that the different countries and regions of South America have developed their own knowledge and technology cultures as well as their own forms of linguistic expressions, their own music, machines and technical images long before and parallel to colonization. The archaeology of South American media could carve out these developments from the deep -time developments of history and have them unfold within a new context” (Broeckmann, 2010).

Latin American Forum 2010-2013

ISEA 2010, Dortmund, Germany

The Chair of ISEA2010 was Andreas Broeckmann, the goals of this participation were two, (1) expose the creative and scholarly work done in Latin America, and to start to prepare a Latin American country to host ISEA in the near future. The LAF program was articulated in four panels: Variantología Latina, Current Media Art Practice, Recent Histories of Electronic Culture in Latin America, the forum had 22 participants.

“Variantología Latina” panelists: Karla Jasso, Domingo Ledezma, Andrés Burbano, Siegfried

Zielinski. The “Variantología Latina” panel explores the deep roots of media history in Latin America, inquiring into phenomena which anticipate the concepts of network, photography and scientific tools before the 20th century.

“Current Media Art Practice-Curators”: The panel problematizes the role of curatorial processes in media arts in Latin America, looking for a contextualization in the global context. Participants: Juan José Díaz Infante, Claudio Rivera, Tania Aedo, José Carlos Mariategui, Giselle Beiguelman.

“Recent Histories of Electronic Culture in Latin America”: Focuses on the study of practices at the artistic and social levels that are relevant for the media art scene today. Participants: Enrique Rivera, Catalina Ossa, Alejandro Duque, Lila Pagola, Simone Osthoff.

“Current Media Art Practice – Artists”: The panel contains a collection of current and fresh media art projects presented by the authors themselves. Participants: Iván Puig, Rejane Cantoni, Brian Mackern, Lucas Bambozzi, Arcángel Constantini (Broeckmann, 2010).

I

SEA 2011, Istanbul, Turkey

The Chair of ISEA2011 was Lanfraco Aceti, in Istanbul the second Latin American Forum took place, Juan José Díaz Infante was the chair of the forum and Claudio Rivera-Seguel and Andrés Burbano were co-chairs, the main topic was “Interdisciplinarity at the Centre of Art, Science and Technology in Latin America”.

“What exactly is Latin America? Is Latin America formed by 21 countries or are there more? There are two very well defined borders to observe regarding a scientific knowledge and a particular Cosmo vision: before and after the Spaniards; A third layer surfaces as independent Latin America struggles to become a region, as separate states, there is the existence of fragmented knowledge from different regimes; independence, revolutions; *coup d'état*; Layers on top of layers that have to do of a linear process between socialism, capitalism and the interests of the United States. Latin America has a distinctive vision of what the world could be, and what the role of technology. Latin America is an option an alternate way to see the applications of technology of social expression and organization. For example, Channel “6th of July” a TV Channel with no concession for air transmission, its way to transmit was through the sale of VHS videotapes, sold 4 million copies at the time” (Acetti, 2011).

Participants: Andrés Burbano, Lucas Bambozzi,

Gabriel Vanegas, Ricardo Dal Farra, Juan José Díaz Infante, Claudio Rivera-Seguel, Felipe Cesar Londoño with the help of Laura Colmenares

ISEA 2012, Albuquerque, USA

The chairs of ISEA2013 Andrea Polli and Suzanne Sbarge gave an unprecedented support to the Latin American Forum making it a central part of the event, seventy direct participants from ten different countries, as well as twenty guest audience -members gathered for this event in Albuquerque, some of the panels were the following:

“Cybernetics in Latin America”, featuring key intellectual researchers Eden Medina, Susana Quintanilla, Eduardo Bayro-Corrochano and Pablo Colapinto. They presented their research projects about the rich history of Cybernetics in countries like Argentina, Chile and Mexico. This was a challenge particularly when it came time to present the investigations on Computational Geometry discovering its relationship with the cybernetic deep history in Mexico. “Public Dialogue” led by Simone Osthoff and Giselle Beiguelman. Simone and Giselle elaborated about the international art context focusing on the dynamic dialogues involving media arts.

“Mapping, Balloons and Kites” featured some of the most active media arts practitioners and activists in Brazil: Lucas Bambozzi, Rodrigo Minelli (RIP), Bruno Vianna and Felipe Fonseca. The panel was proposed as a historical comment to the fact that several inventors related to the aerospace technologies came from Brazil. Today with proposals like the festival Arte.Mov, a festival that runs 5 times a year in different cities of Brazil, such technological tradition is revisited. Of special interest were the presentations by Vianna and Fonseca, two young participants who have contributed to shape the digital culture in Brazil.

“Open Laboratories,” was a window to look at how the politics and ethics of *open source* software has been translated into a series of initiatives of open laboratories for media arts and experimental research in several Latin American countries. The panel featured consolidated scholars like Felipe César Londoño and Ricardo Dal Farra and also opened the doors for young artists like Leslie García, Gabriel Zea and Camilo Martínez. Remarkable is the fact that the moderator Felipe Fonseca has already published a book about the idea of “open labs.”

“Code Talkers and Technology” proposed to revisit the history of the Native American Navajo Code Talkers

Panels

inviting a representative of the Navajo community to take part in the Forum. Eighty-eight year-old Bill Toledo rendered an outstanding presentation about his experience in WWII as a “coder”. This was an attempt to establish a respectful dialogue that affirms the commitment of a new discourse on Latin America regarding of indigenous communities. This panel was possible thanks to the efforts of Esteban García (Poli, Sbarge, 2012).

“Mexican Space Collective” presented their interventions on the celestial and cosmic spaces with the satellite Ulises I. As part of their participation in ISEA the Mexican Space Collective opened an exhibition of the satellite in the Albuquerque Balloon Museum. The Mexican Space Collective was composed by artists Marcela Armas, Gilberto Esparza, Ivan Puig, Arcangel Constantini, amongst others. Juan José Díaz Infante coordinates the project. Such interest in outer space-related matters is not exclusive of the MSC as it was shown in the presentation of Kosmica Mexico, a space art event that took place for the first time in Mexico City right after ISEA2012. The organizer of this presentation was Nahum Mantra. In the media art show the project “SEFT1” by Ivan Puig and Andrés Padilla had a prominent place. The SEFT1 is a machine for exploring abandoned railroads in Mexico as a futuristic exploration of Mexico’s past. At ISEA2012 the “SEFT1” made a historic border crossing from Mexico to the USA, highlighting a process for a creative reading of border issues (Poli, Sbarge, 2012).

The Forum operated as a dialogic platform in a dual sense, by promoting the encounter of Latin American artists and thinkers with people from other latitudes, while also confronting the interesting experience of thinking in the familiar when we are away from home. Juan Jose Diaz Infante offered a thorough presentation proposing Mexico City as host for ISEA2015 (Burbano, 2012). Other candidates to host ISEA2015 are Vancouver, Amsterdam and Jakarta.

Beyond those mentioned, participants of the Latin American Forum III also included: Ignacio Nieto, Yto Aranda, John Angel, Coco Fusco, Eugenio Tiselli, Agnes Chavez, Danny Bazo, Carlos Rosas, Priscila Arantes, April Bojorquez, Matthew Garcia, Miguel Palma, Silva Ruzanka, Rodrigo Guzman, Mariana Perez Bobadilla, Fred Paulino, Lucas Mafra, Henrique Paulo Ganso, Mario Valencia, Tiago Franklin, Andriana Ramirez de Arellano, Miguel Gandert, Vicki

Gaubeca, Manuel Montoya, Gabriel Menotti, Diana Domingues, Alessandro Saccoia, Ian Clothier, Joana Moll, Heliodoro Santos, Marybeth Howe, Alexander Glandien, Luz Maria Sanchez-Cardona, Vanessa Ramos Valezquez, Jorge Rojas, Lucia Grossberger Morales, Micha Cardenas, Miguel Carvalhais, Josephine Anstey, Ed Osborn, Tatsuo Unemi, Joanna Cheung, Lyn Goeringer, Matthew Hawthorn, Jan Mun, Martin Rieser, Sara Schnadt, Rene Barge, David Dunn, Gustavo Matamoros and Duck Pond (Poli, Sbarge 2012).

ISEA 2013, Sydney, Australia

The chair of ISEA2013 was Ross Harley who helped to organize the LAF panels supporting many of the participants in their process to visit the austral country.

The first panel was inspired by the book “The Music of CSIRAC, Australia’s First Computer Music” by Australian composer Paul Doornbusch. This book had a crucial impact in the understanding of computer music history. In Latin America the contributions to computer music history are not as early as the one described by Doornbusch, however composers like José Vicente Asuar in Chile or Cesar Bolaños in Peru and Argentina, made several important and early aesthetic and technical contributions to the Computer Music field. Participants: Paul Doornbusch, Ricardo Dal Farra, and Andres Cabrera and Andres Burbano.

The second panel, Reconsidering Australian Media Art Histories in an International Context “is an ARC Linkage project undertaken by researchers at the National Institute of Experimental Arts, in partnership with a host of national and international partners, that researches the contribution of Australians to the development of media arts as a contemporary art practice, while at the same time examining the important artistic and technical contributions that have shaped media arts in the global arena. The project aims to propose new frameworks, refute inaccurate ‘facts,’ question or expand upon theories, and point out unseen associations and critical connections. The potential for online access to collections of media art in all its manifest forms has been the subject of detailed media art history research. RAMAH aims to provide for a deeper knowledge of the histories of media art history in the international context by making accessible documentation and a range of other materials via an evolving online archive”.

ISEA2013 RAMAH partnered the Latin American Forum to further the discussion by drawing attention to the multiple trajectories that have sprouted from outside of the usual centres and dominant paradigms.

The Panel Re:imag(in)ing Indigenous media art histories was engaged both Australia and Colombian practitioners to focus on histories of Indigenous Australian artists working with new media, and in particular the inroads and dialogues they have established in international networks. More broadly, the session addressed issues of identity, representation and visibility in the so-called 'Global South'. Panel participants: Brenda L Croft, Jenny Fraser, r e a, Timothy Maybury and Esteban García.

One of the most interesting presentations was in charge of professor Delinda Collier from the Chicago Art Institute entitled "The Tacet Mark as Blackness: Interrupted Currents in African Electronic Art" who examined several electronic artworks from Africa that reflect on electricity, the absence of infrastructure as a key signifier for 'Africa'. "In the electricity-based artworks discussed, disconnection is a 'blackness' that is both textual and mechanical, and includes discourses of development and underdevelopment, and the mechanical connections and amputations of Africa from global technology".

Juan José Díaz Infante presented the "PLAY! Festival": An experiment in augmented reality. This presentation showed via a series of slides different examples of the art and technological pieces that were shown in the festival, how they were presented and how the public reacted.

Nahum Mantra, presented the series of meetings on space culture "Kosmica", This gave to the audience a better insight into the new work being produced by leading Mexican artists related with aero special topics, and enabled conversations about potential collaborations. The material for this presentation came from the work done in ISEA2012 in Albuquerque and the first Kosmica organized in Mexico by The Arts Catalyst and the Laboratorio de Arte Alameda. In ISEA2013 the progress of this series of collaborations within the Latin American Forum was shown.

Without losing the Local References

Recent experiences carried out by collectives of artists, designers, software developers, and engineers make it possible to observe complex reinterpretations of local

realities, from critical perspectives, which take into account the universal references, but applied to the local. Networks are now a new way of understanding the processes of creation, especially from the perspective of artistic collaboration, within the framework of an interactive process that links the global with the context. This, however, is not new: in the vanguards of the early twentieth century, the idea of collaboration and networks were already present, mainly in Russian constructivists, German Expressionists, Futurists, Dadaists, and Surrealists, who based their programs and practices on collective creation.

Already in the 21st century, artistic production is directly linked to interactivity, the immateriality of works, telematics works, *open source*, augmented reality, among other processes that invite creators and spectators to explore and carry out systematic research Around the new relations between art, science, technology and society. In Latin America, outstanding experiences such as those carried out by artists and organizations such as LabSurLab, the Center for Experimentation and Research in Electronic Arts CEIARTE, MediaLab Manizales, among many others, generate spaces for dialogue and develop works and projects that reinterpret a Complex reality in sociopolitical fields, seeking, through a creation supported in networks, new ways of understanding culture.

In this line, other perspectives that have to do with memory, heritage, archives, and sustainability make their way in the context of collaborative artistic creations. According to Davis, Nikolic and Dijkema, industrial ecology, which today evolves thanks to computer networks, can be defined as the study of interactions between industrial systems, the environment and sustainability, in order to, from of a multidisciplinary view, to understand the emerging behavior of natural systems. Using this holistic view-point, we hope not only to understand, but also to shape the links between economics, social concerns, and the environment, in order to guide the world towards sustainability. Many artists, interested in these holistic visions of the environment, propose analyzes, activism, and regeneration of ecosystems, some of them inspired by eco-feminism and political struggles against the dominant power. The earliest artistic productions in this category can be seen in landscape studies in European cities, in the views of 19th century savage territories, and in the works of artists such as Robert Smithson, Dennis Oppenheim and

Christo, in the 60. Most recently, efforts by knowledge networks such as Leonardo / The International Society for the Arts, Sciences, and Technology (Leonardo / ISAST), a nonprofit organization led by astrophysicist Roger Malina, Artists, scientists and researchers from many parts of the world through programs with creative and interdisciplinary approaches.

Likewise, events such as Balance-Unbalance, led by the Argentine-Canadian Ricardo Dal Farra, BunB proposes a review of issues related to climate change and environmental crises in the world, with the participation of networks of scientists and artists from different International institutions. Also, the International Image Festival, held in Manizales, Colombia by the University of Caldas since 1997, has been profiling research and creation processes, research and experimentation, from transcendental thoughts that have guided programs such as the Doctorate in Design and Creation and The Master in Design and Interactive Creation. It is precisely on the stage of the Festival that the complexity of contemporary creation networks is observed, in which art, design, science and technology intersect with local realities.

In the regional context, the ClusterLab emerges, a virtual platform that brings together the creative industries of the Coffee Hub, a platform for collaborative exchange to make visible the creations and cultural undertakings that form a fundamental part of the contemporaneity of the Colombian Cultural Landscape, recognized by Unesco as a World Heritage Site.

Networks, therefore, foster the creation of communities that drive important collaborative developments in local communities, however they are also a permanent object of criticism because of the marked fragmentation they generate.

Re-significance

Re-significance is a theoretical initiative to describe an applied media archaeology framework. At the Latin American Forum, we proposed the “re -significance of the media” as a conceptual platform that could be used to investigate and teach media archaeology in an innovative way. The framework introduces how practical research components, such as lab experiences and fieldwork can be applied in workshops or designing academic curriculum. The “re-significance of the media” is a joint endeavor by curators, artists, and archivists to further understand the historical context

of innovation and also as a strategy to upgrade old technology-based art based on primary sources research. Re-Significance investigates the history of artifacts to reconstruct them using contemporary technologies. Through the reconstruction, scholars may gain a deeper understanding of the computer systems and their philosophy as a whole. In this presentation, we will discuss re-significance in the Latin American and global contexts: Yturralde, Giorgini, Comdasuar and Zuse.

Media Archaeology and the Re-significance of Media Art

A possible starting point for the study of early computer-mediated works could be Media Archaeology. Media Archaeology (Huhtamo, Parikka, 2011) is a branch of “historically oriented media studies” that “rummages textual, visual, and auditory archives as well as collections of artifacts, emphasizing both the discursive and the materials manifestations of culture.” Media archaeology is an open-ended qualitative process that engages with the study of artifacts of media culture. These artifacts could be primary sources such as manuscripts, images, diskettes, magnetic tape and computer code. As digital media technologies advance, many of these artifacts from the early computer era may have become obsolete, making it sometimes difficult or sometimes even impossible to properly “read” computer-mediated work from the last six decades. The disembodied nature of computer mediated artworks poses a great challenge for media art scholars, curators, conservators and archivists who have found great interest on this field in recent years.

Media archaeology alone does not take further steps into the systematic analysis of the computer system as a whole, and for this reason we explored Andrés Burbano’s “Resignificance of Media Technology” (2013) as a framework that would allow us to gain a deeper understanding of early computer contributions. In a similar way than Burbano, Francis Marchese (2011) proposes a framework for the long-term preservation by recreating digital artworks through the study of the available documentation about the piece.

According to Burbano (2013), the re-signification of technology encompasses the study of the media artifacts as well as the researcher’s own attempt to reconstruct the technologies of the past. Burbano’s approach is rooted in Zielinski’s concept of “Deep Time”, looking beyond the layers of hegemonic history. Studies of decentralized or often forgotten histories are especially relevant in the

context of Latin America, as its own history has been often forgotten or simply “at the borders of history” (Burbano, 2013). Using the Re-significance method, we have been able to recreate contemporary versions of forgotten media art. Examples of the projects are:

Impossible Figure Generator

Jose Maria Yturralde is a Spanish artist who was curious about computers since 1967. Using Spain’s first computer, Yturralde collaborated with scientists to produce the “impossible figure generator” at the Centro de Cálculo de la Universidad de Madrid (CCUM). The “Impossible Figure Generator” was a system designed to plot all the possible combinations of variable Penrose geometries. The application recreated through this research aimed to reconstruct the software developed by the team Yturralde-Ramos-Searle and illustrated the context in which it occurred. Our impulse was to understand the Yturralde’s work through the re-significance of his creative process. As a result of this investigation, we have created a modern day impossible figure generator, which will allow new generations to access, as well as understand the computational methods used for the development of this early framework. This occurred during Spain’s transition from Franco’s fading dictatorship to democracy. With a historical mindset, we aimed to document and preserve these materials through a contemporary interpretation of this model. The manuscripts about this project, written by Yturralde (1969), served as the foundation for the re-significance of the Impossible Figure Generator.

Ideal Flow

Aldo Giorgini was an Italian expatriate who developed art and science projects through experimentation with main-frame computers in the late 1960s and throughout the 1970s in Indiana. Based on the idea of “at the borders of history,” we looked at the Computer Art movement that unfolded in the Midwestern United States, far away from the traditional art epicenters. Giorgini helped establish a small “computer art” scene in the USA, that integrated academic researchers and artists. These artists preceded the “digital age” from the 1980s and their contribution is relatively unknown.

In this study we were interested in the mathematical equations that Giorgini created to visualize the complexity of fluid dynamics. These historical visualizations show deep understanding of natural phenomena through

computer simulations (before computer displays were available), while being representative of Giorgini’s own artistic voice. Giorgini’s algorithms, developed mainly during 1973 to 1978, on fluid dynamics had not been explored before. Rather than focusing on his entire life, we decided to focus on a specific period concerning fluid simulation, which constitutes his most extensive and obscure work. This gap allowed us to look again at this documentation (now hosted at the Virginia Kelly Karnes Archives and Special Collections Research Center at Purdue University) to revisit and reinterpret Giorgini’s visually engaging art-science practice through a modern-day visualization tool. Ideal flow was implemented in WebGL, which runs in most modern web browsers without requiring any plugins.

Graphomat Z64

The Graphomat Z64 introduced Computer Aided Design (CAD) in Europe for diverse fields such as geodesy, meteorology, and road construction. Later on, it was used in the textile industry (according to Horst Zuse’s site accessed in 2016). Although Zuse himself explains the machines were originally “developed primarily for technical ends,” he explained that “the method can also be applied to artistic objects” (Zuse, 1969). Our Analysis of archival records revealed that Konrad Zuse was a visionary who enabled computer artists through his plotter bed design. Artists who worked with the Graphomat Z64 included pioneers such as Georg Nees and Frieder Nake. Zuse’s contribution to computing has been overlooked, placing more focus on other contributors that were in the UK and USA primarily.

About a Fragmented Reality

Latin America is a fragmented reality, this chapter presents four of those fragments. First a poet from de Sierra Mazateca that never wrote her poems, she was one of the main poets of the hippie generation; Second, an American citizen that believed in fighting for a Republic, exiled in Mexico because of fighting for a Republic; Third an Argentinian that lives in Germany and generated an homage to Beethoven; Fourth a Chicano artist that lives in Mexico and the USA to his convenience. These are examples of the dyslexic society we live in, we live strange times. Latin America is a breeding soup full of discovery and enlightenment. Not developed means still in development, but not behind development. The structure of wealth does not

limit thought. Latin America potential is not limited by technology. Its thought is more advanced. There is not such thing as a coherent art history. A fragmented reality is a term that I like to describe Latin America as a phenomenon, but also, as its essence.

We have geographical and historical fragmentation that give us a common parallel. The last century we lived through revolutions, military regimes, all sorts of different economical systems. Cuba is not Venezuela and it is not Brazil. Latin American artists have become fragmented in all sorts of different exiles, even in their own countries. Poets were put in jail in Cuba for listening to the White Album by the Beatles. Mauricio Kagel, Argentinian develops his work living in Europe. Some artists live in exile within their own country. This paper is chapter is about the stories of María Sabina, Conlon Nancarrow, Mauricio Kagel, and Guillermo Gómez Peña.

María Sabina, a Latin American, Fragmented Reality Number 1

Long before 1960s counter-culture, an indigenous Mexican healer was creating extraordinary poetry under the influence of psychedelic mushrooms.

I learned about some of the experiments that Roy Ascott was doing with Ayahuasca, some years ago. It made me curious why someone from England would find something fascinating in what is our everyday reality. I was also familiar with the book the “Enseñanzas de Don Juan” by Carlos Castaneda where he offers a new thesis on a mindstate he calls “total freedom” and claims that he used the teachings of his Yaqui shaman as “springboards into new horizons of cognition”. That led me to star my own research about mushrooms, I learned about a man called Peter Wolf, at the time of my first session I had some problem with my knee, he taught me how to talk to the mushroom. The “Barranco” Mushroom. I started writing notes about mushrooms, the project’s name is “Notes about a conversation with the Earth”. A conversation with the Earth starts with my first encounter with a contemporary Mexican *curandera*, or native shaman that allow Westerners to participate in the healing vigil that is known as the *velada*. All participants in the ritual ingested psilocybin mushrooms as a sacrament to open the gates of the mind. The *velada* is seen as a purification and a communion with the sacred.

The Western knowledge of María Sabina starts with

an article in the Life magazine written by Robert Gordon Wasson. Some of her visitors who learned about mushroom psychedelic rooms were people like Albert Hofmann, father of LSD. Actually Hoffman published with Richard Evans Schultes a book named “Plants of the Gods” which is in part about their visit to María Sabina. Hoffman visited Sabina in 1962 and others came after, Roger Helm, Aldous Huxley, Timothy Leary, Walt Disney, and Alejandro Jodorowsky.

The influence of María Sabina goes beyond borders, she never took credit for her poetry, she always credited the mushroom. “she describes a mushroom vision whereby the ‘Principal Ones’ – tutelary gods, the lords of the rivers and mountains, ancient invisible presences in nature – announced her mission: “On the table of the Principal Ones, a book appeared, an open book that went on growing until it was the size of a person. In its pages there were letters. It was a white book, it was so white it was resplendent.

One of the Principal Ones spoke to me and said, ‘María Sabina, this is the Book of Wisdom. It is the Book of Language. Everything that’s written in it is for you. The Book is yours, take it so that you can work.’ I exclaimed with emotion, ‘That is for me. I receive it.’ (Rothenberg, 2003). Since her, dozens of other poets from different indigenous communities – Tzotzil, Mayan, Zapotec – have continued to render the world around them in verse. People have begun taking their voices more seriously; they are recognized as contributions to literature, not ethnography. Yet, so far, there’s been no-one remotely like María Sabina.

Conlon Nancarrow, Fragmented Reality 2

Was an American-born composer who lived and worked in Mexico for most of his life. He became a Mexican citizen in 1956. Nancarrow is best remembered for his studies for piano player, being one of the first composers to use autoplating musical instruments, realizing their potential to play far beyond human performance ability. He lived most of his life in relative isolation, and did not become widely known until the 1980s.

Conlon was born in the United States and decide to go and fight against Franco in the Spanish Revolution. Due to that fact, The United States revoked his passport. He decided to become a Mexican Citizen. He was a musician fascinated by machines. He worked on pianola music. It took each composition about a year to be completed, since he did the perforation of the paper himself, but

he also altered the mechanics of the pianola. As some experiments I did with a rented pianola. He worked the pianola to run at least 30% faster. Nancarrow was somehow programming his machines; he was making music that was not for humans to be played. So, in some of his music he would reach the ring going beyond the melody. Conlon Nancarrow is probably within the top 10 contemporary composers of the 20th Century, his fragmented reality makes him difficult to pin in a map.

Mauricio Kagel, Fragmented Reality 3

Kagel was born in Buenos Aires, Argentina, into a Jewish family which fled from Russia in the 1920s (He studied music, history of literature, and philosophy in Buenos Aires (Grimshaw, 2009). In 1957 he went as a scholar to Cologne, Germany, where he lived until his death.

From 1960–66 and 1972–76, he taught at the International Summer School at Darmstadt, he taught at the State University of New York at Buffalo from 1964 to 1965 as Professor of music theory and at the Berlin Film and Television Academy as a visiting lecturer. He served as director of courses for new music in Gothenburg and Cologne (Attinello, 2001). He was professor for new music theatre at the Cologne Conservatory from 1974 to 1997.

Invited by Walter Fink, he was the second composer featured in the annual *Komponistenporträt* of the Rheingau Musik Festival in 1991. In 2000 he received the Ernst von Siemens Music Prize.

Many of his later pieces give specific theatrical instructions to the performers (Kennedy, Bourne, 2006), such as to adopt certain facial expressions while playing, to make their stage entrances in a particular way, to physically interact with other performers and so on. His work is comparable to the Theatre of the Absurd.

Staatstheater (1971) is probably the piece that most clearly shows his tendency. This work is described as a “ballet for non-dancers”, though in many ways is more like an opera, and the devices it uses as musical instruments include chamber pots and even enema equipment. As the work progresses, the piece itself, the opera and ballet in general, becomes its own subject matter. [Similar is the radio play *EinAufnahmestand* (1969) which is about the incidents surrounding the recording of a radio play.

Kagel also made films, with one of the best known being *Ludwig van* (1970), a critical interrogation of the

uses of Beethoven’s music made during the bicentenary of that composer’s birth. In it, a reproduction of Beethoven’s studio is seen, as part of a fictive visit to the Beethoven’s house in Bonn. Everything in it is papered with sheet music of Beethoven’s pieces. The soundtrack of the film is a piano playing the music as it appears in each shot. Because the music has been wrapped around curves and edges, it is somewhat distorted, but Beethovenian motifs can still be heard. In other parts, the film contains parodies of radio or TV broadcasts connected with the “Beethoven Year 1770”. Kagel later turned the film into a piece of written music itself which could be performed in a concert without the film—the score consists of close-ups of various areas of the studio, which are to be interpreted by the performing pianist. He has been regarded by music historians as deploying a critical intelligence interrogating the position of music in society (Griffiths 1978).

Guillermo Gómez-Peña, Fragmented Reality 4

Guillermo Gómez-Peña is a Chicano performance artist, writer, activist, and educator. Gómez-Peña has created work in multiple media, including performance art, experimental radio, video, photography and installation art. His ten books include essays, experimental poetry, performance scripts and chronicles in both English, Spanish and Spanglish. He is a founding member of the art collective Border Arts Workshop/Taller de Arte Fronterizo and director of the performance art troupe *La Pocha Nostra*.

Acknowledgements

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Authors' Biographies

Andrés Burbano

"Burbano, originally from Colombia, explores the interactions of science, art and technology in various capacities: as a researcher, as an individual artist and in collaborations with other artists and designers. Burbano's work ranges from documentary video (in both science and art), sound and telecommunication art to the exploration of algorithmic cinematic narratives. The broad spectrum of his work illustrates the importance—indeed, the prevalence—of interdisciplinary collaborative work in the field of digital art." Andrés Burbano is doctor in Media Arts and Technology from the University of California Santa Barbara. Burbano is currently Assistant Professor in the Department of Design at Universidad de los Andes and is Academic Chair of ISEA2017 and Gallery Chair of Siggraph 2018.

Juan José Díaz Infante

Juan José Díaz Infante (Mexico City, April 19, 1961) is a transdisciplinary artist, photographer and poet. He is the director of the Ulises I project, the first Mexican satellite designed for artistic purposes and created by Citizens. The relevance of Ulysses I has positioned Díaz Infante as a member of the Cultural Committee of the International Astronautical Federation: ITACCUS. The satellite project has been presented in international forums including The Arts Catalyst in London and the Massachusetts Institute of Technology in Boston, among others. Díaz Infante is the current director of the International Festival Play! and was curator in Chief of *Transitio_mx03* (2009). He was also the Chair of the Latin American Forum II at the International Symposium of Electronic Arts. His personal work includes experimental poetry, photography, video, installation, multimedia, music, netart and electronic art, he has exhibited in Mexico and abroad. In the month of October 2013 he was honored with the recognition "Mentes Quo + Discovery" in the category "Vanguardia".

Esteban García Bravo

Esteban García Bravo explores computational arts as a researcher, a practitioner and as an educator. He earned

his MFA from Purdue University in 2008, and a Ph.D. in Technology, also from Purdue, in 2013. His research on computer art history and digital media art practices has been featured in the annual meetings of international organizations such as SIGGRAPH, ISEA and Media Art Histories-MAH. His artwork has been displayed internationally in media art festivals, gallery exhibits, museums and artist-in-residence programs. Esteban is an Assistant Professor in the department of Computer Graphics Technology at Purdue University, where he teaches digital imaging, visualization and computational aesthetics.

Felipe César Londoño

Felipe César Londoño is Rector of Universidad de Caldas (<http://www.ucaldas.edu.co>), and Titular Professor and researcher in art, science, design and new media. Is director of International Image Festival, an event held since 1997, in Manizales, Colombia, integrating art, science and technology. Felipe was co-founder of the Department of Visual Design, director of Master and PhD in Design & Creation, Dean of the Faculty of Arts and Humanities, director of the research group DICOVI - Design and visual cognition in virtual environments and curator of the Monographic Show of Media Art. He has done the following research: Serious game on citizen participation, Interaction, public space and new technologies, design and development of multimedia educational materials in higher education, Digital Design, Interfaces of Virtual Communities, Patterns of Color in Caldas, The World of Visual Design, and Visual Expression in Cities Bahareque, among others. He has published several books, including: "Landscapes and new territories. Mapping and interactions in visual and virtual environments", his doctoral thesis: "Interfaces of Virtual Communities", the research: "Patterns of Color", "DIGITAL DESIGN. Methodology for creating interactive projects", among others.

New Realities of the Body in Contemporary Performance: Québec, European and Latin American Perspectives

Isabelle Choinière, Andrea Davidson, Enrico Pitozzi

With participants from the Université du Québec à Montréal, Hexagram, the University of Venice, the University of Chichester, Concordia University, Universidad de Caldas, Universidad Distrital Francisco José de Caldas and invited members of other Latin American universities

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Abstract

This panel considers the new and multiple relationships of the senses and related perceptual and cognitive processes which characterize contemporary performance integrating new technologies. Focusing on the corresponding effects on corporeality, performativity and representation, it considers the sensori-perceptual deconstruction, reorganization and reconstruction involved when the body is “touched” by, interacts with, and “incorporates” the effects of technology. And, as these new approaches directly concern current research -creation and are expressed through collaborations, hybrid artistic approaches, new forms of interdisciplinarity and communities of practitioners, the panel will also consider the implications of this activity for existing networks of research-creation, looking at their specificity while examining how participants in these networks exchange, interact and collaborate.

Keywords

New Technologies, Performativity, the Senses, Somatics, Perception, Cognition, Design, Embodiment, Research-Creation

Introduction

Over the past decades, a fundamental epistemological rupture—or shift of perspective—in the arts and performance has redefined notions of performativity and representation under the influence of new technologies. Mediation and digital technologies have extended dramatic, narrative and semiotic possibilities, revealing, amongst other things, new and multiple relationships of the senses and modes/levels of perception. They have thus also challenged and transformed conventions surrounding spectatorship and the understanding of corporeality in performance: for performers and spectators alike. As an introduction to these themes and the panel that will address them, this article presents an overview of the book *Through the prism of the senses: Mediation and new realities of the body in contemporary art and performance. Technologies, cognition and emergent research-creation methodologies*, a

forthcoming publication by panel moderators Isabelle Choinière, Andrea Davidson and Enrico Pitozzi. While taking into account a current context of research-creation and its conceptual and empirical prerogatives, the book centers on the question of technological intervention from the perspective of its encounter(s) with the sensate, somatic body. Based on a first premise of the body as a living perceptual entity, adaptive biological phenomenon and indeed, “technology” in its own right, the authors reflect on the status of *corporeality* in contemporary art and performance while analyzing the various technical means and artistic strategies employed by artists to inscribe the mediated body and its manifestations within a spectrum of contemporary artistic production.

If life in the 21st century has seen the mass adoption and ubiquity of a digital “norm” touching all areas of human activity and thought – science, philosophy, sociology, biology, medicine, and art – technology can also be described as having produced an ontological shift away from worldviews anchored in a culture of knowledge based on representation, moving instead towards a world of “machine-based modes of “world-making” (Hörl 2008) based on a science of algorithms, modelization, simulation, emulation and binary code. Requalifying a centuries-old understanding of *technē* and foundational Platonic distinctions of *technē/art*/the artificial on the one hand, and nature/*epistemē* on the other, it has uprooted the classical age notion of representation as mimesis – in the arts as in science. Or, as Roy Ascott noted in 1996, today, “our personal neural networks merge with global networks to create a new space of consciousness” (2007).

Technologies are not simply “means”. They constitute an environment, a logic and thought processes. This said, in the context of artistic projects, discretion is in order. On a *technical level* – that is, in the course of a work’s technological development – technology

must be subordinated to the *aesthetic level* of artistic composition.

Only in this sense can technology be truly understood as a *logic of technicity* – or *technē* – and not as a simple spectacular application. And only in this sense can an aesthetic of digital art and performance be approached and understood as a unique form of knowledge that is principally communicated through perception and sensory experience.

The omnipresence of technologies in daily existence has also ushered in new habits, skills, activities, modes of communication and the production of yet other machines; what French philosopher Stéphane Vial (2013) calls “digital ontophany”¹ after Gaston Bachelard’s term *phénomènotechnique* (1953) – a phenomenality of the technical. Bodies today already live and perceive in multisensory and multimodal dimensions. As living organisms, they have adapted and continue to adapt to a perpetual state of transformation that seems to be accelerating, with obvious consequences for entire populations and the environment. The body which emerges in a context of technological evolution constitutes a new reality: a *contemporary body*.

It is this body and the multimodal, multisensorial phenomenality expressed in the aesthetic of contemporary digital performance that the authors address with their analysis, situating the different levels and types of adaptive mechanisms, learning skills and multiple channels of perception at play in the body’s contact with technology and its assimilation of phenomena within new technological environments. Along with this axis of perceptual-cognitive activity, attention is also paid to the emerging interpretations of time-space, presence and corporeality in contemporary art and performance.

The book thus proposes a reframing of notions and conditions of representation with respect to new contemporary performative stages via the prism of the senses. It notably examines the sensori-perceptual deconstruction, reorganization and reconstruction involved when the body is “touched” by, interacts with,

¹ “(...) ontophany in the etymological sense of the term initiated by Mircea Eliade (...) signifies that something presents itself to us” (Vial, p.110). “Digital ontophany” signifies “how people and things appear to us through digital devices or the effect of their ubiquity, and this can be described with the help of eleven characteristics: noumenality, idealism, interactivity, virtuality, versatility, reticularity, instant reproductibility, reversibility, indestructibility, fluidity, ludogenity”.

and “incorporates” the effects of technology, and, as the authors argue, how new and multiple relationships of the senses also call into play various interdependent forms of cognition of which they distinguish a capital role of bodily intelligence and the possibility of transformative experiences through interactions with technology. Seeking to identify and analyse the new configurations – or cartographies – of the living body’s sensory mappings, the book examines the impact of technologies in performance which, at the same time as they extend theatrical potentialities and modes of performativity, also solicit and engage spectators in new sensori-perceptual relationships with art and more explicitly embodied forms of reception.

Compositional modalities involving digital technologies and new media may be alternately interactive, immersive, multimodal and/or networked. Through artistic strategies involving sensory immersion, altered cognitive experience or intermodal sensoriality, a new “geography” of perception linked to reception is constituted, which the authors argue constitutes a potentially fertile space for the imagination, but also for a more embodied experience of art, heightened sensory stimulation and psycho-corporeal awareness. And, if artistic paradigms such as the transitional, flux, the processual and non-matrixed representation can be seen to underpin such experimentation, the evolutive, transversal and/or emergent nature of such artistic processes also reflects the new aesthetic paradigms that characterize the contemporary stage in its plural forms while also marking the point of departure for new research-creation methodologies.

A New Methodological Framework for Research -Creation

Adopting a predominantly historical-critical tone, *Through the prism of the senses: Mediation and new realities of the body in contemporary art and performance* presents a multimodal, three-stranded methodological approach whose goal and *modus operandi* is to reveal – like a prism – different facets of relations existing between the body and technology and thereby examine the status of *corporeality* in the arts and performance today. Conceived by Isabelle Choinière and developed in interaction with Enrico Pitozzi and Andrea Davidson, this methodology can serve as a tool for an enriched understanding of the creative experience as well as a model for creative practice. Grounded in transversal and

syncretic research processes, it implies, on a first level, an interweaving of practice and theory that is characteristic of much research-creation, while also defining a form of collective and collaborative research.

On a second level, this methodology can be said to engage a form of “personal risk” (Rolnik 2006) (Roux 2007). Here, the researcher accepts to sublimate his or her preferred practice and/or methodological approach in order to explore other levels of being and perception; what art historian Céline Roux has called “matter to be rediscovered in a conscious way of thinking about being” (2007). In the specific context of research concerning artistic processes integrating new technologies, it implies that the researcher be willing to engage in, and experience first-hand – physically – the mediated environments under study and artistic strategies which destabilize and potentially transform corporality and corporeality. These strategies notably underpin the creative process of Isabelle Choinière, and were tested and experienced by various researchers studying her work including Enrico Pitozzi. Promoting a form of embodied comprehension of a topic, this approach also allows for a complementary empathic dimension to emerge between theory and practice.

On a third level, and in connection with the second, the proposed methodology allows for an intimate exploration of the ways in which technologies solicit and stimulate new forms of sensoriality, cognitive responses and bodily intelligence, proposing a means through which to study the interplay between perception, cognition, the experiential and technologies – in mediated art in general, and with respect to notions of performativity, artistic expression and reception in particular. One example might be first-hand testing and analysis of practices that generate “sound bodies” wherein the body not only serves as a medium for the production of sound, but also, in which the generation of sound awakens alternate forms of “tactile” reception and the possibility of sensory “re-creation”. One could also reference forms of simulation that determine particular relationships between the body and environments; for example, situations in which the performer (or spectator) must imagine and project his or her body in space before taking physical action or interacting with a media device.

Conversely, this methodology can also be applied and experienced as an evolutive framework for undertaking practical research. Constituting an integrative approach

that favours interconnection and complementary intelligences, it validates proprioceptive experience and bodily intelligence alongside embodied thought as guidelines for research and the basis from which to reflect upon the body in its more internal, functional, developmental, adaptive and homeostatic aspects. The flexibility of this methodological approach also allows for a consideration and implementation of knowledge issuing from a potentially vast range of scientific disciplines – for example, from neurobiology, movement studies, kinesiology, physics, biomechanics, biomedicine or dance, sports and computer sciences amongst others – as complementary epistemological perspectives in the creation of technological environments. When integrated with a spirit of methodological openness and transversality, knowledge culled from other disciplinary contexts – each with its own logic, applications and/or functionalities – can create new spaces for the imagination while also offering refreshing sources of stimulation for any investigation of technological mediation in performance.

Lastly, the book’s cross-methodological and pluridisciplinary nature allows for original perspectives to emerge regarding terms habitually employed to describe the sensory modalities of contemporary artistic reception: *kinesthetic empathy*, *embodiment*, *intersubjectivity*, *the haptic* and *corporeality*, to name but a few. Questioning existing understandings of performativity, the effects of presence and the role of empathy as a form of communication between spectators and performers, the book takes into account the multimodal effects of sensory stimulation on the body and the physiological consequences of synesthesia and other technologically-induced destabilizations of perception by examining the body’s adaptive mechanisms and capacity for accrued sensori-perceptual awareness. It goes without saying that dance, or specifically, the dancer’s keen awareness and knowledge of the body in its proprioceptive, kinesthetic dimensions, can serve as an appropriate model and testing ground for the effects of technology on the body. It is also perhaps not by chance that two of the authors have had extensive training and experience of various dance techniques, the martial arts and somatic practices.

Engaging in a dialogue with technology that is simultaneously productive and critical, the proposed methodology is both open – implying and comprising the various disciplines it traverses – and specific – in

the description and analysis of complex works. This position allows the authors to change the point of departure (and basis) for a form of reasoning commonly associated with more normative interpretations of technology, its references and founding concepts, proposing instead a structure of reasoning and possible discursive developments that can change the way certain terms are habitually understood by redefining them. This is, of course, an ambitious task because nothing is more difficult than changing the angular concepts and fundamental ideas which support an entire intellectual edifice. The whole structure of the system of thought is therein upset, transformed. This is what one must be prepared for.

Lastly, if technology has the potential to modify cognitive processes, it can in turn be influenced or conditioned by the creative process, which invariably introduces new demands and forms of knowledge. This is important from the point of view of the methodology proposed. On this level, interesting interconnections between the living “machine” of the body and the “artificial” machinery of technology are to be found. Through the arts, a particular account of the impact technology has on human life can be elaborated by questioning, for example, how practices, thought and behaviours might have changed our understanding of technicity over time, or how design has influenced the composition of stage devices in terms of an architecture of the stage as environment. One must also consider the consequences of technical progress – and the arts are an excellent observatory from which to do so – by controlling the direction and nature of the research at hand. The book’s methodological approach thus also extends to encompass ethical and anthropological dimensions of research as an “ecology” of technology.

Axes of Reflection

Adopting a strategy of multiple voices with the three authors engaged in a process of discursive interaction, the book takes the form of a triple-voiced narrative which establishes interrelations of theme and subject matter, while also operating subtle shifts of focus that reflect a pluralistic worldview, also exemplified by the three authors’ different professional experience, backgrounds and nationalities.

This methodology concentrates its analysis on two main axes of reflection in interaction. The first consists of the analysis of technological devices as means and processes by approaching new performative stages/

devices integrating technology as complex systems which are designed, tested and supported by a structured set of knowledge, skills and practices: of the body, as well as of technological environments. The aim of this approach is to discern the new perceptual processes underpinning and generating the composition of digital works in their aesthetic, scenographic, and technological dimensions. The dynamics of its integrative nature constitutes a flexible yet comprehensive basis for examining physical and media interactions and distinguishing emerging forms of performative behaviour through analysis of the ways in which technological devices establish new relationships with the performative body, and, further, how these interactions can provoke and induce changes in corporality. This last point extends to include the more opaque way technologies operate today: through a consideration of how, on the one hand, technologies produce cognitive changes in terms of anthropological development (de Kerckhove 2014), and on the other, how creative processes can influence technological development and to what extent the creative process itself can become a “territory” for generating new technological tools.

The second axis, closely linked to the first, consists of reflecting on the conception and experience of the performative body in light of the relationship(s) it entertains with technology. The authors propose to consider this relationship as an evolutive *complexification of self* developed through and expressed by experimentation with new modes of perception and reception related to multimodality and multisensoriality.

Reflecting on why artists feel propelled to invest in such multimodal and multisensory explorations, some of the theoretical perspectives explored in the book include

Derrick De Kerckhove’s view that the technological age in which we live has broken with the distancing objectivity of the Renaissance “era of vision” (2014) or Jean-Louis

Weissberg’s (1989) view that we now inhabit multisensory universes which are apprehended with instant awareness of the whole. For Suely Rolnik (2007), digital technology has activated a process of sensory renewal through an acceleration and permanent destabilization of the senses produced by, amongst other things, electronic media which have brought together different universes.

Provoking a constant reorganization of the senses, this situation creates an exacerbated state of being, of

presence, but also, according to Rolnik, a potentially salutary, adaptive state of openness facing the experiential at large.

Choinière, Davidson and Pitozzi interpret these positions as manifesting a *fracturing of the visible*; a situation concretely reflected in the multimodal and multisensorial nature of scenography in contemporary performance. This position allows one to alternately consider new stage devices from the angle of physical and symbolic time-spaces that are increasingly hybrid or to analyse modifications of the physical body produced by contact with technological devices. It also invites analysis from the perspective of a disappearance of the fourth wall, calling into question issues concerning the subject/object or spectator/performer relationship and leading to, amongst other things, a consideration of the dissolution of psychophysical borders between the performer and audience, and to contemporary forms of intersubjectivity (Rolnik 2007a, 2007b) (Berthoz 2013) (Brett 2004) (Rizzolatti 2005).

To account for the intermodal perspectives just evoked and to the concepts from which they derive, the organization and internal logic of the book develops three correlated levels of analysis in resonance. These perspectives, which also correspond to the book's three chapters are organized as follows.

Strand 1: *Embodied Thought*

A first methodological strand, developed by Enrico Pitozzi, correlates a theoretical framework of analysis with direct observation of artistic practices and a consideration of the experiential body. While constituting a primarily aesthetic and philosophical approach, it nevertheless emanates from, and takes into account, the researcher-theorist's first-hand physical experience of compositional processes involving new media devices: in Pitozzi's case, stemming from close collaborations with choreographers as an outside observer-researcher of their works and through pedagogical experience with dancers. The theoretical position that issues from this experience reflects a logic of *embodied thought*, leading the author to propose an emerging philosophy of contemporary stages in resonance with the book's other methodological strands.

Overview

Pitozzi begins his analysis announcing a theme of *corporal potentiality* as constituting a vital element in the

relationship between the moving body and technology. With a first reference to the concept of virtuality, from the medieval Latin *virtualis* and *virtus*, "force," "power" (Lévy 1998), he establishes correlations with Spinoza's positions on the body as a "reserve" of movements and gestures (2007) and subsequently, to perception and more specifically, to the modification of perception as influenced by technology. Here, he aligns his analysis with references to Leibniz on perception (1921) and to Berthoz (1997) and Jeannerod (1994) with respect to physiology. This framework allows him to introduce notions of *corporeality* and *corporal potentiality* with a specific analysis of artistic processes involving technologies that mobilize perception and/or extend the body's potentialities. These issues lead to the question of intermodal, multi-sensory strategies of composition and the emergence of *new performative behaviors*. As a first example, he cites the sound body – "*le corps sonore*" – (Pitozzi 2010) developed in the work of Isabelle Choinière, a model that has also been explored by other artists in different ways.

Examining relationships between the conventional stage for theatre and dance and immersive and/or multisensory installations which, importantly, stage the presence of devices, Pitozzi then considers a range of contemporary experimentation which points to a new understanding of multimediality: from the more "organic" representations of the body in multimedial stage productions by artists such as Myriam Gourfink / Kasper T. Toeplitz, Ginette Laurin / Martin Messier, Robert Wechsler / Palindrome and Isabelle Choinière, to the more stylized audiovisual environments and installations of Dumb Type / Ryoji Ikeda, Hiroaki Umeda, Cindy Van Acker / Mika Vainio, Shiro Takatani and Herman Kolgen. Four trends emerge from his analysis: the first concerning the creation of immersive environments that transform the conventional stage into perceptual environments – for example, in the case of works by Granular Synthesis or Edwin van der Heide. The second concerns a reinterpretation of structural models of nature in their metaphysical dimension – as in the works *Datamatix* (2008) by Ryoji Ikeda (2009) or *Rheo* (2009) by Kurokawa Ryoichi. A third perspective describes strategies that "extend" sound and vision – as in *Dust* (2009) by Herman Kolgen, *Ripple* (2004) by Thomas McIntosh, or *To extend the visibility* (2008) by Elio Martusciello – in which media devices are employed to "visualize" normally invisible

and inaudible dimensions of reality. A fourth category includes works that, in their most radical dimensions, have led to the emergence of autonomous multimedial forms – for example, in the works of Heiner Goebbels or Verdenstheatre, where performers have been replaced by a *theatre of objects and machines*.

Having established points of connection between multimedial stages and installations, Pitozzi then turns his attention to the phenomenon of multisensory immersion and to compositional strategies involving immersive devices, which he describes as producing a unique aesthetic related to a *logic of latency* and the capacity to induce specific sensations. Advancing the idea that these strategies initiate a transformation – or reconfiguration – of performers’ and spectators’ sensorial activity, he also places emphasis on the subliminal dimension of artistic composition, questioning not only the material conditions of composition, but also, conditions underpinning reception. If the transformative aspect of installations lies in a reconfiguring of spectators’ perception, it also concerns the relationship spectators entertain with environments in which they are immersed. A pathway, or “current”, is created between the stage or installation’s materiality and the mind – the artist’s intention and performers’ action – on to the spectator’s perceptual sensibility. Pitozzi argues that through this connection, spectators gain access to an unprecedented scope of perception, which, in turn, invites a reconsideration of the range of all possible sensation. He suggests that in this experience, the apparent substance of all things perceived may be but the spark of an encounter between what he calls two infinities: between the material stage or installation, and the stage of perceptual experience.

Strand 2: Embodied Cognition

This second methodological approach constitutes an axis of practice-theory that Isabelle Choinière, as a dance artist-performer -researcher, tested and developed in the context of her interdisciplinary choreographic practice and further conceptualized in her writings. Rooted in the experiential, and specifically, in the artist -researcher’s moving body in contact with technology, it aims to establish an interactive relationship between practical research and the generation of theory wherein practice informs theory and theory, practice. The creative process – here understood as both practical and theoretical – is guided and enriched by critical and reflexive feedback:

as much via collaborations with external researchers as by practical experimentation in the studio. One example of this cross-fertilization is a consideration of the reorganization and reconstruction of the performer’s sensori-perceptual references when in contact with technology as a form of phenomenological knowledge, also implicit in the dancer’s accrued sensory, perceptual and improvisational capacities. Choinière thus proposes a means to understand digitally-based creative processes as systems of *embodied cognition*, underscoring an intersection of the somatic with the technological, but at the same time, proposing a new way of thinking about and creating digital works.

Overview

Choinière’s research takes as a basic premise the possibility of a modification and evolution of corporality through the body’s contact with technology. Firstly grounding her argument in a revisit of the etymological origins of the term “aesthetic” – understood by the ancient Greeks as a reference to sensation and the capacity to perceive – and a reference to the sensori-perceptual nature of lived, subjective experience in what she describes as a renewal of Merleau-Ponty’s existential phenomenological project, she subsequently bases her hypothesis on notions of personal risk-taking (Roux 2007); on cultural processes of transformation marking the transition from a logic and a culture of objects to one of intensity and flux (Buci-Glucksmann 2001); and on Rolnik’s theory of a dissolution of psycho-corporal boundaries (Rolnik 2006) (Brett 2004) (Clark, cited in Brett 2004) (Luz 1975) (Rolnik & Diserens 2005). She then introduces her model of a collective and collaborative form of research that served both as a creative impetus for *Flesh Waves*, a project she has developed over the past years, and as the work’s evolutive methodology, inspired by a phenomenology of *lived experience* and a dynamic of empathy. Her intention is to create a space of bodily resonance and ecosystem of interaction and mutual influence, in which empathy and corporal intersubjectivity are proposed as a form of *intercorporeality*.

Presenting the principal axes of her practical research and referencing other creative works she has designed and participated in, Choinière firstly addresses questions of sensory perception and the complex multisensory, multimodal and integrative relationships which characterize her work and distinguish it an alternative

vision of the performative body. This analysis sheds light on her research's central interest and focus: a dynamic link between somatic principles and technology, derived from a personal practice of contemporary dance rooted in the somatic and an equally strong interest in digital interfaces from the outset of her career as a choreographer. She also evokes the new aesthetic, cognitive and communicative paradigms she sees emerging with this technological-somatic orientation, also reflecting on dance's potential contribution to a broader understanding of technological evolution in general.

The technology-somatic relationship, which Choinière further describes as underpinning the concept of *embodied cognition* already alluded to, was concretely tested in practical experimentation in the studio with five dancers for whom she elaborated exercises to develop heightened sensori-perceptual and experiential awareness, and secondly, through the creation of a performative model involving an interactive sound interface in which the dancers' movement, breath and intimate vocal utterances generate a sound environment and what she calls a "collective carnal sound body" (2014, 2015). She notably outlines the strategies of sensori-perceptual destabilization tested with the dancers, describing how, on the one hand, they imply a learning process with technology based on principles of self-organization and sensory "attunement", and on the other, how a relationship between the performative body and technology can construct, through a focus on intensities and flux, minute changes of state, and elements in resonance, a new form of presence that is at once physical and mediatized, and further, capable of communicating, through an extended or diffused effect of resonance, with the somatic sensibility of spectators seated in proximity to the stage and immersed in the sound environment generated in 360°.

On the basis of this experimentation, Choinière elaborates a theory of *vibratory and interfaced intercorporeality*, expanding on Pitozzi's notion of *corporal potentiality* and also qualifying it as a new aesthetic of the interface. She notably argues that the collective body can constitute a new paradigm and organizing principle for experiential forms in the performing arts when the body and its specific intelligence are "reintroduced" in the understanding, conception and elaboration of relationships amongst performers and between performers and spectators. While describing the technology deployed in her

research as itself constituting a distinct physical environment and new form of physicality with which performers engage, she suggests that technology can become the activator of a process of sensori- perceptual reconfiguration leading to a phenomenon of *interfaced intercorporeality*. For Choinière, this paradigm is possible thanks to a renewal of the types of relationships artists can develop with technological interfaces and the notion of *corporal potentiality* which is activated and actualized in her creative work.

Strand 3: Embodied Perspective

Picking up on the themes of *corporeality and sensori-perceptual transformation* raised by Pitozzi and Choinière, Andrea Davidson adopts a third methodological approach and focus: that of the practitioner -theorist engaged in the analysis of the performer's double status as *mediated body and mediating agent*. Drawing on empirical knowledge gleaned as a former dance artist and choreographer, and applying analytical tools common to dance and somatic theory and practice, Davidson establishes a first line of inquiry concerning what she observes and analyses as the corporeal or somatic dimension of digital performance as it plays out in the performer's physical contact with technological devices: how does the *body* actually *experience* technology? What changes in the relationship with respect to one's "normal" state? What adjustments are required? These questions lead her to further consider the effects of mediation on those on the receiving end of a work: spectators, who, wittingly or not, also become mediated bodies of sorts.

In a second line of inquiry, for which she adopts a more aesthetic and discursive methodological framework of analysis that draws on a wide and transversal set of sources, Davidson examines the performer's experience as a mediating agent operating within systems of technological interfacing. This analysis leads Davidson to evaluate, after Broeckmann (2003) and Kusahara (2007), the nature of the technological device as encapsulating or cristallizing a concept, a channel of perception and a discursive mode. Correlating the practical-theoretical strands of her methodology, she then advances a notion of *embodied perspective*, through which she proposes an understanding of digital interfaces as *new viewing/sensing devices* (Davidson 2013, 2015) which, in their capacity as *instruments of perception*, proffer somatic experiences while also

conveying a work's particular aesthetic *perspective*. Her argument concludes with a consideration of perspective itself as a new form of dramaturgy.

Overview

On a first level of interpretation, Davidson situates the dual nature of the mediated/mediating body within a general context of mediation and intermediality in performance, and then, with respect to new aesthetic imperatives that locate and stage performers within hybrid technological systems. Examining the two-way connectivity of interfaces and/or of networks of interrelated devices which characterize these works, she looks at the alternative and multiple forms of presence, intervention and relational complexities their dramaturgies introduce. She then focuses on the new skills, forms of address and composite forms of corporeality that become necessary/operative for performers acting as mediating agents within these environments, also broadening the scope of her analysis to scrutinize other relationships generated by mediation in performance: between the mediated/mediating performer and spectator, and between spectators and mediated environments. She notes, for example, how mediation and intermediality can challenge, divert or deter habitual chains of sensori-perceptual-cognitive action and reaction, their levels of intensity, modes of organization and aesthetic outcomes (Lévy 1998) (Ihde 2009) (Kattenbelt 2008).

On a second level of interpretation, Davidson remarks, like Pitozzi, that the multimodal nature of contemporary scenography often goes beyond an appeal to the senses of sound and vision alone to elicit modes of perception that are multi-sensorial, layered and/or immersive. She notes that in so doing, artists can amplify or concentrate perception, communicate different levels of narrative complexity, and further, inform the spectator of his or her own corporeality. She suggests that these devices/interfaces also underscore the capacity of technology to reveal what has hitherto remained inaccessible or hidden to the senses. To support her argument, she looks at a selection of works from several artistic disciplines, also questioning whether disciplinary prerogatives may change the way mediation is conceived of and designed, and, if so, what changes to performative agency and reception might be involved.

In a third perspective, Davidson introduces the notion of interfaces as “new viewing/sensing devices”, looking at the range of possible somatic qualities expressed or stimulated

by mediating devices. Examples are given of works that namely stage the effects of variables such as light/shadow, colour, air, temperature, pressure, weight, balance, distance, proximity, scale, orientation and reverberation. Noting how these devices call into play responses of a proprioceptive and kinesthetic order and also identifying the more psycho-physiological relations they produce, she notes how, in provoking new spatiotemporal references and sensory reactions, certain devices can also constitute variations of touch, new ways of sensing space and time, perceiving objects or experiencing gravity. These observations lead her to advance the notion of *embodied perspective* as a new form of dramaturgy. Situating the role of sensori-perceptual adaptation and corporeality alongside the singular perceptual/semiotic perspective a device offers, she analyzes how these new dramaturgical forms stage alternative dimensions of performativity and modes of reception.

On a final note, any analysis of current trends of contemporary performance involving technology would be incomplete without considering a posthuman or transhuman vision of the body and agency. Under this category, works can include representations of critical discourse surrounding identity in a technologically mediated world, the depiction of bodies that are instrumentalized, controlled and/or replicated by machines, devices that physically penetrate the body and/or transform the human form, or transmutations of human attributes as virtual entities, modelizations or abstract functions. While aesthetic statements and strategies like these are not necessarily new or recent, with artists such as Stelarc, Orlan, Marcellí Antúnez Roca or Guillermo Gómez-Peña already having explored this territory, Davidson remarks that they may not be the only possible response to technology or expression of a posthuman aesthetic. On the contrary, she asks, how might an expressly somatic – human – vision of the body inform technology? Citing Remshardt's (2008) concerns, after Auslander (1995) about mediation having sealed the fate of the phenomenal body in performance and his comment that “mediation changes only the perceptual, not the ontological status of the body” (2008), Davidson, for whom these oppositions remain problematic, expresses the view that an ontological status of the body in mediated performance need not necessarily eschew the mediated body because, as in society, the mediated body has become increasingly integrated as part of human experience.

For Davidson, somatic experience, as an expression of presence-to-experience, can also pose a viable counterpoint to what Remshardt (2008) further refers to as a contemporary “collapse into mediation”. Citing the example of *Huang Yi & KUKA, A Duet Of Human and Robot* (2013), in which dance, robotics and laser technology combine to communicate a rare poetic symbiosis of man and machine, she distinguishes what she views as the ongoing potential of mediated performance to renew performative models while also transforming the perception and rituals of theatre. On that note, she ends, raising questions as to how technologies of the future will impact the performative body and spectatorial experience. What new media, interfaces and applications will emerge? What new potentialities of the performative body will they inspire?

Conclusion

The themes evoked in *Through the prism of the senses: Mediation and new realities of the body in contemporary art and performance* fall within a range of current research at the intersection of the arts, culture and media studies exploring questions of mediation, sensoriality, perception and human-computer interaction. In placing corporeality at the core of its aesthetic focus, the book distinguishes itself however from studies which limit their analyses to the functioning of technological “objects”, machines or systems, an evaluation of mediation from historical, aesthetic and/or sociological perspectives alone, or alternately, notions of “lived-in” or “body-specific” knowledge as they apply or can be related to fields such as software studies, the computation of movement as numerical representations or their equation with concepts of immediation, enactment, interactivity, ergonomics, etc. Even the adjectives “embodied”, “intuitive” and “intelligent” used to describe aspects/qualities of digital systems have become so common and all-encompassing that the processes they reference are also taken as givens and left largely unexplained, incomplete.

The experiential, multisensorial and somatic nature of mediated performance does not readily conjure up abstract concepts or theoretical objects, but rather, as the book demonstrates, derives from and facilitates an active experience of embodiment. One of the principal arguments advanced by the authors concerns the role of *bodily intelligence* in the conception, reception and analysis of works deploying technology, also underscored

by the concept of *corporeal potentiality*, proposed as a new aesthetic model for interactive interfaces. In the cross-modal, relational and creative relationship the moving, sensate body weaves with technology, these principles can open up new understandings of the contemporary body and spheres of performative action and spectatorship, while also constituting the basis of new dramaturgical strategies.

The book’s practical/theoretical axis highlights another dimension of this activity that has not yet found a precise aesthetic framework of analysis but that is examined and also integrated in the book’s dynamic and transversal methodology: an understanding of the experimental nature of practice as a process of transformation and not, as habitually understood, a process leading to representations that are anticipated as such, and thus locked into, final, fixed outcomes. The paradigm of *interfaced intercorporeality*, as an example of a dynamic experiential process revealing the complexity of the body in a state of constant evolution, can open up a powerful space of transformation in creative work and also be of interest for the history and evolution of new contemporary stages by marking a transition from representation to transformation. It is hoped that these perspectives and their emphasis on corporeality and the inherent somatic dimension of human-technological interaction, can be of significance to any debate surrounding mediation in art and performance.

Panel participants

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Artist, researcher and teacher of new contemporary performative practices, Isabelle Choinière holds a Ph.D. in the Philosophy of Integrative Arts from Planetary Collegium, Plymouth University (2015). Her works include *Communion*, *Le partage des peaux II* (1994-1999); *La démente des anges*, *La mue de l'ange* (1999-2005); *Meat Paradoxe* (2005-2010); *Flesh Waves* (2013) and *Phase 5/Generativity* (2016), productions that have toured Europe, Latin America and North America in major festivals, exhibitions and art institutions and been referenced by research groups around the world. Alongside her artistic practice, Choinière's research has been published by n French, English and Portuguese. Intellect Press, UK (2006, 2013, 2015), *Archée* (2016), the *Journal of Transdisciplinary Knowledge Design*, Korea (2009), CENA and VIS (2015, 2017) and Cambridge Scholars Publishing, UK (2009, 2014). She is currently Associate Professor at the Faculty of Communications at University of Quebec in Montreal, and member of the international research groups "Hexagram-UQAM and Planetary Collegium Research Network.

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Reimagining the Art Institution as an Open Source Civic Organisation

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Abstract

Free Libre Open Source Software (FLOSS) is an encompassing term, which refers to the licenses associated with making the source code that is the instructions and language per se, which define how software works and is made available for others to read, modify and share. Providing a brief history of FLOSS, this paper presents a hypothetical situation, whereby elements of FLOSS are applied to reimagining institutional change within the context of a contemporary arts venue and organisation. Framed as an artistic intervention, the art institution's structure and its existing forms are considered as the living materiality of the practice. The paper presents a set of processes, defined as 'Acts of Transition', whereby the values of Free Libre and Open Source are collaboratively explored with the institution's staff and executed together, across and within the organisation's teams. As 'Acts of Transition' they aim to support more commons-based peer-production processes, by reimagining the arts organisation as an open source civic organisation.

Keywords

Free Libre Software, Open Source Software, New Art Practices, Art Institution, Commons-Based Peer-Production

Introduction

Historical Free Libre and Open Source Software (FLOSS) refers to different approaches to licensing that are bounded in debates over the nature of knowledge and information exchange, which emerged from the UNIX and hacker cultures at the universities of Berkley and the Massachusetts Institute of Technology (MIT) from the 1970s-90s. Traditionally the term 'open source' refers to what has been described as the "bill of rights for the computer user" (Perens 1999). In other words, the rights that describe how the source code, the system and symbols that a programmer writes in order to make a software work, are shared and distributed.

With the explosion of the commercial software market in the 1980s the closure of source code became common.

What this meant is that only a few people, most often the original authors, could legally copy, inspect or alter the source code. As a result the upgrade and repair of computers and other forms of technology (smart phones and cars etc.) became more difficult as it was not possible to 'get into the engine' of the machine. Closing the code also meant that modifications and customisation was also unlikely. Ethically this turn towards closure negated the view that information sharing is a powerful, useful and positive, social and common good.

Caring about these changes and the effects of closure on the software scene and industry. Harvard graduate, MIT programmer and hacker, Richard Matthew Stallman developed the four freedoms of software: the freedoms to use the software as you wish; change it to suit your needs; distribute it to anyone else and distribute altered versions. These freedoms were outlined in the "GNU Manifesto" (1989) and the Free Software Foundation (FSF) was established as a vehicle for implementing the manifesto. In order to preserve these freedoms permanently, Stallman inverted the legal system of copyright – by developing what is known as copyleft and in doing so created a licence that protects the commons from private appropriation, and gives power back to the user. Today various forms of FLOSS licences exist, including Creative Commons and its derivatives (Lessig 2004).

Considering the potential misinterpretations of the term 'free' as in gratis versus 'free' as in unhindered in use, Eric Raymond in his book 'The Cathedral and the Bazaar' (1999) discussed how bottom-up, free software approaches can lead to high quality, secure software. Raymond argued that the term open source is a more beneficial and less ambiguous way to describe the approach and its different forms and would encourage more businesses to adopt the method. Given this, the term Free Libre and Open Source Software (FLOSS) emerged as a means to enable people to understand the direct and

wider relevance of Free and Open Source Software.

Today the ideals and values that inform FLOSS are applied not just to computer code but have been used within the fields of governance (Lathrop & Ruma, 2010), architecture (Ratti & Claudel, 2015), community development (Tuomi, 2000), licensing (Lessig 2004; Stallman 1992) and economics (Benkler, 2016; Khalak 2000, Lerner & Tirole, 2000). In this respect FLOSS is best understood as a value system that underpins a particular way of making and doing. This is also referred to as the 'open source way' which, as outlined on the website opensource.com¹¹, includes the following values: *Open exchange*: we can learn more from each other when information is open; *Participation*: collaboration helps us to solve problems, we cannot solve on our own; *Rapid prototyping*: we learn best by doing, testing and experimentation; *Meritocracy*: when everyone has access to the information, collaborative team effort enhances the chances that the best ideas can emerge.

Applying FLOSS values to the Art Institution

Distilling the values of FLOSS and the open source way, the following is a set of activities aimed at supporting an established contemporary arts institution to transition from a hierarchical, closed system into a more open source civic organisation. Specifically this institution is imagined as a national or regional centre with important local significance and a highly regarded international profile. The institution would typically be in existence for at least 25yrs, own or rent its own building and employ between 20-60 people (full and part- time) to run its various divisions (e.g., gallery, education and outreach programme, bookshop, café, studios and or residency programme). The institution is also imagined as one which is experiencing difficult financial or managerial issues, partly due to internal politics, leading to a loss of confidence in its public audience, funders and/or board members. Further drops in public funding and austerity measures extenuate these problems. However the institution has built its reputation on supporting leading contemporary artists, thinkers and creators. It prides itself on taking risks and, given this, it is prepared to open its process up to experimenting with FLOSS models as a means to explore new operational approaches. Central to this exploration is

working with artists, who are familiar with FLOSS values. The following section, 'Acts of Transition', describes a process whereby the values of Free Libre and Open Source are collaboratively explored with the institution's staff and executed across and within the organisation's teams over a 6-month period.

Acts of Transition

1.Enculturation – Taking the position that senior staff may not know about FLOSS, the first step is to provide a mechanism through which this can happen. For example, the organisation could create regular and informal ways to meet, so that mutual understanding and trust can form; develop visual material, which illustrates the history, key terms, licence models and modes of participation; host a salon on the topic and invite guest speakers who have experience of working in a FLOSS manner; create a hospitable environment which can provide space for discussion and conversation.

2.Community Works – In parallel with the first step, consider the arts institution as a community of practice, which has its own set of routines, behaviors, habits and rules. Take time to learn about current working practices. Understand funding models and key stakeholders positions. Use this knowledge to help run the workshop as outlined in step three.

3.Generate Together – Run a workshop or series of workshops, which are open to *all* members of staff. Divide the teams into their everyday groups (e.g., catering, technical, curatorial, educational, bookshop). Invite a FLOSS expert as a support guest to join each team. Open the workshop by welcoming and introducing everyone. Provide a summary of FLOSS and the values of the 'open way'. Create a set of activities, which can help people embody, perform and express the ideals of FLOSS. Design a set of activities, through which each team can brainstorm how a FLOSS approach can be implemented within their team. From this discuss the merits of each idea and vote on 1 or 2 to take forward. Refine the selected ideas, working through the pros, cons, and realities. Present the final idea/s to the wider group and vote collectively on which ideas are suitable to go forward for a 6-month pilot implementation (ideally there should be at least 1 idea per team).

4.Test & Tweak – Post the 'Generate Together' workshop, allow for a period of 1 week-10 days for

¹ opensource.com

the ideas to rest in the minds of each team. Then meet with each team for an update session and discuss how implementation will begin. Develop a plan together, which plots out the course, discussing potential pitfalls and issues. Sign-off on the implementation plan with the team and associated senior members, ensuring that there is enough support for the team to carry it out. Meet the team regularly (every two months) to discuss how ideas are developing. Encourage teams to keep a journal or weekly logbook, which documents successes and challenges.

5.Open Exchange - In order to gain critical and supportive feedback, discuss with teams and senior members of staff how and who can be included within this process. For example, at the end of the 6-months, meet collectively and present the outcomes of the 'Test and Tweak' step. Invite FLOSS experts, critical friends and audience members to join. Discuss strengths, weaknesses and next steps. Acknowledge points of conflict and difference. Make it possible across the 'Test and Tweak' phase for audiences or other key stakeholders to feedback or become involved. Create an in-house, open day for specific audiences and stakeholders to feedback on the working process.

Conclusions: Moving towards a Commons-Based Peer-Production Model for the Arts

FLOSS approaches are considered as examples of commons-based peer-production (CBPP). CBPP refers to the collaborative efforts and outcomes of a large number of people working incrementally on a problem or artifact without being organised on either a market-based, managerial or hierarchical model (Benkler, 2016, 2006, 2002). Benkler, like many others (Lessig 2004; Stallman 1992; Boyle 2010) considers CBPP as an emerging "third model of production" (Benkler 2002), which harnesses human creativity through the use of ubiquitous computer communication networks. In essence the network effect brings about a dramatic change in the scope, scale and efficacy of peer production.

Across the arts there exists multiple examples from individual artists to group practices, institutional approaches, projects and programmes, which already use the values of FLOSS, the 'open way' and CBPP. To name but a few, the international group unMonastery²

²unmonastery.org

explicitly adopts open source approaches to create what they refer to as a social clinic for the future. Championing open source and peer-based approaches to art, Furtherfield³, London, promote and support artistic practices in which people become active co-creators of their cultures and societies, likewise RIXC⁴ in Riga run on similar principles. Major international events such as the 13th edition of the Venice Architecture Biennale explicitly led with the theme 'Common Ground' and open source (Rodger, 2012). Artist groups such as irational⁵, Platoniq⁶, Open Group, Chto Delat⁷ and CAMP⁸ focus on open democratic systems, commons and peer-to-peer processes as means of creating their work, while festivals such as OPEN SOURCE London adopt the term to highlight the focus on inclusive and community focused artistic practices.

The arts therefore are not without their FLOSS or CBPP examples. However larger national or regional art institutions are more hesitant to adopt such practices. There are multiple reasons for this, which are not the focus of this paper. Instead the aim is to present examples from an approach whereby artists lead on this conversation with the institution in a manner that takes the organisation itself as the living material through which the artistic practice is carried out. In taking this approach the artist and the institution enter into relationship, whereby the 'Acts of Transition' become themselves works of art, which operate at an organisational, open and civic-minded level.

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³furtherfield.org

⁴rixc.org

⁵irational.org

⁶platoniq.net

⁷chtodelat.org

⁸studio.camp

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Fake Organum: The Uneasy Institutionalisation of Art as Research

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Abstract

Artistic research is still in its infancy and continues to pander to dominant institutional discourses of what research is. In particular artists too often ‘borrow’ methodologies from the sciences to justify their practice as research. There is a need for a *Novum Organum Artium* that will form the foundation of an artistic method, just as Francis Bacon’s *Novum Organum Scientiarum* did for the scientific method.

Keywords

Artistic Research, Research Methods, University-Based Art, Methodologies, Scientism, Francis Bacon.

Introduction

In *Novum Organum* (1620), Francis Bacon introduced his inductive method of experimentation that was foundational for the development of the modern scientific method. *Novum Organum*, translated as ‘new instrument’, argued for an alternative system of logic to the syllogism described in Aristotle’s *Organum*. Bacon’s method advocated that only after careful cataloguing and classification of all instances in which a characteristic under observation is present (or absent), could a theory on the observed characteristic be formulated inductively. Despite the problem of induction outlined by both Hume and Popper, inductivism continues to feature in scientific practice and has historically demonstrated considerable success. Most contemporary research utilising *Big Data* could certainly be described with Bacon’s method of induction. A method in which “the scientist would question nature without biases or hypotheses and move to generalities in an algorithmic fashion, as if (in Bacon’s words) by machinery” (Conrad & Serlin, 2011). Indeed, the relentless and exhaustive collection of data required by Bacon before any general theory can be posited is perhaps only possible if undertaken by a machine.

This new machinic tool of science that Bacon designed to “restrain discursive reason and make good the defects of the senses” (Rees & Wakely, 2004) may

have since been subject to centuries of critique, but the basic principles it introduced of experimentation and observation importantly continue to be representative of the public understanding of what scientists *do* and what research *is*.

Art as Research

After the amalgamation and mutation of art schools into universities and the emergence of the PhD in artistic practice, art students and art academics are increasingly asking themselves how to do research (Buckley & Conomos, 2009). Approaches to research are vastly influenced by the structure of the system that they are generated in (Newman, Tarasiewicz & Wagner, 2015) and artists are now increasingly finding themselves within a university system. In this system, artistic practice can only be made sense of “as a kind of research that creates new knowledge—art as science, art as humanities, never within its own terms, but in the ever-present standardised language of scientism, bureaucratic and economic rationalism” (Conomos, 2009).

The reframing of art as a “kind-of research” may be necessitated by its institutionalisation but it continues to be debated if it indeed the case. Adam Geczy (2009) argues that art is not research, that art is art, and this is an important distinction “for it recognises the discourses about what art means, which are a whole lot more venerable, productive and accurate than the definition that art is research. Glen Lowry (2015) criticises university-based art as producing both bad art and bad research. This is further amplified by the emergence of “the (art) academic as a conformist intellectual” whose institutionalisation has located them in a “box-ticking culture of pedagogy and research where academics are snug in their tenure-track career” (Conomos, 2009).

An institutional environment that demands the accumulation of research “points” is hardly encouraging for what Lowry calls “good research-creation” that pulls

professional academic “outside zones of comfort and away from monitored disciplinary divisions or divisions of labour” (Lowry, 2015). It was in this environment that artists started redefining their practices as research, and although many now make the distinction between “art” and “artistic-research” (Lowry & Freitas, 2013), art as research will remain a dominant feature of the practises of university-based artists, both students and academics.

Fake Instruments of Artistic Research

Conomos (2009) has described the institutional environment that led to the repositioning of university-based art as research, as in fact hostile to creative arts research. With its “cultic fetishisation of patently unsuitably narrow criteria of evaluation as to what represents academic research” (Conomos, 2009), artists have started to distort their own arguments to accommodate this criteria (Elkins, 2006) and ingratiate themselves with the overriding institutional narrative. In doing this artistic researchers begin to consider and conjure methods and methodologies to describe what was previously known as a practice.

As artistic research is still in its infancy and lacking a comprehensive research agenda (Jones, 2006), there is no comprehensive overview of artistic research methods (a fruitless task in itself). Artist researchers therefore seek-out methodologies from other disciplines and ‘borrow’ them, often simultaneously critiquing the appropriateness of these adopted methods (Macleod & Holdridge, 2006). The implementation of these “fake methods” is rarely because it is suitable for the art/research the artist intends to undertake, but rather to justify the art/research within its institutional context by using the dominant language of that context. As Butt writes, “...a stereotype of scientific language is adopted to bring a veneer of academic respectability to a creative project whose material transferability cannot be guaranteed” (Butt, 2011). This is evidently the wrong approach, as while art is research, it is a different type of research that produces a different type of knowledge than that of the sciences (Newman & Tarasiewicz, 2013). In-stead of developing another *Novum Organum* (new instrument), artistic research is too often pandering to science, the dominant language of research embedded within the university, and instead offering up a fake *Organum*.

Novum Organum Artium

More than two hundred years after Bacon’s *Novum Organum*, William Whewell offered an alternative approach with his *Novum Organum Renovatum*. Described as “philosophically perverse” (Butts, 1965) and irresponsible (Herschel, 1841), Whewell’s schema could assist with the development of a *Novum Organum Artium* (new instrument of the arts). Whewell argued for the importance of the guess. According to Wettersten (1993), Whewell’s approach demonstrates that “even if we start with poor guesses and treat them critically, we can come to the truth; there are many paths to the truth, but only one goal”. As described by Macleod and Holdridge (2004), “findings presented through art are always *a posteriori* and thus, ill suited to the institution’s pursuit of truth and prescribed outcomes.” In this case, a guess is possibly the best place to start, it’s definitely a vast improvement on pretending to know what you’re doing and where you’re going.

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Author Biography

Andrew Newman is an artist and researcher based between Sydney and Vienna. His research focuses on epistemic cultures in arts and technology, while his performative art practice stabs in the dark. Newman currently leads the Open Publishing Lab at the Research Institute for Arts and Technology and he is co-editor of the Journal for Research Cultures.

Forking as Cultural Practice: Institutional Governance after the DAO

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Abstract

Since the microcomputing revolution in the 1970s we live in the age of permanent (technological) disruptions, but institutional and educational practices have barely changed. “Technologies come and go but the university remains, in a recognizable and largely unchanged form” (Flavin, 2017). Disruptive technologies, such as distributed consensus systems (blockchains, DLTs) challenge the role of the university as gatekeeper to knowledge and question the structure and organisational architecture of institutions. The only chance for traditional institutions is to find interfaces to informal and technology-driven “production cultures” (Tarasiewicz, 2011) to be able to radically reinvent the university. If the universities don’t react to technological and societal change, they will be forked, replaced, and decentralized.

Keywords

Bitcoin, Blockchain, Code Governance, Code Politics, Coded Cultures, Consensus, Cryptography, Cryptopolitics, Cypher-punks, DAO, Disruption, Distributed Autonomous Organisations, Ethereum, Forking, Governance, Hacker Culture, Innovation.

Introduction

With the accelerated pace of the introduction of new technologies, the appropriation of techno-culture has targeted all niches of informal work. Terms such as “Hackerspaces” and “Hackathons” show that the terminology “hacker” and “maker” has been commodified (Davies, 2017). In recent years, informal cultures of knowledge production are actively targeted and their methods and formats are emulated and transported into business and education. The hacker ethic, as Brett Scott points out, is a composite of “not merely exploratory curiosity or rebellious deviance or creative innovation within incumbent systems. It emerges from the intersection of all three” (Scott, 2015). Numerous incompatibilities question the interfaces between informal and ‘formal’ research (Wagner, Newman & Tarasiewicz 2015). In the new age of permanent disruption “it is not assets we need to leverage, but networks” (Satell, 2013).

Disruption and University

A “disruptive innovation” (Bower & Christensen, 1995) is said to create a new market and value network (or disrupt existing ones), with “significant societal impact” (Assink, 2006). Hypes and hype-cycles are evolving, while at the same “tethered appliances” (Zittrain, 2008) are consequently “reducing the potential for technological literacy” (Wuschitz et al., 2016). Institutions as tethered appliances introduce limitations, and have been re-invented (Johnson et al., 1995), hacked (Cohen and Scheinfeldt, 2013) and rebooted (Berechet and Istrimschi, 2014), while still being in its permanent crisis (Nelson, 1997; Scheper-Hughes, 2011; McCabe, 2013).

Although there are many ongoing attempts to implement novel and “disruptive” technologies into teaching and learning practices, traditional institutional practices have barely changed (Blin and Munro, 2008; Christensen et al., 2011). “Teachers have implemented computers in the most commonsense way – to sustain their existing practices and pedagogies rather than to displace them” (Christensen et al, 2011). As Michael Flavin notes, “technologies come and go but the university remains, in a recognizable and largely unchanged form” and “the use of disruptive technologies challenges the role of the university as gatekeeper to knowledge and signifies the possibility of a more open borders approach.” (Flavin, 2017).

The Age of Permanent Disruption: from the ‘Crypto Dream’ to the ‘Blockchain Revolution’

...disruptive innovation does not take root through a direct attack on the existing system. Instead, it must go around and underneath the system” (Christensen et al, 2011)

Simon Penny describes how cultural production and innovation always involves diverse communities of toolmakers, and their “particular contributions and motivations are seldom noted, except in specialised studies” (Penny, 2008). Often such cultures, are, as Penny

calls them, “renegades” or “eccentrics”, producing their tools outside of institutions and “by definition, ahead of the technological- industrial curve” (Penny, 2008). One example of such an eccentric innovative technology-based community are the cypher-punks.

In 1983 cypherpunks already debated the usage of digital cash without a central issuing authority (Chaum, 1983, 1990; Finney, 1993; Medvinsky and Neuman, 1993; May, 1994; Szabo, 1997; Dai, 1998; Reagle, 2005), which was only introduced in 2008 by the anonymous entity ‘Satoshi Nakamoto’ (Nakamoto, 2008). Within a self-published paper Nakamoto described the blockchain ledger, thus inventing the first crypto-currency: Bitcoin. Digital currency and even more so the ‘blockchain’ might be the most disruptive invention since the internet, though its ‘disruptiveness’ is still debated (Iansiti & Lakhani, 2017; Swan, 2015; and others). Originally interpreted as a critique to the bank bailouts after the financial crisis (en.bitcoin.it, 2017) and used only by a few, together with existing other so called “altcoins” (Tarasiewicz & Newman, 2015), the market capitalization of digital currencies nears \$27.85 bln as of 04/2017 (Suberg, 2017).

Blockchains have a multitude of potential applications and the industry is “imagining a blockchain world” (Ernst & Young, 2016), but we have to still read them as experimental technologies. They are “distributed community experiments” tackling evolving problems that emerged throughout the various phases of adaptation and collective learning processes (Tarasiewicz & Newman, 2015). Traditionally designed institutions are trying to react to the massive technological and societal change disruptive technologies introduce, but the underlying own governance models and decision making protocols are rarely questioned.

Code Governance and Fork Politics

“Generally, no leaderless developers have ever written big and complex software. It is unheard of. Whether that shows that people cannot or prefer not to do it, is unclear”. (Meatballwiki, 2010)

Conflicts appear in coding communities on a regular basis, protocols for resolution have to exist in order to continue development. A “Fork” in software engineering describes the situation, when developers create their own “branch” and start individual development on it. “The right to fork is inherent in the [fundamental software freedoms] common” and “also takes place

in non-profit associations and political and religious movements”. Participants of the social system of software projects can utilise their “right to fork” as well as their “right to leave” (Meatballwiki, 2010). Software repositories are usually governed through “benevolent dictators”, in contrast to “management committees of meritocratic projects” (Gardler & Hanganu, 2010). But the introduction of the blockchain (Nakamoto, 2008) introduced numerous new governance models, which are based on experimental “cryptoeconomic” settings (Zamfir, 2014) and are tested by numerous initiatives in experimental way. As De Filippi notes, this had been already achieved through the automation to decision-making processes, the incorporation of legal rules into code and more recently through the “code-ification of law” (De Filippi, 2016).

Flattening organisational structures (to emulate and mimic development and production cultures) is experimented upon in technology-based companies for a longer time already, *Holacracy* for example, is a system of organisational governance developed by the company HolacracyOne. Its’ claims are to “[turn] everyone into a leader” and goes on explaining “this isn’t anarchy – it’s quite the opposite” (Robertson, 2015).

Critique of the system is manifold - Bernstein et al. describe “old power rules can be deeply embedded in culture and institutions”, so a transition from an existing (hierarchical) governance model to self-governed one appears problematic (Bernstein et al., 2016). Other examples are “liquid democracy” or “delegative democracy” (most prominently used by the German pirate party), where an electorate vests voting power in delegates rather than representatives (Ford, 2002).

Futarchy describes a form of governance proposed by economist Robin Hanson (2007). He criticises, that democracies “fail largely by not aggregating available information” and that “betting markets are our best known institution for aggregating information”. Under futarchy, users would “vote values, but bet beliefs” (Hanson, 2007). Voting would not be to implement particular policies, but on metrics to determine how well their organisation/institution is doing, and prediction markets would be used to pick the policies that best optimize the metric. In a binary (yes/no) vote on a specific topic, two prediction markets would emerge, and on resolution, all trades on the rejection market would be reverted. Vitalik Buterin (co-founder of the Ethereum ‘world computer’) in 2014 described a

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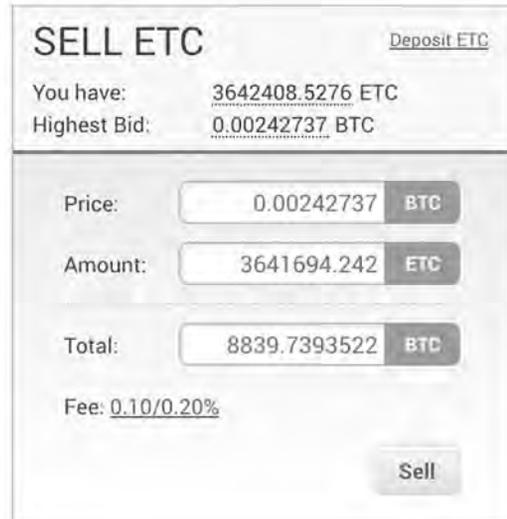
decentralized autonomous organization (DAO) using futarchy to govern a (fictional) nation. “DAOs allow us to very quickly prototype and experiment with an aspect of our social interactions that is so far arguably falling behind our rapid advancements in information and social technology else-where: organizational governance” (Buterin, 2014).

The Ethereum project had to face a “hard fork” on the network in 2016, resulting in two different blockchains: ‘Ethereum’ and ‘Ethereum Classic’ as philosophical differences between “radical crypto-decentralists” and “bailout supporters” of the first decentralized autonomous organisation emerged (Widrum, 2016). *The DAO* was to this date an investor -directed, stateless venture capital fund, with the largest crowdfunding campaign in history with over \$168 million in available (crypto) funds (Metz, 2016). After hackers exploited a vulnerability in the DAO code, and a third of the collected funds have been moved away, the original proclamation of Ethereum’s “unstoppa-ble code” and “by -laws [which] are immutably chiseled into the Ethereum blockchain” (Cryptohustle, 2016) has been questioned. The community decided to block the ‘stolen’ funds through a hard-fork of Ethereum, a modification of the underlying code.

Conclusion

De Filippi and Loveluck in their 2016 paper differentiate between “governance by the infrastructure (achieved via the Bitcoin protocol)” and “governance of the infrastructure (managed by the community of developers and other stakeholders)”. It would be more interesting not to use the blockchain as a “regulatory technology” enforcing a particular set of predefined protocols and rules (Bitcoin), but as a “platform on which people might encode their own sets of rules and procedures that will define a particular system of governance” (De Filippi and Loveluck, 2016). For ‘new’ and ‘old’ institutions alike, governance models based on distributed consensus and cryptoeconomics offer a significant opportunity for implementing change to react to technological and societal developments. The preconditions for such a model are not only technological, as governance in cryptocurrencies relates to decisions about the “rules of the protocol (the code) and the incentives the network is based on (the economics)” (Tomaino, 2017). There is a strong need for a form of ‘blockchain literacy’, but more importantly there must be a strong emphasis on the

interaction and communication between both institutions and informal coding communities to further the research into and development of new amalgamations of social and organisational structures. Otherwise everything is ‘forked’.



The image shows a 'SELL ETC' interface. At the top, it says 'SELL ETC' and 'Deposit ETC'. Below that, it displays 'You have: 3642408.5276 ETC' and 'Highest Bid: 0.00242737 BTC'. There are three input fields: 'Price' with '0.00242737 BTC', 'Amount' with '3641694.242 ETC', and 'Total' with '8839.7393522 BTC'. A 'Fee: 0.10/0.20%' is also shown. A 'Sell' button is at the bottom right.

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Author Biography

Matthias Tarasiewicz is active as curator, researcher and technology theorist since the last millennium. He co-founded Coded Cultures (media arts festival and research platform) and is deeply involved in coding and decoding (both literally and theoretically). He researches in the fields of artistic technology, experimental documentation and cryptocurrencies. His work BitCoincloud received various prizes and has been shown internationally since 2010. He is part of the group 'Artistic Bokeh' and was coordinator for research projects such as 'AXIOM - Open Source Cinema' (EU Horizon2020), Artistic Technology Research (FWF PEEK), etc. He currently works as Board chair for the Research Institute for Arts and Technology, as Editor of the Journal for Research Cultures and as researcher and consultant for numerous

block-chain initiatives. He is actively involved in fostering an interdisciplinary discourse in the field of crypto-economics and distributed consensus systems as part of the RIAT Post-Blockchain Initiative.

Establishing the Continuously Unfinished The Institution as an Artistic Medium

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Abstract

When realising themselves as dispositifs, no matter whether they extend into a physical or nonphysical dimension, artistic works are motivated by urgency.

The engagement of artists with and within institutions increased within the last century, yet they may well not only be applicants or founders of institutional formats, but utilise these formats and the processes establishing them as an artistic strategy, creating a dispositif to meet an urgency framed by a specific historical context. This paper discusses the properties of institutions, which are indeed exemplary for dispositifs and are permitting their appliance as artistic media.

Keywords

Artistic Medium, Institution, Art, Discursive Territory, Performative Act, Artistic Strategy, Processuality, Experimentation, Dispositive.

Introduction

Now, the term ‘art’ might be starting to describe that space in society for experimentation, questioning and discovery that religion, science and philosophy have occupied sporadically in former times. It has become an active space rather than one of passive observation. (Esche, 2004)

The relation between art and its pertinent institutions has been differentially addressed and recent years were marked by growing interest in the forms and formations of their reciproque inducement.

Constituting Institutions

However close one might be to the multifaceted theoretical discussions, the term institution is one way or the other seething with alleged meaning. Even though those might be their most obvious; most typical characteristics, institutions exceed the walled facilities embedding organisational structures and containing a variety of purpose-bound material objects and tools. Indeed they only then come into being when replenishing their physicalspatial configuration with constitutional

processes steeped in social engagements, set objectives and shared visions, potentially interfering with personal imaginaries, which are just as much a part of them. Characterised by being manifest yet elusive constructs of a material and immaterial nature, institutions represent most prominently what Foucault (1978) signified as a dispositif and hence “the said as much as the unsaid”. Inheriting a concrete aim, and pursuing a strategic function motivated by the quest to meet an urgency, they establish and reproduce themselves through the continuity of recurring institutionalising and institutionalised processes virtually until the moment they fall apart, which is specifically the moment when the reproduction of these processes ceases. Institutions are based on their processuality and consequently the interruption of this processuality inevitably leads to the end of the system, when all that remains are its hollowed physical ruins.

The Artistic Dispositif in Medium and Form

Media denote those forms of transmission, which ascertain that certain elements are perceived while at the same time the transferential form is eclipsed by exactly those elements. Giancarlo Corsi and Elena Esposito (2007) refute anything from being form or medium per se, but always either medium with regard to a form establishing itself, or form establishing itself within a lower-level medium. Art realises the connection between consciousness and communication without necessarily having to resort to language. It challenges our perception in different ways than those achieved by other media, since its perceivable forms are subject to a different order. At the same time it produces within this proprietary structure and order nothing but communication, since their dispositifs hold selected information that has to be disclosed and processed in order to be able to serve their intrinsic function. Art hence is to be categorised as its own communication

system and makes use of certain media whilst being medium itself, no matter if its transmission form takes a physical shape or an immaterial one, and this applies to any art form even to those claiming to exclusively consist of ideas.

Institutions exhibit every necessary characteristic to be both form and medium, designed to serve a communicational function and constituted by communication. They are regulating effects of the relation of discursive and non-discursive formations and are meeting at the specific historical time of their existence, which is exactly what defines them as a dispositif as Foucault (1978) described it. It may reversely be concluded that institutions therefore hold the potential to pursue the urgency of establishing a discursive formation and therefore consciously design them to be experimental communicational media relying on and constituted by dialogue and participation.

In her essay *The institution is dead! Long live the institution! Contemporary Art and New Institutionalism*, Claire Dorothy emphasises the importance of “a dominant strand of contemporary art practice – namely that which employs dialogue and participation to produce event or process-based works rather than objects for passive consumption”. Utilising the institution as an artistic medium allows to embrace the inherent mortality of process-based art by being vigorously impermanent, focusing on highly temporal outbursts of artistic energy and supporting a practise that isn’t aiming to produce finalised objects but emphasises the discursive dimension of realising art.

As Gilles Deleuze and Félix Guattari (1976) express it in their work *Rhizome*, art imitates nature with its own methods, bringing to a good end what nature is not or no more capable of. Utilising the institution as an artistic strategy, as material and immaterial medium, realises itself as a repetitive but ever changing performative act. Analogous to Deleuze and Guattari’s presumption this performative act imitates certain appearances of not natural but traditional institutional frameworks and processes and disposes simulacra subverting its original by playing the same field but under different rules, thus possibly bringing to a good end what those originals are not or no more capable of.

The act of constituting and running such a construct can, when withdrawing from a definition of art founded on the ontology of the picture, be interpreted as an intentional part of artistic creation. At a time where there

is no artistic production so subversive that it can not be capitalised the urge to retrieve to other artistic strategies increases, presupposing that artistic work shall be more than just an arrangement with the art market. A potential approach of this concept is focusing on the creation of situations and experiences while neglecting the general appearance of what is considered as being art and while possibly neglecting external interpretation altogether and maybe even going further and instrumentalising just that.

This space of possibility allows to undermine the axioms and principles of art perceived as such based on its aesthetics or the context it is presented in. While traditional art forms need to establish an aura of originality and productivity inevitable to create the desired lines in an artist’s CV, artistic strategies that are radically process based while not even presenting themselves in the seemingly appropriate context of a museum, a gallery, a theater or something similarly art connotated, render themselves incapable of participating at what commonly is perceived as art and its market, and might find themselves excluded from being defined as art altogether. Yet this very strategy inherits asubversiveness of other quality and utilises creative elements, which don’t necessitate to lean to the absurd yet so transparent system that has established itself as art. The intention of this approach however is not to negate art, but to realise it, to make daily life into a creative, continuously delirious experience and within this very process be an artist.

The purpose of art was defined within the work of Immanuel Kant (1790) as providing more inspiration for thought than can be grasped with language – in expressing something unnameable. By perception art is able to penetrate consciousness as a transformed experience, making use of perception as an instrument. Accordingly, the function of art may be located in the incorporation of something intrinsically incommunicable into communication. So while institutional critique most certainly can be communicated by other means of communication as proven prominently by a large number of theorists, another layer, one of artistic expression and thinking is likely only to unfold on other levels.

Universities as institutions of truth and sustainability are by nature hesitant to include ambiguity or temporality in their practices and are hence designed to fail in recognising that these are essential characteristics of art and what is commonly called artistic research. The continuous process of deconstructing and rethinking

Panels

strategies, frameworks, audiences and formats of art, allows alternative initiatives to map out the discourse territory that art can be, whilst in this very process potentially being art themselves.

Conclusion

By consciously creating an institution that neither disciplines nor controls the exhibition, as terminologically defined by Michel Serres (1994), but one that embraces it, therefore allowing for heterogeneous connections, a socially informed form of network can be created that is opposed to traditional institutional frameworks and their rigidity or even finiteness, as described by Gilles Deleuze (1992), who wrote:

[E]veryone knows that these institutions are finished, whatever the length of their expiration periods. It's only a matter of administering their last rites and of keeping people employed until the installation of the new forces knocking at the door.

This creation of an institution embracing the exhibition, creating regulating effects which are effectively allowing irregularities and for a daily life as a creative, continuously delirious experience by employing institutional characteristics as a medium, lives up to a dream all artists share according to Dan Graham (2006), who said "All artists are alike. They dream of doing something that's more social, more collaborative, more real than art."

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Author Biography

Sophie-Carolin Wagner investigates elaborately, works passionately, quotes vigorously, writes peripatetically, communicates epistemologically, but not exclusively insightfully, holds as many degrees as names and never signed up to Facebook.

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Design for the Non-Human

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Abstract

New forms of technology now support shared experiences between humans and other species and may enhance the function of non-human life forms. Design for the Non-Human, brings together artists and designers working on generative, agent-based artworks that either (1) allow a non-human life form to use technology in such a way that its abilities are greater than those of a non-technologically enabled member of its own species, or (2) extend the sensorium of us humans to the sensorial experiences of our companion species.

Keywords

Non-human, Anthropocene, Design, plants, Animals, Microflora, Art

Introduction

In line with ISEA 2017's theme of Biocreation and Peace, *Design for the Non-Human* will focus on the technology we create for our living, non-human co-inhabitants. This panel brings together a mix of artists and artist teams working on technologies designed with and for plants, animals and microorganisms. Panel participants will discuss relevant works of art and works-in-progress that attempt to forge new technologically-mediated relations with non-human entities. These works bring to the fore new philosophical questions alongside new technological forms. The panel participants will facilitate a dialogue that includes audience members to discuss relevant practices and approaches in designing for non-humans.

We would like to propose that these works are an act of speculation. As such, they relate to various intellectual movements that seek to challenge commonly

held positions and biases, especially those that are anthropocentric. Speculative Realism, Posthumanism, New Materialism, and the Non-human turn all question the limit of what Donna Haraway has called "fantasy of human exceptionalism" — the idea that humans are somehow separate, beyond, or more advanced from our earthly cohabitants (2008, p. 11). Philosophers and theorists working within one or more these thought-trends help elucidate the limits of human experience and thought, highlighting capacities, experiences and potentials of both living and non-living non-humans.

As Steven Shaviro writes, "Such a questioning is urgently needed at a time when we face the prospect of ecological catastrophe and when we are forced to recognize that the fate of humanity is deeply intertwined with the fates of all sorts of other entities. Anthropocentrism also has become increasingly untenable in the light of scientific experiment and discovery" (2014, p. 1).

Speculation, however, is not just a tool of philosophy, but also encompasses making. Speculative design, as but one example, is a call to action, a shift in design practice to "search the space of actual possibility" (Bratton, 2016, n.p.). It is an attempt to use the tools, methods, and practices of design to challenge "mainstream design" (ibid). Often this is a critique of consumerism and capitalism, but it rarely ends there. Contemporary art has long been the process of instantiating ideas in physical form. Like design, the goal is not to create new systems of thought, but a more materialist practice of creating new experiential forms.

Panels

It seems that the experiential form is the joy and potential of design and art making. Art may provoke the mind, but it does so first by provoking the senses. The following works are not just speculative, but *actual*. To actualize, or to make physical is the important contribution artists and designers can make in this realm.

Actualization is a critical counter-narrative to the emphasis on thought often found within theory. Theory is, arguably, intended to change the way we think; it provides new techniques of speculation and analysis. This is valuable and necessary and should in no way be castigated. Yet, it is equally important to feel in new ways. Thus, the following works offer new forms of phenomenological experience for humans and non-humans alike. This is a process that involves the configuration of techniques and technologies to produce physical objects.

These new forms of experience are created and bridged through technological invention. The philosopher of technology Gilbert Simondon claims that technology extends our sensorial experience into the world. It is through technology that we may experience the subtleties of nature. “When it’s a question of detecting subtle, yet determinant phenomena that escape regular perception, one can only see the aesthetics of nature with the aid of the technical object” (Simondon, 2012, p. 5). Technical objects are surrounded by a “margin of liberty” that affords new aesthetic experiences (Simondon, 2012, p. 5). The following projects help us imagine what new experiences we may find for both our human and non-human audiences through technical experimentation. While our focus in this panel is largely on living non-human experience, we must also consider the ways in which technical objects structure and mediate cross-species encounters.

However, to be actualized, as in art and design, is not necessarily to end with a stable object that closes some sort of speculative loop. Instead, we hope that these projects individually and cumulatively trigger other speculations. As such, the panel will include an open-ended conversation between panelists and audience members to further the notion of designing for and with non-humans. Additionally, a public bibliography will be shared and crowdsourced during the panel to develop a more rigorous approach to our understanding of the non-human.

Projects

The Hand Up Project (HUP): attempting to meet the new needs of natural life forms is dedicated to producing alternative forms of housing, specifically designed for use by land hermit crabs out of man-made materials. In order to remain housed and protected from predators, hermit crabs adopt the abandoned shells from marine gastropods. The problem is that, due to environmental degradation, there are no longer enough shells on global shorelines for this animal to use.

In answer to this issue, HUP utilizes an adaptable 3D design to produce a superior form of hermit crab housing. This new design minimizes the spiral in the middle of a traditional shell to produce an internal volume to weight ratio favored by the animal. Upon its debut, HUP was a great success. Twenty-five percent of a crab population chose to move into a new, fabricated home when presented with the novel structures over a two-month exhibition period.

In order to fund a widespread distribution of the new shelters HUP is currently soliciting corporate sponsorship. In exchange for financial support, the project proposes to place a logo on each fabricated form before placing the shelter back into the wild for the animal to use.



Fermentum

Sensors embedded into fermenting vegetables are used to track environmental changes resulting from microbial

transformation. The data from these sensors is then sonified. Sound offers a subtle mode of revealing the ongoing processes of fermentation. While the project relies on the quantification and indexical tendencies of computation, the resulting sounds challenge our abilities to understand the data. The sensors provide hard data on the fermenting milieu, yet sound offers the opportunity to deal with 'hard data' in ways that do not present numerical focus. The goal here is not to overwhelm the audience with 'knowledge,' but instead to create an environment, a sensory experience.

Central to this project is the claim that we need to push beyond theory and attempt to engage with non-human experience through our own, human, sensorial register. How can we create events shared across different experiential regimes? The underlying conceptual framework, which builds upon the ideas of Gilbert Simondon and Alfred North Whitehead, focuses on this question. Simondon's philosophy of individuation and concept of techno-aesthetics help define a praxis of making biological and technological artworks. Whitehead's theory of prehension reinforces Simondon's techno-aesthetic claims while emphasizing non-human experience.



Differently Abled Arts Studio: Appropriate and Creative Technology for Enrichment of Non-Human Intelligence, Culture and Personality under duress

How do we make art for non-humans? The intention is to improve designs and methods of expressing art for non-humans with a variety of species and trans-species in captivity. In particular, we are interested in those animals showing signs of behavioral disturbance, cultural alienation and neurotic personality disorders. We would like to underscore the similarities, differences, power relations and mutualisms between humans, non-humans, living being non-persons (without dignity) and transgenic trans-organisms. To do this properly we work through combining ethological, relational, experiential and aesthetic communication. Performative ethnography may be enough to show appreciation for the differently abled, but how do we design enrichment for those torn, chopped and screwed through Ontological Remix: zoo beings, farm beings, park beings, pet beings and lab beings? What radical remixes can we offer as being options in a trauma zone of industry and usury?

Project Florence

Mankind evolved on the ground of tools nature provided and started very early taking advantage of biological processes. Over time, nevertheless, humans had been distancing more and more from nature and disconnected from being part of it - instead we built our own artificial world. New technologies put biology back into spotlight and open up a lot of new opportunities to manipulate, design, understand, protect and interact with our natural environment. This raises the question, though, what is still natural and what artificial.

This talk is on the opportunities of a future where the natural and the artificial are connected and interact enabled by technology and driven by nature - and on how this combination of digital and natural processes leads to new applications and innovative products like Project Florence. A first attempt to build an interface between plants and humans. It approaches plants as reactive living matter which generates new perceptions towards how we interface with our natural environment. This creates a rudimentary conversation with our natural environment. Project Florence will be one of many other examples how technology can be an enabler for more sustainable systems and a mediator between the natural environment and us.

Urban Animals Need a Better Business Plan: Street Cat Photo Booth 2.0

“Urban animals need a better business plan.” As it evolves, Street Cat Photo Booth answers the subtle challenge posed by artist and professor Natalie Jeremijenko in her ISEA2016 keynote, recasting animals as participants in the digital economy in its exploration of what it means to be an urban resident. In empowering cats to assert and monetize their own social-media presence, the project explores metacreation in conjunction with non-human stakeholders as well as the aesthetic potential for camera orientations primarily used for surveillance; while also challenging Maslow’s Hierarchy of Needs in the Post-Anthropocene Era. In viewing the results of cat-initiated photo shoots, the audience can playfully question the role of art creator, agency of animal subjects, authorship; and more broadly, the worth of marginalized and itinerant scavenger communities existing within urban environments—both animal, and, by reflection, human. Street Cat Photo Booth enables an animal-network interface that requires no human intervention while empowering feral cats to earn money for their own caretaking. The use of open-source hardware (the Raspberry Pi) and software enables any interested person to cheaply construct and deploy a photo booth of her own, which will begin making images once a street cat enters its space.



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Authors’ Biographies

Elizabeth Demaray designs listening stations for birds that play human music, fabricates alternative forms of housing for hermit crabs, and builds light-sensing robotic supports for houseplants.

This last endeavor, titled *The IndaPlant Project: An Act of Trans-Species Giving*, entails creating moving floraborgs that utilize machine learning to allow potted plants to roam freely in a domestic environment in search of sunlight and water.

A recipient of the National Studio Award from NY MOMA/P.S.1 Contemporary Art Center and the NYFA Fellowship in Sculpture, Demaray is an associate professor of fine arts and head of the sculpture concentration at Rutgers University, Camden. On the Rutgers, New Brunswick, campus, she is an advisor in the Department of Aerospace and Mechanical Engineering and an advisor at the Art and Artificial Intelligence Lab in the Department of Computer Science, which is dedicated to supporting artistic practice in the fields of computer vision and machine learning.

Kira deCoudres is a recent graduate of Science, Technology, & Digital Media Studies at Hampshire College in Amherst, Massachusetts (US). Her work ponders questions of posthuman potential and the futility of futurism through “glitched” media remixing and sensorial scrambling. At play in deCoudres’s work are themes of distortion and remix as bio-technic disruptions of embodiment.

Tyler Fox is an artist, researcher, technologist and educator, his work focuses on the ways in which non-human relations shape our experience of and relationship to the surrounding world. Fox leverages technology to create affectively rich experiences featuring living, non-

human organisms. His writing mobilizes philosophy and contemporary theory to consider the aesthetic potential of technology and non-human experience. Fox incorporates pedagogy into his artistic practice, using formal and informal workshops as a form of community engagement. His artwork has been shown nationally and internationally. He received a PhD from the School of Interactive Arts & Technology at Simon Fraser University, an MFA from the Elam School of Fine Arts at the University of Auckland and bachelor's degrees from the University of Washington. He is a member of DPrime Research, an art-science nonprofit research organization. Fox is a Lecturer in Human Centered Design & Engineering at the University of Washington.

Leigh M. Smith is a computer scientist and software developer of music information retrieval (MIR), audio signal processing, computer graphics, embedded, and cryptography systems. He has published as a post-doctoral researcher with the Music Cognition Group at the Universiteit van Amsterdam and Analysis/Synthesis Group at IRCAM (Paris), and taught at several universities on music perception, cognition and MIR, with a focus on analysis and modelling of musical rhythm for interactive performance systems. He is currently a senior research engineer at LANDR Audio Inc., based in New York City. His musical interests include performing as a guitarist. Smith and Yerman presented Street Cat Photo Booth 1.0 at ISEA 2015.

Helene Steiner is a UK based designer and researcher with a focus on new interactions in and with our (natural) environment. Her research follows a biological approach and looks at opportunities to not only bridge the physical and digital world but also the natural and artificial. Her background is in Product Design with a MDes from the Bauhaus University in Weimar. During her time in Vienna she studied under FROG founder Prof. Hartmut Esslinger to explore the opportunities of extending our bodies with technology and prosthetics, what led to her MA and MSc in Innovation Design Engineering at the Royal College of Art and Imperial College in London. Before her PostDoc position at Microsoft Research, she collaborated with the Tangible Media Group at MIT Media and is a visiting lecturer at the Royal College of Art.

Jordan Matthew Yerman is a Vancouver-based artist and writer who has worked and created from Tel Aviv to Tokyo. He explores the experiences of feral cats as a metric of urban measurement, while assessing the

embodied practice of engaging such furtive subjects. Internationally published, he partnered with Fujifilm to photograph cats across Japan. He presented the Street Cat Project at BIL2015, and Street Cat Photo Booth at BIL 2016.

He studied at UC San Diego and the London Academy of Music and Dramatic Art. He has performed off-off-Broadway and on the West End, and has appeared as a digital installation at the Bronx Museum of Modern Art.

Adam Zaretsky, Ph.D. is a Wet-Lab Art Practitioner mixing Ecology, Biotechnology, Non-human Relations, Body Performance and Gastronomy. Zaretsky stages lively, hands-on bioart production labs based on topics such as: foreign species invasion (pure/impure), radical food science (edible/inedible), jazz bioinformatics (code/flesh), tissue culture (undead/semi-alive), transgenic design issues (traits/desires), interactive ethology (person/machine/non-human) and physiology (performance/stress). A former researcher at the MIT department of biology, for the past decade Zaretsky has been teaching an experimental bioart class called VivoArts at: San Francisco State University (SFSU), SymbioticA (UWA), Rensselaer Polytechnic Institute (RPI), University of Leiden's The Arts and Genomic Centre (TAGC) and with the Waag Society. He has also taught DIY-IGM (Do-It-Yourself Inherited Genetic Modification of the Human Genome) at New York University (NYU) and Carnegie Mellon University (CMU). His art practice focuses on an array of legal, ethical, social and libidinal implications of biotechnological materials and methods with a focus on transgenic humans. He also runs a public life arts school: VASTAL (The Vivoarts School for Transgenic Aesthetics Ltd.) and psiFert, a psychic Fertility Clinic.

Panel on Sonology: Sonifying the Conflict

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Abstract

The experimental sound practices extend the acoustic referent of the conflict and produce cultural objects related to experiences of violence, displacement and social disparity. The Panel on Sonology will gather five artists-researchers whose works allow us to reflect on the role of music, sound art and sound design on communities disturbed by social inequality and violence. From different perspectives, the panelists will show personal modes of sonifying the conflict, discussing artistic experiences where experimental sound practices have been introduced in communities traced by social disruption: (1) Musical instrument building in the periphery, by Tomas Laurenzo (2) Acoustemology of the Armed Conflict in San Juan Nepomuceno, by Luz Eneida Ramirez (3) Mestizo Machines by Jorge Barco, (4) Sound: expression of the conflict and pedagogical tool, by Joaquín Llorca and (5) In the interstices of a memorial: A Review on Triangulation Gender/Sound/Technology, by Ana María Romano G.

Keywords

Sonology, Sound Studies, Soundscape, Sound and Conflict, Experimental Sound Practices

Introduction

The tensions and imbalances among human groups that occur in different scales eventually result in social conflicts. Under these conditions, experimental sound practices propose an arena to consider the particularities and different views in negotiation. Since the plurality of voices that participate in social processes outlines a more complex picture of the conflict, sound media practices extend the acoustic referent and produce cultural objects related to experiences of violence, displacement and social disparity.

The awareness of listening plays an important role in the recognition of sound as a place to pose stories and

memories about the conflict, allowing us to take into account oralities, testimonials, interviews, soundscapes and sound field recordings as artistic raw material. At the same time, just like writing, experimental sound practices require craft, editing and articulation (Feld & Brenneis 2004). The appropriation of sound production technology in decentered and peripheral places, and in particular in those impacted by social disturbances, has encouraged alternative stories about the conflicts by restituting listening as a transcendental activity. These emplaced practices come from "...a generation for whom global consumption of media products is not necessarily seen as oppositional to their local appropriation in certain parts of the world, which decenters place as the arbiter of authenticity or signification" (Samuels et al, 2010). Experimental sound practices have been the medium to embark endeavors of activism, preservation, gender, citizenship empowerment, resistance and insubordination. By addressing memory, identity and by dealing with the tensions between contemporary culture and tradition, these practices reflect a critical counterpart of the official versions and amplify unheard voices.

The Sonology Network

The sonology network brings together Colombian and abroad academic works produced in diverse fields, discussing sound theory and practice from a creative and critical perspective. Two encounters have been held, in 2015 and 2016, under the Festival Internacional de la Imagen umbrella whose memories are being made available for online consultation (Arango, 2016). In 2017 the Panel on Sonology will be held under the International Seminar on Electronic Arts (ISEA)

gathering five artists-researchers whose works allow us to reflect on the role of music, sound art and sound design on places disturbed by social inequality and violence. Particularly, we will go around the Colombian conflict, gathering researchers based in Manizales (Julián Jaramillo), Cartagena (Luz Eneida Ramirez), Cali (Joaquín Llorca), Medellín (Jorge Bejarano Barco) and Bogotá (Ana María Romano). Uruguayan composer and researcher Tomás Laurenzo will introduce the discussion, by analyzing peripheral instrument-making practices. From different perspectives the panelists will show personal modes of sonifying the conflict, by facing some previously suggested questions:

- How can sound media display untold stories about the conflict?
- In which ways sound media can convey the experiencing of the conflict?
- What is the impact of sound arts in communities affected by social disturbances?
- How can sound arts contribute in the processes of post-conflict, reconciliation and conviviality?

Sonifying the Conflict

This text is organized as a collection of answers, proposals, comments and reflections to these questions, carried out in different locations in almost the same period of time. Since there are few regional precedents in our region integrating these concerns, the interpretations and crossing points, which will lie with the reader, promise a rewarding outline of the role of experimental sound practices in disturbed contexts.

Firstly, Thomas Laurenzo will introduce the discussion by reflecting about decentered instrument-making practices. While musical instruments can be thought as robust cultural objects, *epistemic tools constructing new systems of knowledge* they also raise the centre-periphery dichotomy. Under the political discourse giving to peripheral cultural production the role of “the other”, musical instruments are condemned to *talk about non-fundamental matters*. Around this dilemma, Laurenzo finds an opportunity to reflect about the musics emerging in decentered contexts where new digital musical instruments practices are taking place, and how these artists can escape the “localist” reading of their own praxis.

Then, the ongoing research project entitled “Sound World” by Luz Eneida Ramirez will be the first work to address the Colombian conflict. The project adopts

sound-scape analysis and creation to observe the emerging dynamics, cultural transformations and violence impact in a resilient community, the San Juan Nepomuceno population. In 2002 fifteen people were murderer in that place in a still unpunished event called the Guáimarus slaughter. The project raises different insights about the role of sound and listening in the everyday community life, based on recent ethnographic and anthropological conceptual resources.

Jorge Bejarano Barco will discuss public cultural activities focused on media art and experimental sound held by the Medellín Museum of Modern Art (MAMM). Since two decades ago the city had prominent violence indexes, the MAMM has played a key roll in the growth of experimental practices in a period of peace building. Through workshops, encounters, exhibitions, concerts and other events, MAMM has engaged local community in experimental practices, as well as it has hosted and supported networked regional encounters gathering media art regional research and production. Barco will bring out three sound art projects exhibited in the Lab3, a space within the MAMM exclusively concerned with sound experimental practices: *Tactile Territory* (2015), *Jagüey* (2016) and *Micro-Ritmos* (2016).

Joaquín Llorca will report pedagogical resources focusing on the appreciation and critical approach to the acoustic environment developed by a interdisciplinary group of researchers from Icesi University in Cali. He will discuss negative and positive meanings of Colombian iconic sonorities, as well as ethical and aesthetical properties of Murray Schafer’s soundscape concept. By integrating listening as a meaningful activity in the recognition and valuation of the inhabited territory, the group adopts the soundscape theory in its pedagogical practices distinguishing formal and non-formal education as a twofold endeavor. Last section Ana María Romano will shortly report the *Intersticios sonoros* call that gathered 81 artworks from four Colombian cities. The call invited to create electroacoustic miniatures with material collected by researcher Christine Renaudat as a means to think / rethink war and conflict.

Julián Jaramillo Arango
Panel proposer and moderator

Musical Instrument Building in the Periphery, by Tomás Laurenzo

The field of new digital musical instruments, while very active and vital, often produces instruments that

lack playability or expressiveness in traditional musical terms. Sometimes the instruments aim at providing the illusion of control (Jordà, 2003), or are extremely tailored to specific performers or performances. In the words of Tod Machover, the field has not been able to standardise its instrumentality (Machover, 2002).

The creation of new instruments can potentially provide with tools for the creation of new musics (Jordà, 2005), but the instruments produced are sometimes too simplistic (like the rather naïve new incarnations of traditional step sequencers and drum machines), lack of playability (often due to the delegation of too many performative decisions to the instrument, not providing an effective fly-by-wire alternative), or are *too different* from traditional instruments not being able to fit in the artistic language (and societal role) of their traditional counterparts.

Although this eclecticism of new musical instruments is easy to note, in an ever-more technologically imbued world, it became clear that the mere fact of using relatively new technologies with a musical intention does not automatically grant artistic or social relevance.

Musical instruments can be thought of as epistemic tools, designed with “such a high degree of symbolic pertinence” that they help constructing new systems of knowledge (Magnusson, 2009). At the same time, they propose a hermeneutic relation to the artistic practice. This potentially situates artists on a passive role with respect to the (instrument mediated) political construction of the world. Although being able to *read* is important (and reading is never a completely passive act) this hermeneutic approach systematically concretizes a worldview that inherits and pushes forward established orders of power and relationships with existing artistic languages.

In McLuhan’s terms, musical instruments can be thought as extensions of ourselves (both in cognitive and embodiment terms), and therefore they are also extensions of our political understanding of the world. If “by listening to music, we embody the vibratory nature of sound and music that take over our body and mind” (Chagas, 2014), by using musical instruments we also “embody” the political understanding of these same instruments.

However, the other phenomenological mode, the “hermeneutic relationship”, is different, for instead of conceptualising this extension, it thinks of the instrument as an *external* tool, whose information

requires interpretation (Magnusson, 2009)

It can be easily argued that technical objects have political qualities, and that technical arrangements can be thought of as “forms of order” (Winner, 1980). This politically not only exists in the ex post facto appraisal of the selection of problems worth solving, but on technical objects embodying specific forms of power and authority.

This is particularly relevant in peripheral artistic contexts where the reproduction of the centre-periphery model, systematically reduces peripheral art to a subservient state that requires playing the role of “the other”: a highly refined re-edition of the *bon sauvage* (this hegemonic taxonomy also fails to see how political art naturally and systematically appears in the periphery without creating the ontological tensions that explicit politics create in central narratives).

There is an urgent necessity of rejecting a discourse that relegates political and artistic narratives conceived in the geopolitical periphery to talk about non-fundamental matters. When the spectrum of the possibilities of a political discourse is constructed referring only to central voices (either in agreement or disagreement), then not only this spectrum is narrowed, but its own conceptualisation concretises a hegemonic worldview.

We need ask ourselves. What are the musics that can only come to existence through peripheral processes of creation of new digital musical instruments? How these processes should be? What artistic languages will they allow?

How can geopolitical peripheral artists, escape the “localist” reading of their own praxis?

The aforementioned inability of the field to standardise its instrumentalities provide an opportunity. If there is a need for the adoption and creation of new (relevant, impactful) arenas of expression, where the centre-periphery dichotomy can be ignored, a field that simultaneously unfolds and develops in the symbolic plane while being unable to systematise its own understanding, offers a unique possibility.

The Sound World, an Adjacent Interpretation of the Colombian Armed Conflict. A Theoretical-Empirical Proposal to Unveil Alternatives from sound Studies, in a Peace-in-Progress Extended Territory. The Case of Guáimaras Slaughter in San Juan Nepomuceno, Colombia, by Eneida Luz Ramírez Centeno

The sound world project intends to unveil the course of action and the cultural transformations in a territory expanded by sound, taken the latter as a knowledge construct. To do this, some sociologic and anthropologic resources were adopted, which will be implemented in the study of a disruptive and violent event: the 2002 Guáimaras population slaughter, carried out in San Juan Nepomuceno, a northern Colombian town.

The sound world is assumed as an adjacent alternative to approach and interpret emerging dynamics in a territory that is self-recognized as resilient and builder of peace. In this theoretical-empirical endeavor, the territory is conceived as both, a physical and a psychological space, in which affective and emotional bonds transcend the geographical borders and open to symbolic and immaterial aspects, and to the deploy of emergences (Yory, 1999); (Hall, 1973). Likewise, sound is considered an organic extension that penetrates the human bodies (Cárdenas & Duarte, 2015), reflecting an open world that shed light on the understanding of phenomena whose research is being carried out in the borders of different fields of knowledge.

On the other hand, the sound world is raised as the interweaving of relations between humans and non-humans, whose lens is based on symmetry, in other words, a flattening sheltering the hybridization between the human, natural and technical (Latour, 2008). In this interweaving are included sounds produced in a relational way by plants, animals, the wind, water bodies, the rivers, the rain and the ground; as well as the artifacts' sonorities, the technological devices and the music; but also the sound produced by human beings, such as the voices, shouts, crying and the body sounds, among others.

These elements, and still others that will be inquired in the interweaving, can be considered inside the sound world as actants (Latour, 2001, 2008) and potential social, natural and technological actors, under the identified function in the research terrain. They provide key information in the interpretation and later artistic translation of the cultural transformations that came about in the territory dynamics, from a "disruptive

violent event" through chronologic, social and ecologic temporalities (Schafer, 1977).

The Colombian juncture, facing a process of peace building, calls for finding alternative views that contribute to the explanation and resolution of the tensions produced in the territories having suffered the armed conflict, particularly in the rural area. Although in the research and actions made by governmental and academic institutions, art collectives and the population itself it has been studied, represented and memorized violent events from different fields, adopting in some cases sonic elements as representation modes; it just has covered a tiny part of the whole picture of the possibilities provided by the information and sensibility of sonorities as knowledge constructs.

Thus, the sound world become an opportunity to analyze, interpret and translate with epistemological and artistic depth the cultural transformations occurred in the San Juan Nepomuceno dynamics, on the basis of the everyday life's disruption produced by the armed conflict that caused large impact in the town's coexistence.

In this regard, the research takes as a case study the Guáimaras' slaughter that happened on 30 and 31 August 2002, in the "Vereda de los Corralitos", where fifteen native farmers and population leaders were murdered, causing a break in the course of the everyday actions and creating an emergency context where, momentarily, a "high fidelity" soundscape arose in the town. It was not a conscious contribution to the acoustic ecology mission, but it occurred because of the "Code of Silence" imposed by armed actors across the region. This event still throbs in the population and demands justice, because still today the authorship of this abhorrent event remains unknown.

In terms of methodological orientation, the structure with which the actant sound producers will be tracked, embraces a sense of temporality that covers not just a chronological time, but also an ecological one (the cycle time of plant life, insects, animals and the weather) as well as a social one (events, population festivities and others). This sense of temporality has been determined not only before the event (pre-act): ¿how was the population of San Juan Nepomuceno in terms of everyday sonic and cultural habits? But also after the event (post-act): ¿Which cultural transformations have occurred after the slaughter? And: ¿Which relations bonds have been traced between the actants sound producers and the object on count in the territory

dynamics? These concerns generate a wide picture in which the fluctuations' traces of the soundscape will be followed in a particular context.

In brief, this proposal arose as an alternative interpretation of the territory, adjacent to the conventional one, concerning the capture and appreciation of the sounds of a particular acoustic environment and seeking to make a tracking of the relations bonds among actants, actors and the cultural practices that interwoven in different spaces and sonic scales. According to biological and artificial times, it is demanded an identity with the qualities of the mobile that generates a sensorial, aesthetical and emotional relevance.

Under this ever-changing motivation, that rebuilt itself and is molded by the work in the case study community, it is intended to highlight, from artistic creation, the complexity of the sound world and to translate this synthesis owner of multiple expressions linked to the cultural transformation of a dynamic territory, that faces a peace times.

Mestizo Machines: Experimenting with Noise in South America, by Jorge Bejarano Barco

Over the last decade the Medellín Museum of Modern Art (MAMM) has been leading a series of electronic art projects that have nourished Medellín's creative ecosystem, as it proposes a mixture among art, science, technology and society, methodologies from experimental laboratories, cooperation and networking. As a result, since the end of 2015 we have set up the Room for Experimental Sounds (Lab3), as a space for research and creation of artistic projects that incorporates sound as a primordial element, therefore concentrating the actions on the fields of sound art, to foster hearing and experimentations with sound. The intervention in the Panel on Sonology will gather a variety of experiences that have developed within Lab3, a space characterized for its research on surrounding areas and the approach of social and environmental problems, among others. We will go over the design processes of different projects such as: Territorio Táctil (2015), Jagüey (2016) and Micro-Ritmos (2017). They were carried out as part of a project entitled El Paisaje Sonoro como Estrategia de Educación Patrimonial (Soundscapes as a Strategic for Heritage Education), with the aim of looking for cross points among the notions of listening, mediation, otherness and hybrid technologies.

On the one hand, it is worth outlining something about

the context we, as Colombians, have lived: decades of violence and armed conflict linked to drug trafficking and illegal groups have made of the city the epicentre of rough confrontations. During the nineties Medellín was considered one of the world most violent cities. However, in the last decade, after having partially overcome these disturbances, the city has been endeavoring in making culture as an engine for development, and in this task, museums activities play a remarkable roll. Along with other social and cultural organizations, they have given shape to the creative ecosystem in which gradual changes have been taking place in the city imaginaries and cultural practices.

Observing the museological development of Medellín allows visualizing the emergent landscape of electronic and sound arts as a local particular feature, since the above mentioned historical disturbances have driven the institutions and organizations to develop strategies and methodologies focused on community participation. Maybe the instability and context's hardness have motivated the community to take full advantage of the available resources and to create collaborative works models and networks.

On this basis, it is worth mentioning as a precedent to the work we are currently being conducting in the Lab3, the first International Encounter of Media Laboratories Lab-SurLab (2011), the second version of the same event held in Quito (2012), the "Cooperaciones" project (2012), Medelab (2013) and "El Puerto" (2014). These initiatives seek to address, from a wide perspective, the cross points among arts, science, technology, community and social innovation. In this context, and with the rise of new spaces and projects in Medellín, during the last year we have focused on sound as a strong dimension of contemporary art creation. In the next paragraphs we will report some of the recent artistic interventions and pieces carried out in the Lab3.

Tactile Territory (2015)

This first project, conducted by artist Carlos Gómez Caballero, was conceived as a starting point of a long-term program that amalgamates didactics, research and creation about the sound landscape with cartography, contemporary art and critical reflections derived from the use of technology. The *raison d'être* of this installation is thinking about the idea of the interface, and analysis about the representation instruments that cartography provides to human beings -cartography as

a fundamental tool that humans have used throughout their whole history, giving measurement and proportion to their presence and to their movements within a territory, and also placing them in the world-. The cartography in the present project proposes not just a direct approach to the territory where human beings live, providing an experience with the landscape, but also the understanding of up to which point certain technologies are necessary to access it nowadays.

In a period when technological tendencies that make emphasis in standardized visual interfaces are thriving, it is interesting to present the development of specific tools for specific contexts, contrary to the tendency that aims for a global technology and intends that all people in the planet share and use the same type of technology. Why call a tactile project one that is basically a sound project? Tactile Territory proposes a space for enjoyment and attentive listening. It is a tactile interface that responds to the hand's touch; a canvas made into a sensitive-to-touch membrane that displays a map on it feeds and sculpts in space the sounds of the territory it represents.

Jagüey (2016)

“I saw the dry brook, I remembered the recorded sounds and I was surprised by how quickly those sounds are becoming patrimonial. I thought about how important it is to have an abundant sound archive that is associated to water events, because in these new environmental and political conditions, it may possibly be the only thing we have left”. (Vásquez, 2016)

This sound installation takes its name from the jagüeyes in La Guajira large depressions where water forms pools and deposits due to the containment action of clay soils. The *Wayúu* community relies on these natural concavities to accumulate rainwater during the winter so they can stock up on water in periods of drought. The use of these geophysical containers denotes the resistance, adaptation and coexistence of multiple forms of life subjected to extreme ecosystems. This project is articulated based on three core notions that group several thematic interests: *Bodies of water*, *Survival*, and *Reservoir*. *Bodies of water* is an invitation to explore the possibilities of perceiving sound with all of our being: our senses, our bones, our skin and inner fluids (“descentralized auralty”); possibilities provided by our body, for example, to develop underwater hearing

and which may surpass the limits of any visual field. The second theme, *Survival*, is a call to encounter the voices, songs and sounds that inhabit the waters. It is about the echoes and resonances in soundscapes and the encounter with cultural traditions where the territory is configured through its songs. Finally, *Reservoir* encourages us to think about the environmental catastrophes towards which contemporary humans are headed, from the perspective of the memories offered by endangered or extinct soundscapes.

Water from the jagüey, aside from playing a survival role for human consumption (quenching thirst, use for personal hygiene, watering herds of goats, and so many other possibilities) holds an important place in the traditions and customs of the peoples from La Guajira. In this environment, water configures a key part of the landscape: *jagüeyes* are palpable knots (nodes) in a fabric of biological and cultural relationships where the human, the natural and the supernatural unfold. The jagüey is a water reservoir, a sound reservoir, a reservoir of life, and a reservoir of myths. *Jagüeyes* hold the possibility of subsistence for a population that in recent years has been at risk due to a long season of drought, a fact that intensified human displacement and led the community to celebrate rites where they sing *jayechi* (1) to call the rain. They also sing to the water because that way they can express the deep feeling of respect and admiration that it awakens in them. These songs are part of the ancestral rites of water nurturing: practices of understanding, interacting and caring for the element-liquid that allow to treat it as if it were a living being with feelings, emotions, and as if it were capable of reproducing by itself, similar to what happens with humans. Tackling waterscapes from the perspective of sound means engaging in the temporary and ephemeral experience of a territory in crisis. It is the urgent expression of an environment that is drying up, partly because of natural evolution, partly because of human intervention.

The installation exhibited at Lab3, in the Medellín Museum of Modern Art (MAMM), invites spectators to experiment with the cyclic complexity that waterscapes possess.

This is a research project that includes field recordings, encounters with communities and their songs, as well as a laboratory that experiments with hydraulic physics combined with other materials and technologies that react to the sound of air, metal, and, of course, water

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and clay in order to generate new sound experiences. Listening to the sounds produced by water livens the possibility of interpreting its messages, while it offers us tools to harmonize with its transits and become aware of our participation in them. Understanding waterscapes, both in abundance and in scarcity, allows us to rethink the cultural, economic and environmental priorities of water use practices, and implies recovering a sustainable model based on the understanding of this element's own rhythms.

Micro-ritmos. Bioelectric Messages from Medellín (2016)

Micro-ritmos (Micro-rhythms) is a multidisciplinary project that seeks to transport the audience to a hybrid world made up of sounds and luminous movements produced by bacteria-generated energy. The installation amplifies the micro voltage produced by these microscopic organisms - regarded as an interspecies system- and transforms their oscillations into pure electric signals that are then used to create an audiovisual system that evokes the origin of codified languages. As part of this project, the Interspecifics art collective carried out a research and creation workshop with a group of participants who collected earth samples from different areas of Medellín to feed bacterial cells and consequently produce bioelectric energy. Thus, the processes through which the exhibition's works were produced are linked to the city's geography.

The exhibition combines a variety of components and tools that were created by the artists themselves. A micro-voltage decoding system utilizes lamps to create a pattern that visually represents the activity of bacteria present in a group of cells. In an audio piece, a RaspberryPi camera system analyzes, through the use of Open Computer Vision resources, the coherence and correlation of the sequence generated by the lamps.

Micro-ritmos falls under the field of bioart. It uses laboratory methodologies and experiments with interspecies communication. In this project, the concept of the interface acts as a connector between worlds, a linking bridge that both, sensitizes and invites us to observe and listen beyond what our senses allow. Technology, science, and art inter-twine and coexist to create new approaches to reality. Humans are not the only beings who observe and communicate the state of the world. There are others, in this case, bacteria, who perceive through their unique sensory interface,

and respond by creating a complex network of bioelectricity and vibration, in an expressive performance on their environment and its inhabitants.

Interspecifics is an art collective created by Paloma López, Leslie García, Thiago Hersan and Emmanuel Anguiano, that experiments in the space between art and science and focuses its research on the use of sound and its physical manifestations to shed light on the bioelectric activity that takes place in different groups of bacteria, plants, mucilaginous fungi, and human beings, as a way of approaching reality.

Sound: conflict expression and Pedagogical Tool: Towards the Incorporation of the Soundscape as Field of Study in the Colombian Education, by Joaquín Llorca

The sound phenomenon embodies both conflict and harmony, is tritone and third major. Its communicative nature expresses emotions and at the same time leaves marks on societies. The shock of Colombian guerrilla commander Timochenko at the peace signing ceremony when hearing a dreaded family sound (a kfir aircraft overflying used for bombing the FARC flew overhead) is a reflection of how certain sounds are signs of conflict.

However, beyond negative meanings, the landscape is full of cultural and natural sounds that mediate the relationship between people and their acoustic environment. In addition to the well-being, the emotional bonds that can be established with the landscape make us think of the need to preserve the positive environmental signs that shape our culture and transform the ones that do not satisfy us.

The concept of soundscape has become an interdisciplinary tool that brings together diverse fields such as music, ecology, urbanism, citizen culture, art, communication and perception among others. Despite of the debates it has aroused, the articulation between art and ecology that Murray Schafer (1977) propitiates with his way of understanding music through soundscape, proves to be a valuable starting point to consolidate the necessary integration between the ethical and aesthetical spheres in everyday life. The ethical dimension includes issues of coexistence such as democracy and citizenship, and aesthetical includes everything related to music, art and play.

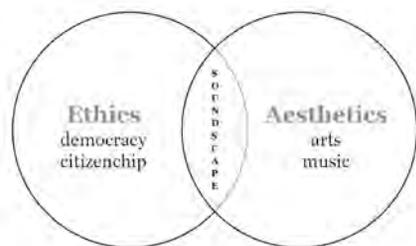


Figure 1 soundscape in between ethical and aesthetical spheres

Our environment is becoming more and more shaped by sound residues from productive activities, following the above reflections, it is necessary to design pedagogical experiences that take into account the individual and collective production of sounds. Therefore, an interdisciplinary group (architects, musicians, visual artists, anthropologists) linked to Icesi University has been working in the educational field from two fronts: *non-formal* and *formal education*.

Non-formal Education

Throughout four years, we have developed laboratories in the Colombian coffee growing region where the work with the soundscape offers diverse tools to establish new aesthetic relations with the environment. The workshops focus on two main objectives: on the one hand, to expand the notion of cultural landscape towards the sound so that the inhabitants incorporate acoustic signs of their culture to the intangible heritage and, on the other hand, to resignify the territory in zones of conflict where the landscape has been marked by the sounds of war. The work focused on encouraging communities to participate and relate to their landscape through a clean listening and field recordings to reconfigure the automatic links and to re-signify the sound signs of their habitat¹.

The Colombian Ministry of Education, in the elaboration of Institutional Education Projects (PEI), has created curricular guidelines as a reference for orienting

¹ For more information see in these same proceedings: Llorca, Guerrero, Garay, Ordoñez. *Soundscape as a pedagogical and reflective tool for the preservation, re-signification, and creation of narratives about the Colombian Coffee Cultural Landscape: visual arts laboratories of the Ministry of Culture*.

institutions and teachers from 11 modules². These fields of study are the space where it is proposed to insert the subject of sound. Together with the aesthetical dimension, which is included in the artistic education, or to the ecological dimension that corresponds to natural sciences and environmental education, a line from the social sciences stands out, that can be articulated with the responsibility that the sound has in the construction of democracy and citizen-ship. The sum of the ethical and aesthetical dimensions points to the formation of a sensitive and responsible citizen of its environment.

Formal Education

In order to incorporate the study of the soundscape from the elementary school, a two-year research project that seeks to find points of encounter with the school curriculum from the pedagogy is currently taking place. The classroom is one of the most important spaces in childhood and educators are fundamental actors in the construction of a new educational project that incorporates the sensuous as a main part of learning (Mead, 1971). Returning to Schafer, one of the foundations of his educational proposal is based on “listening” because in the aural consciousness lies the beginning of a key sensitivity for any critical approach to sound. For the Canadian composer, the primary objective is to make conscious decisions about the design of our sound environment (1992).

The research project aims to design a series of didactic tools according to the results of the inquiry that can be developed in the company of professional teachers and students of the School of Education at Icesi University to be distributed in the teaching field. This in order to incorporate the soundscape, understood as a didactic tool, in the different instances of the Colombian elementary education curriculum.

In the Interstices of a Memorial: A Review on Triangulation Gender/Sound/Technology, by Ana María Romano G.

In November 2012, En Tiempo Real Festival, Nuevos Encuentros Sonoros (which used the figure of cycle and was called Lado B. Nuevos encuentros sonoros at the time), the collective Sonema and Christine Renaudat,

²Social Studies, Afro-Colombian Studies, Political Constitution and Democracy, Arts Education, Natural Sciences and Environmental Education, Mathematics, Spanish Language, Foreign Languages, Ethics and Human Values Education, Physical Education, Preschool

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joined by an interest of working collaboratively and to network, started a project which articulated their creative interests and relied on the context of the Colombian armed conflict. We were also interested in combining common interests: the testimonial presence of the voice, memory work, the role of the sound recording and the use of electronic and digital media.

This was the birth of the call *Sound Interstices*, where we invited to think publicly on issues of violence and to create using sound. The call was to compose electroacoustic miniatures (with a duration of 1 to 3 minutes) using a bank of sounds, that is, reusing a set of recordings from Christine's personal archive, gathered after 11 years (2001-2011) of journeys throughout the country as a correspondent of Radio France covering the conflict. This bank is composed by 24 sound files pertaining to interviews which gathered testimonies (from victims and perpetrators), speeches (of members of all sides), soundscapes (crickets, frogs, night, the countryside, crying babies, infant games, rain) and other daily activities carried out in different environments (school classes, bell towers, instructions to recognize and prevent accidents with mines, sections of radio and television news, etc.). The call made it possible to use as much as three recordings per piece, and it was possible to send three different miniatures.

On the other hand, we relied on the benefits of the Internet to develop the process. The 24 sound files were uploaded to a Soundcloud website and were available for creative work. The miniatures were sent via different providers designed to download from a server (Wetransfer, Dropbox, etc.), parallelly, an online inscription had to be filled registering the title, name, and short biography of the composer, the titles of the files that were used in the piece, email, phone number, city and country of residence; some of the inscriptions added as well a brief comment on the sound creation.

The main goal of the conveners of the project was that the content of the sound materials would invite a journey through the sonorities of violence, as well as to ponder on the different voices that are weaved into the absurdity of war; we wanted to assume these recordings as triggers for creative ideas that will enable them to be recontextualized, to serve to think and rethink the war from the point of view of sound creation in a very particular context. Given our interest in the diversity of sounds (the ones in the files as well as the new ones, created in the pieces), the call was not a competition,

and was not restrictive in terms of technical processes, aesthetic searches, nationality, age, or discipline. The success of the call was evident in its results: Works received: 81, Participants: 66, Countries of origin of the works: 16 (Germany, Argentina, Brazil, Colombia, Chile, Ecuador, El Salvador, Spain, United States, Guatemala, Netherlands, Kosovo, Mexico, Peru, United Kingdom and Venezuela, Colombian cities sending works: Barranquilla, Bogotá, Bucaramanga and Cartagena.

Festival *En Tiempo Real*, *Sonema* and *Christine* were moved by the way the call stimulated and interpellated a broad and plural group of artists who wanted to get involved and reflect on the materials, the themes, and contexts; these creations enhanced the original materials and put us through the labyrinth of that which we call humanity, their voices reminded us of the voracity of war and at the same time, took us through territories of resistance and solidarity.

Memorial of voices is a sound installation created by Christine Renaudat, which consists of a dozen headphones that emerge from a group of 50 pairs of plastic black boots and, in the words of its creator, symbolize an "army of absent" with which she lived while doing her journalistic work (peasants annihilated by violence, displaced families, men and women mutilated by mines, abductees and teenage guerrillas devoured by war). The installation, which takes a little over one hour to tour, relies on the recordings that were made available to the *Sound Interstices* project, only that the materials are almost raw, with a few subtle modifications that highlight their testimonial character.

In 2012, after the death in captivity of some of the oldest hostages of the FARC and with more than 100 hours of recordings, the need to amplify the testimonies that resonated in Christine for a long time arose; for her, the installation was a sound journey into the conflict which shared the sense of absurdity of the war make us ask: "Is more violence bearable? Is there, as witnesses, victims and participants of the Colombian war say, another way?" The need to actively intervene suggested other ideas that materialize their own questions: "Can the naked word spread the emotions of the other in a world of images? Can sound suggest more than a picture or a video, and take us to an uncomfortable territory, where these voices can interpell us, challenge our indolence, or our silence?"

The first *Memorial of voices* exhibition coincided

with the announcement of the beginning of the process of peace between the Revolutionary Armed Forces of Colombia (FARC) and the Colombian Government. It was inaugurated in September 2012, during the month for peace at the Centro de Formación y Capacitación de la Cooperación Española in Cartagena, Colombia. The first presentation of Sound Interstices took place in November 2012, within Sonema 3 and Festival En Tiempo Real, which happened simultaneously. Given the large quantity of pieces, 28 were chosen for that presentation. Both the Memorial and Sound Interstices have toured several Colombian cities and abroad, and since November 2012, Christine places the raw material of her installation in dialogue with some of the other works that were chosen, switching them between exhibitions.

Memorial of voices and Sound Interstices are the result of an encounter between a personal archive and multiple collective experiences of horror in Colombia. They both remind us of the deep roots of the conflict and its multiple ramifications; they warn us that war is not far away, in distant places; they alert us on the fact that, although the city makes it easier to forget about the war, the truth is we're deep into it. They alert us about the conflict to disarm the war in Colombia.

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Panelists and Moderator Biographies

Julián Jaramillo Arango (moderator) is composer and researcher working in the field of new media design, focusing on experimental sound practices, multimodal communication and in the development of interactive applications and services. Jaramillo Arango's works bridge the gap among science, arts, technology, creativity, society, community and sustainability through works that explore different modes of sonic interaction. He holds a Ph.D. in Sonology advised by Dr Fernando

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Iazzetta São Paulo University. Currently Julián conducts a postdoctoral research in the Caldas University Design and Creation program where he develops novel interfaces for the local urban space.

Tomás Lorenzo (panelist) is an artist and academic who works with both physical and digital media exploring the artistic construction of meaning and its relation with power and politics. Lorenzo's production spans across different practices, including installation, interactive art, music, live cinema, and digital lutherie. His artworks and performances have been shown in the Americas, Europe, Asia, and Oceania. He is Assistant Professor at the School of Creative Media of the City University of Hong Kong. He has several publications, mainly in the areas of New Media Art, and HCI. He holds a Ph.D. in Computer Science, advised by Dr. Alvaro Cassinelli, University of Tokyo, and Dr. Franco Robledo, University of the Republic of Uruguay.

Eneida Luz Ramirez Centeno (panelist) Eneida Luz Ramirez Centeno is Master in Music by the Institution of Fine Arts and Sciences at the Bolivar University, and Master in Development and Culture by the Technological Bolívar University. She has been granted by the Ministry of Culture in 2015 as part as the Stimulus Fellow Program to conduct an artistic residency in the Javeriana University in Cali. Eneida founded the National Net-work of Thought and Cultural Action MORE CULTURE and has been advisor on public policies issues on NGOs dedicated to cultural and social endeavors. Currently Eneida participates in the National Network of Music Networks leading workshops on Public Policy and Cultural Management as a member of the Artistic Organization UNO-A and the Artistic Guild Board Bogtá. **Joaquín Llorca (panelist)** is architect and musician. He is a professor and researcher at Icesi University where he is in charge of courses on sound design, art and acoustic ecology. He is part of the Seminar of Esthetics that deals with theoretical reflections and research on urban topics. The latest project about the soundscape of a traditional Cali's neighborhood can be consulted-www.cartofonias.org. Since 2013, he coordinates the annual Laboratory of Visual Arts of the Ministry of Culture about the soundscape of Colombian Coffee Growing Area.

Ana María Romano G (panelist) Her creative interests have allowed her to work acoustic and electroacoustic media, as well as in interdisciplinary projects (contemporary dance, performance, videodance).

Her music has been performed in different festivals and theatres in America, Europe and Asia; have been published in Colombia, Ecuador, England, Mexico and Russia. And has received national and international distinctions. She has taught widely and be very active in the dissemination of contemporary and experimental music through concerts, magazines, CDs, digital platforms. She has been invited as a teacher, lecturer and curator for different academic and cultural institutions, national and international. Her actual work is focused on triangulation Gender / Sound / Technology. She leads the *Festival En tiempo real, Microcircuitos Digital Platform* and teaches at El Bosque University.

Jorge Bejarano Barco (panelist) is a sound artist, curator and educator living in Medellín. Director of the Department of Education and Culture (2010 – 2015) and currently the Special Projects Curator at The Museum of Modern Art of Medellín. Active promoter of experimental laboratories, electronic arts and sound art, in both independent and institutional fields. He has done academic contributions and artistic projects in different locations of Latin America and Europe: Medialab Prado, Universidad Complutense, Sumerlab la Coruña (Spain), Centro Nacional de las Artes / Centro Multimedia y CMMAS (México), Festival de Cultura Digital (Río de Janeiro), Universidad de Oporto (Portugal), Festival de Música Experimental Tiempo Real (Bta), Salón Nacional de Artistas, Videosónica 2016 (Colombia), among others. He has a Cultural Affairs specialization from Ortega y Gasset Foundation (Buenos Aires), a Graduate Degree in Social Sciences from UDFJC (Bogotá), and various certification courses in Art and Museology.

Training Methods for Transdisciplinary Collaboration: Best Practices and Didactics for Team Work

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Introduction

Collaborative work appears as a need for successful transdisciplinary efforts and communal professional activity among individuals with different expertise. Collaboration frames activities in a scenario of mutual benefits, where each participant contributes with her work to personal and group goals. Collaboration is expected to augment individuality because participants' peculiarities, strengths, knowledge, and skills may articulate and negotiate to achieve an integrated outcome, which could be more successful and constructive.

However, individuals have limited abilities to exploit the personal and collective benefits of collaboration. Formal or informal training methods need to be refined and tested to enhance transdisciplinary work. In the Manizales Mutualism Project, we are exploring training methods for transdisciplinary collaboration. We are looking for multiple perspectives of training methods, but we are also interested in inspiration from metaphors from the natural environment. Training methods, and pedagogics, exist for team management training and team building in other fields such as medicine or industry; we are interested in the specifics for transdisciplinary training on creative projects that bridge the design, arts, and humanities with science and engineering.

A key issue in transdisciplinary collaborations is understanding the metaphors and terminology used in each discipline; we seek to clarify and make visible the metaphors and language shared in transdisciplinary practice. In nature, some animals and plants master interspecies communal living in some biological relationships and collaborative work. In mutualism, for instance, individuals from different species live together and benefit from a relationship based on strategic alliances. There could be much to learn from the mutualism as a metaphor in human transdisciplinary collaboration, including training methods, while recognizing the limits of translating from one field of

application to another.

In this ISEA panel, experienced transdisciplinary collaborators present their collaboration methodologies. A half day working group meeting would also be held with interested participants (see workshop proposal). An annotated critical bibliography of collaboration references would be published as well as a report from the ISEA panel and workshop meetings.

A transdisciplinary approach to research-creation. (When art is part of everything else) Dr. Ricardo Dal Farra

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Abstract

The solution to complex problems is being explored, increasingly, from multi and/or interdisciplinary perspectives. However, those strategies are not enough in many cases and therefore developing a transdisciplinary approach becomes an essential tool. The traditional academic structure based on rigid disciplines has proven not to work well to face problems such as climate change or poverty, taking here only two among many multi-dimensional challenges we are facing. Can we really and effectively develop innovative useful ways to do research and apply our findings with a creative approach? This is an introduction to some experimental strategies used in transdisciplinary projects focusing on research-creation, aiming others could benefit and eventually emulate some of the experiences carried out.

Keywords

Transdiscipline, Collaborative Research, Education, Research-Creation, training.

Introduction

I was seeing a documentary where scientists from around the world were explaining that trees are connected, they have feelings, they take care of each other. Trees have families and friends and they inform others when one is attacked. Life is about communication and mutual understanding or disagreements. Nevertheless, humans have created systems and regulations in trying to understand how this world works but we are far from finding answers to complex issues. The traditional academic structure based on rigid disciplines has proven not to work well to face problems such as climate change or poverty, naming here only two among many multi-dimensional challenges we are facing.

Can we really and effectively develop innovative and useful ways to do research and apply our findings having a creative approach. The solution to complex problems is being explored, increasingly, from multi and/or

interdisciplinary perspectives. However, those strategies are not enough in many cases and therefore developing a transdisciplinary approach becomes an essential tool.

There are different definitions about multi-, inter-, cross-and transdisciplinary research. The approach of considering transdisciplinary research as a way to create a unity of intellectual frameworks looking beyond a disciplinary perspective seems to be appropriate and useful also from the arts perspective.

Research, Creation, and Knowledge

Gian Giudice, Italian physicist and head of the Theory Department at CERN, the European Organization for Nuclear Research, has said in an interview that “the level of complexity of the different branches of theoretical physics is such that nobody can be an expert in everything” and that he believes that “the way science develops often follows paths that are much less logical and rational than most people think” adding that “only at the end of the process a clear picture emerges and then, in retrospect, everything looks simple and straightforward”. A doctor in physics too, Spanish professor and writer Jorge Wagensberg compares scientific with artistic knowledge. While for science communicability and intelligibility are fundamental, he understands art as a powerful way of communicating unintelligible complexities. Can an anthropologist, a philosopher, an illusionist or an investment advisor not only participate but also to actively contribute with their personal experience and background to an electronic art class? Why did we decide to be a mechanic, a composer, a historian, a baker or an astrophysicist? I am not only speaking here of the context and the circumstances that could have conditioned or inspired us, I am also considering the decisions that we take in our daily life and that are slowly taking us to follow a

road and not a different one, finding us later as a flutist, a cardiologist or an engineer. Is it possible to integrate characteristic elements of architectural thought into structural processes of music creation? It is not the idea here of a simple translation based on the geometry of the spaces, their dimensions or other aspects that could be measured and transposed in a relatively simple way. This is not about adapting and converting from one field to another, from space design to musical composition models, for example, just to show a possible application. The motivation, intention, and goal here would be to find ways of integrating various methodologies, visions and overall values in a process that could help us to understand better how to collaborate and share, discuss, comprehend and -expectedly- apply our findings.

Changing Glasses

This is not a proposal to dissolve disciplines. It took centuries to build the complex system we have today for the teaching and learning of the various fields of knowledge, as well as to support the research that has been allowing us “to advance”, at least in the terms that we understand it in our Western civilization. At the same time, it is necessary to recognize the different visions that people have of the world, and even if sometimes could be hard for us to understand or accept it, some of that can teach us and can be reflected in our academic or professional activity.

Art is not apart from anything, is part of everything. It is not part of a bubble of musings. It helps us to connect with the world or to isolate ourselves, to understand and embrace or to dissent, to make sense or to confuse, it can be an engine to free our creativity or to lock it. Art is linked to politics and economy, it can convey feelings and emotions, can also lead us to think about human biology or complex mathematical equations; it can apply principles of fluid mechanics and key elements from game creation, and can open new spaces, make use of very simple or extremely complex techniques, be based on serendipity, and navigate between the accidental or casual and causal, too.

When we talk about multidisciplinary we refer to join various disciplinary fields needed to reach a goal but considering experts coming from their own individual disciplinary space. Interdisciplinarity can take us to another level of interaction, integrating methods or knowledge from different disciplines. The proposal to consider transdisciplinarity as an intellectual

framework that goes beyond the vision imposed by independent disciplines is certainly a major challenge. We are usually looking (and acting) as a consequence of those “glasses” we have grown with, those that we used during our years of studies at school or in the university when we learned how to interpret the world, probably according to a traditional structure of education with clearly separated disciplines. We need to learn about crossing borders again and going beyond the limits, even if some of them are strong as walls. We should be able to understand different perspectives about the world and generate knowledge from a broader apprehension of reality. The quest to create new conceptual and methodological frameworks, the pursuit of innovations that could allow us to capture and shape the knowledge of multiple disciplines could make possible to cross the usual barriers and create not just a simple mixture but an integration that goes beyond the parts. The result of the operation could be then more than the sum of the individual elements, an added value significant enough to enhance our understanding and clarifying that collaborative work has a relevant role in getting results. This could be the approach to consider when facing a complex problem that the traditional disciplinary way cannot solve, but it could also be a line to follow for looking again to the strict disciplines that molded our understanding, now from a broader perspective facilitating us to reach a better overall comprehension and grasping the deeper meaning of what we do, how we do and why we do.

Experimental Transdiscipline

The conceptual proposal of transdisciplinarity might be interesting to some but still too far from a possible practical implementation. These ideas have emerged from a long period of intellectual elaboration but are not intended to be merely an intellectual offer of good intentions that cannot be applied in daily activities. Some examples of activities developed considering a transdisciplinary approach follows. Activities that have been bringing art and disciplines apparently far from each other close enough to work from a unified but large conceptual framework.

The Transdisciplinary Creation and Performance class originally proposed about six years ago to Concordia University in Montreal was finally offered to the Music Department students in 2015. In this class opened to composers and performers, music students were

working with academics and professionals from fields as diverse as dance, philosophy, economy, anthropology, illusionism, space engineering, computer science, design and more. This experimental class allowed also a truck-driver and a call-center supervisor to participate, and in most cases, the process was revealing and the results amazing.

With students from the Interactive Design and Creation Master program at the University of Caldas - Manizales, an intensive transdisciplinary workshop was done in 2016 with results beyond expectations. Participants with backgrounds in pedagogy, graphic design, history, visual arts, X-ray analysis, music, industrial design, programming, marketing and more were producing projects focusing on the consequences of extreme mining activities, actions to be implemented in their university to reduce climate change effects, and a mobile lab created after a thorough field study of the local actions to recycle wasted food.

Following a similar line of thought is the international symposia Balance-Unbalance that “bring artists together with scientists, economists, philosophers, politicians, management and policy experts, sociologists and engineers from across the world with the intent of engendering a deeper awareness and creating lasting intellectual working partnerships in solving our global environmental crisis”. A spin-off of the Balance-Unbalance series is the sound miniatures ‘art! ∩ climate’ international contest organized in partnership between the Red Cross / Red Crescent Climate Centre and the Electronic Arts Experimentation and Research Centre (CEIARtE-UNTREF) from Argentina. The Red Cross Climate Centre’s mission is to help address the humanitarian consequences of climate change and extreme weather events. In its efforts to engage people at risk, government agencies, academic institutions, donors and other stakeholders, it has become clear that information is rarely sufficient to trigger behavior change. As a result, the Climate Centre has been designing and facilitating methods for learning and dialogue that involve not only brainpower but also the emotions of participants (such as collaborative workshops, participatory games and short educational films linking information, decisions and consequences on disaster management). The ‘art! ∩ climate’ contest has two main objectives: a) Provide the Climate Centre with sound-based art material that can support their actions; and b) Improve knowledge about the human dimensions of the

environmental crisis and promote awareness about the effects of climate change, both among creative artists and among those exposed to their work. The contest has a double jury, one for artistic quality and another made up of experts from the Red Cross Climate Centre. For the Climate Centre, it is increasingly important to have artworks to help with preventive and remedial tasks. This is because the traditional ways of addressing many of the complex problems they face are not sufficiently effective. Thus, they have found in art an important factor that facilitates and improves the efficiency and effectiveness of its work.

Final Words

Art as an engine of change, as a key element that adds and helps to build the web of life. Art, not isolated but united by force fields to the network (and to the many networks) helping to design the map of tensions that allow us to create, usually on the edge of understanding. The route of uncharted territories, where certain signs could open new paths or stop us, following our experience and desires but also according to the way we see, we listen, we act. The collective construction done from individual effort, where the contours can be diluted, values are questioned, and frames are unraveled.

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Author Biography

Dr. Ricardo Dal Farra is a composer, new media artist, curator, educator, and historian whose work has been focusing on new music and the electronic arts for several decades. He is a professor at Concordia University, Canada and director of the CEIArtE-UNTREF Electronic Arts Research Centre, Argentina. His music and media artworks have been presented in about 40 countries. Dal Farra is the founder-director of the Balance-Unbalance (electronic arts & the environmental crisis) and Understanding Visual Music conference series and has been a researcher for UNESCO in France, De Montfort University in the UK, Amauta in Peru and the National Ministry of Education in Argentina. He was director of Hexagram, the interuniversity international network for research-creation in media arts, design, technology and digital culture, and coordinator of DOCAM, the Documentation and Conservation of the Media Arts Heritage research alliance. Dr. Dal Farra created the Latin American Electroacoustic Music Collection hosted by The Daniel Langlois Foundation.

When a School of Satellites is a School of Photography

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Abstract

In 2010, Díaz Infante founded the Mexican Space Collective, a group of people which objective was to build and launch a satellite piece of art. In the process of doing so, Díaz Infante realized that all the knowledge learned had to be transferred somehow to the Mexican society. He founded in 2014 a concept called “School of Satellites” ESATMX. A virtual school with many campi. Its slogan “too much technology, very little imagination”. This school’s objective is the building of nanosatellites as a learning experience. Each project is an art, cultural and educational project with no distinction at any moment. Díaz Infante is a photographer graduated from Brooks Institute in 1982, and he went through a relative revolutionary school, it had only one subject, photography: 1, photography 2, photography 3. And it only had 2 hours of lecture or crit a week. The School of Satellites was founded the following principle: it is not training is about understanding. We are overtrained on things we do not understand or we understand partially, Culture is a basic tool of converting already “trained” people into a transdisciplinary experience. Building nano satellites are a tool for teaching understanding a concept of mission.

Keywords

Space art, science and art, transdisciplinary, Ulises I, School of satellites, satellite technology

Introduction

This is the story of a virtual campus in which we teach how photographers would build a satellite.

“The future belongs to those who give the next generation reason for hope.” — Pierre Teilhard de Chardin

Intro. Avoid the Confusion. Review Assumptions. Multidisciplinary, Interdisciplinary, Transdisciplinary, not the Same Thing Since 1984

One day I met Ángel C6smos, a poet, in 1982 and we worked together in an idea that that pushing forward concepts of producing “art” is a problem of “the group”. We had an idea of producing in “collaboration” as a

way of generating unknown results, we were trying to avoid the personal style concept of art in which style is actually a lot of repetition. We needed to stop that catch 22, no to have style and to realize that creativity can be found easier as a group effort. A way of not to know the end result. We were trying to rediscover our use of the hypothesis. A way of reaching the unknown. We founded the Camera Music Group, also inviting Arturo M6rquez to join us. We were one photographer, a poet and a musician. The idea, to create music, scores made of photographs and photographic elements, to perform photography. Few basic principles were to be followed, work as a group, not to worry about copyrights, the new technologies are different ways of writing. We ended up working with over 200 people producing concerts that today would be called multimedia performances.

Working as a group is a system that generates a special energy and this is the energy that needs to be shown in an art project. We were coining these concepts 20 years before the “group collectives”, “multimedia” or “copyleft” were popular. Working the unknown makes you have more questions than answers: what is collaboration, what is a group, what is a team in a creative context. How to invite a piano player to interact with someone who will be breaking in pieces a TV set? When creation is free like in Art, the dynamics are different when the purpose of creation has a specific utilitarian problem. Maybe not, maybe everything should be seen as a troubleshooting experience? We were discovering those terms ourselves trying to put together a concert in which we needed 60 photographers on stage. We had to review assumptions as a first order of the day. Multidisciplinary is different from interdisciplinary and it is different from transdisciplinary, but who knows the difference, and who has the eye to notice the difference.

Two basic elements mark the beginning, objective and strategy. It is a way of talking and a way of working. One of the most important things as you work in

transdisciplinary projects is to have your questions clear in your mind, not to assume that terms mean the same to everyone. 1984 is the year when we started working with the concepts of interdisciplinary, as a concept for creating. Again, is interdisciplinary art or science or a specific discipline? That is the question, what are you? As you start, you learn by accident, by trying. Working with others becomes a process of teaching. In a true transdisciplinary effort, no one has the same background, how do you glue them together. Working together is teaching everyone to review assumptions. It is learning from experience like in the Renaissance. The master teaches the pupil. What is at the soul of the project? The term “Transdisciplinary” is a need in a certain creative process. The term “Multidisciplinary” is a need in an industrial process. It is all in the planning, it is the way you put together the group. The creative approach cannot be acted if it is not a creative system. It is learning again, as a group, the term Hypothesis. Learning to make hypothesis through music.

Introduction to the School, 2010

In 2010, I founded the Mexican Space Collective, a group of people which objective was to build and launch a satellite piece of art. *Ulises I*, it was designed to be put together as a collective project instead of a team project. The idea was that a member of the Mexican Space Collective needed to have a sense of a social understanding of his own identity. First, you are part of a family, a city block, a city, you are really a citizen if you belong to a society. Then, you become part of a team. If you are not aware of your geographical situation in a society you do not have a real sense of social purpose. A better way to say this, you have to be eager to be part of a society, to be a citizen, to be part of a team. There is a conflict of thought, we are trained to be competitive not to be collaborative, but we are not aware of that. Capitalism and Neoliberalism have become an atmosphere, an ether against collaboration. We absorb these created habits from home, from school, from the conversation, as an instinct. So, when we assemble a team and we have a series of people taught to be competitive and we are asking them to be collaborative. So, in *Ulises I*, we invited artists, students, engineers, scientists, politicians, administrators and lawyers working together. If left unattended, it can become a dyslexic experience. It was an electric shock. It was part of the success of the process to change the

language or to be aware than a transdisciplinary effort requires rewiring, we will call it teaching. Nonetheless a lot of the people working with us they were not aware that they were in a transdisciplinary event, a lot of them think of the event as a result not as a process. So, they do their part without becoming part of the team. We named this a “latin syndrome”, wanting to reach the end before going by its process. Also, a supposition that needs to be reviewed. Learning collaboration is not a subject! How can you tell people to go against a stream of thought. A behavioral dilemma: is Architecture the right metaphor for collaboration, the army or an orchestra. We chose an orchestra, Gustavo Dudamel, we study the Orquesta Sinfónica Simón Bolívar y La Filarmónica de los Ángeles. We are conceptualizing learning working as a team as becoming a flock. How a score becomes music and how music is a group/team/flock.

Trying to reach self-organization, self-formation, flexible flock formation, independent obstacle decisions remaining in the flock. We started two satellites in two different direction, *Ulises I* had a flow of artists conceptualizing a mission, *Ulises 2* had a flow of engineers conceptualizing the mission. Two different beginnings to explore what would happen.

Mission

We learned that to establish a mission, we need to generate the formality of the language. Without the formality of the language you cannot communicate among the different subsystems of the satellite. Language became important. It reminded me of Fernando Flores and his concept of conversation. If people come from a conversation of competition, you have to change to a conversation of collaboration. Language becomes essential between engineers of different subsystems and the same exercise allows engineers to be able to work comfortably with artist.

“As we talk, we build our reality with the other, it is not an abstract thing. Talking is a way of living together and is the coordination of doing things and emotional content. The conversation is the capacity to construct realities. To operate in language, it changes our shape. We can hurt or love with words. In this relational space, we live in constant requirement or in constant harmony with others. We can choose an aesthetic wellbeing or a continuous negative requirement experience” (Humberto Maturana)

[En el conversar construimos nuestra realidad con el

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otro. No es una cosa abstracta. El conversar es un modo particular de vivir juntos en coordinaciones del hacer y el emocionar. Por eso el conversar es constructor de realidades. Al operar en el lenguaje cambia nuestra fisiología. Por eso nos podemos herir o acariciar con las palabras. En este espacio relacional uno puede vivir en la exigencia o en la armonía con los otros. O se vive en el bienestar estético de una convivencia armónica, o en el sufrimiento de la exigencia negadora continua.”] (Humberto Maturana)



Figure 1. Team of Ulises 1, Mexican Space Collective

The simple story of working together in a satellite, artists and scientists made us realize the wealth of knowledge that the experience yields. In the process of doing so, we realized that all the knowledge learned had to be transferred somehow to the Mexican society. We

founded in 2014 a concept called “School of Satellites” ESATMX. A virtual school with many campi. Our slogan is: “too much technology, very little imagination”. This school’s objective is the building of nanosatellites as a learning experience. Each project is an art, cultural and educational project with no distinction at any moment. We base our transference of knowledge in learning how to do a mission and learning how to build a conversation.

Acknowledgements

The Mexican Space Collective and the School of Satellites is an effort of a team of over 75 people working together

Juan José Díaz Infante

Photographer, artist, expert in technology, founder of the Mexican Space Collective, founder of the School of Satellites, Mission Director of Ulises 1 and 2.

We are extremely serious

Towards an Inventory of Best Practices for Transdisciplinary Collaboration

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Abstract

Transdisciplinary, as opposed to inter or multidisciplinary, practices are increasing in many areas in industry, government, academia and civil society. The benefits of such practices have been proven in areas such as health, engineering, or business. However, in wide collaborations, collaboration bridges diverse fields such as art and design, humanities, science, technology, and medicine; these pose specific challenges. Institutional contexts bridge those of self-employed practitioners, to profit and nonprofit sectors both in civil society and government; training practices are less clear and specific difficulties can be anticipated. In this paper, we review some best practices and didactics for teamwork collecting relevant sources from different fields. Our conclusion is that it is possible, and necessary, to train individuals and teams for transdisciplinary collaboration practices. Depending on the field of application some approaches are shared, but also different approaches will be required. The authors recommend new research and development adapted to particular transdisciplinary fields such as STEM to STEAM.

Keywords

Best Practices, Transdisciplinary Collaboration, Art and Science

Introduction

According to Buchanan (2001), for three centuries since Renaissance, academic disciplines in much of the western world focused on incremental theory development and specialization. In the last century, researchers and practitioners from many different fields have reached a level of expertise limited to silos with difficulties to collaborate in inter and multidisciplinary challenges. In other cultures the framing of these epistemological approaches has been different and sometimes more integrative. Unfortunately, western technoculture has often not benefited from these approaches.

The rise of complex sociotechnical systems has stimulated multiple initiatives to promote inter, multi and now transdisciplinary collaboration even in traditionally opposed areas such as art and science. There is a large

literature on holistic, integrative and problem driven practices (Evans, K. 2016) The ability of individuals and institutions to integrate diverse knowledge and cultures of practice is asserted as a necessary asset, and value. We insist however that ‘integration’ does not imply “unification”. Transdisciplinary practices draw on and confront different research methodologies.

There is an extensive literature, going back at least a 150 years, that addresses the differences between multi, inter and transdisciplinary practices; see for instance the work of Allen Repko and Rick Szostak (2017) or Julie Klein (1991). The focus on transdisciplinary projects, particularly in the context of problem solving in societal and community projects, is a more recent development. In 1998, the United Nations Educational, Scientific and Cultural Organization (UNESCO) Division of Philosophy and Ethics published “Transdisciplinarity: Stimulating Synergies, Integrating Knowledge”. The report includes a useful bibliography which this project seeks to update.

Transdisciplinary collaboration has benefits in allowing the multiplicity of perspectives and specific methodologies. In its practice, knowledge management among different fields is motivated by the promise of collective potential. Also, participation of different professions facilitates the recognition of other knowledge and the strengthening of networks of collaborative work as well as the transfer and translation between communities. In this exploratory collection of best practices the authors reviewed selected literature from health, business, research, and design. Transdisciplinary collaborations as we discuss them are embodied by transdisciplinary practices that must draw on diverse collaboration methodologies as well as research methodologies.

There is a large and growing literature on collaboration methodologies. These include from those used, for

instance, in business strategic alliances, where the Association of Strategic Alliance Professionals (ASAP 2017)) allows the sharing of best practices and training.

In the field of space activities, NASA for over 60 years has developed detailed methodologies. NASA's Academy of Program and Project Leadership provides ongoing improvements in management techniques for their sector. Their Collaboration on Collaboration (2017) initiative () has also inventoried specific collaboration best practices.

Initiated in translational medicine, the Science of Team Science (2016) initiative has developed specific toolkits to improve collaboration (Stokol et al. 2006).

In the military there is a very large collaboration training literature; for instance the 2017 annual ITEC conference focuses on innovation through collaboration (ITEC 2017).

In the field of design, there are several tools and methods that can support stakeholders collaboration in design projects. A major firm, IDEO, through its non-profit Ideo.org, published a website called Ideo Design Kit (Design Toolkit, 2017)) to disseminate methods of design thinking, which is both a designerly and transdisciplinary approach. Similarly, scholars at Politecnico di Milano have developed a repository of design methods (Service Design Tools, 2017).

In the transdisciplinary fields that bridge the arts and humanities to science and engineering, there is only relatively recent literature and little consolidated best practices. In 2012 Joost Heinsius and Kai Lehtikoinen aggregated a number of texts for "Training Artists for Innovation: Competencies for new contexts" (Grezlec 2017). They issued a number of policy recommendations primarily focused on including artists as integral to innovation funding programs, and highlighting the specific issues of self-employed artists collaborating with professionals in institutional contexts. When such projects bridge addressing societal issues, particular challenges are encountered. Specific initiatives include those led by anthropologist James Leach (2014), those by Joline Blais and Jon Ippolito through the Cross Cultural Partnership (2017) have developed, and tested, specific cross disciplinary collaboration templates. The work, grounded in cross-cultural research across asian and european cultures, provides new insights and strategies.

Particular problems arise from very different cultures and history of collaboration; within some of the arts and

humanities, individual practice and creative authorship dominate, and collaborative practices are relatively recent. The variety of approaches of how intellectual property are addressed is complicated by the more recent moves towards open science and software movements. The 2001 Collaborative Ownership and the Digital Economy Conference (Robinson, 2001) led to the 2005 book by Rishab Ghosh with the same name (Ghosh, 2005). One of the authors of this paper (RFM), is involved in the SEAD network that published in 2015 a report, funded by the US National Science Foundation, entitled "Steps to an Ecology of Networked Knowledge and Innovation: Enabling New Forms of Collaboration among Sciences, Engineering, Arts, and Design" (Leonardo NSF e-book 2017). This report called for particular attention to improving transdisciplinary collaboration processes both between individuals and between institutions. The different disciplinary and institutional cultures pose particularly hard problems that require attention. The recent international 'STEM to STEAM' movement seeks to develop initiatives that integrate the arts/design/humanities with science/technology/medicine. In the education area, the US National Academies of Science, Engineering and Medicine have currently underway a study to address the challenges and proposed approaches (Policy and Global affairs at the national Academies 2017). In Europe, the EU STARTS initiative (ICT and Arts 2017) asserts that "the arts are gaining prominence as catalysts for an efficient conversion of science and technology knowledge into novel products, services, and processes" and funding mechanisms are in place.

Towards an Inventory of Best Practices

The panel and workshop held at ISEA2017 in Manizales was one step to continue to focus attention on these problems. Here we develop some initial areas for discussion and development.

Identify Values and Set Up the Environment for Teamwork

In projects where practitioners share an overall disciplinary culture (e.g. military, health care) in general values and success criteria are fairly easy to develop. However, in transdisciplinary projects that cross different 'ways of knowing', conflicts can arise when the individual values are not made explicit or overt. For instance, the 'truth' status of results derived from the

scientific and engineering fields may not be viewed in the same way by practitioners in the arts or humanities which emphasize individual reception within a specific cultural context. The US National Science Foundation funded Toolbox toolkit provides one approach for making implicit values explicit (Tool Box Project 2017) and in particular seeks to make clear individual participants views on the practice and values of others.

Setting personal and group goals for interdisciplinary collaborative work facilitates the recognition of the capabilities of team members and confronts participants to identify the importance of their input and the type of participation they wish to have. Likewise, it outlines the participation of the collaborators according to levels of expertise, preference for some subject or interest in strengthening certain capacities to the extent that they commit to work in a specific area.

The investment of time and effort at the initiation of transdisciplinary collaborations is significant, more significant than in inter or multidisciplinary ones. There is often resistance by individuals to develop clear understandings of differences in values and specific goals. Early discussions on intellectual property approaches can be disruptive, but must be addressed. Often in transdisciplinary collaborations there are intentionally multiple forms of outputs (e.g. discoveries for scientists, technical solutions for engineers, impactful artworks for artists, etc.) and often there are not shared criteria for success.

In health fields, there is wide study of collaboration among diverse care providers. Salas and Rosen (2013) reported the evidence about training for collaboration in this area and one of the best practice they suggested is that leadership support is the key driver of effective teamwork because organizational culture and priorities affect how staff collaborate. In less hierarchical institutions different from health, a commitment technique should be defined.

We assert that the beginning of a transdisciplinary collaboration, it is important to be convinced, through analysis, that transdisciplinary practices rather than inter or multidisciplinary ones are required.

Train Individuals to Learn Collaboration Skills.

There is an extensive research in health fields to train care providers from different specialties to work together in common goals. Salas and Rosen (2013) synthesized the progress in this research area and explained that learning

teamwork may be easy and engaging; however, practice and guided practice are the best didactics to apply knowledge in actual collaborations. They also pointed out that feedback (causes of effective or ineffective performance) help team members to improve their collaboration. In areas beyond health, collaborations may not occur with previous training programs protocols or requirements. Therefore, guided practice and feedback may need that one of the individuals is skilled and assumes the role of guide and provides feedback.

A promising training technique for collaboration applied mainly in health and aviations is the use of high fidelity simulations. But Beaubien and Baker (2004) criticized its efficacy has been because of the lack of evidence. They recommend a careful planning of the training to tailor specific needs, goals, and evaluation. In transdisciplinary collaborations, this technique would be particularly helpful when there are clear goals with determined outcomes. In more creative tasks with undetermined outcomes, simulation training may limit creativity in post-training performance.

Assign Roles to Each Individual in the Group.

Sunstein and Hastie (2014) contended that behavioral economics can explain the pitfalls of group performance because cognitive biases influence behavior of individuals in the groups. For example, people underestimate the time needed in a project (planning fallacy) or stick with endeavors that are unlikely to succeed (sunk-cost fallacy). These authors suggest that assigning roles gives member the confidence and responsibility to share information that otherwise would be hidden by the avoidance of social rejection. The advantage of transdisciplinary collaboration is that the collaborators know that others have different skillsets and worldviews. However, to enhance collaboration, roles should be clarified or constantly revised in the process. Sunstein and Hastie also suggested two similar strategies regarding role assignment. First, they recommend appointing a devil's advocate, which frees an individual from the social pressure of accepting a dominant group position. Second, they recommend establishing contrarian teams, which is a variation in which part of the group has the mission of identifying weaknesses of the decisions or outcomes.

Leading the Team from Disciplinary Diversity and Integration.

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Leadership in transdisciplinary collaboration is a task that can be performed by a participant, but it may also be desired by multiple individuals in various leadership roles. Gray (2008) suggests three approaches to types of cross-disciplinary leadership: (a) cognitive leadership to motivate participants to move beyond their disciplinary knowledges, to break schemas of thinking, and to propose expanding their limits of knowledge; (b) structural leadership that adds value to the extent that it facilitates the creation of relational bridges between participants less interaction, and

(c) procedural leadership that gives participants confidence and converts conflicts into constructive interactions. Gray recommended that leadership should be a shared process in dispersed work networks, which allows the search of the objectives of the work team to leverage from different actors.

Influence Collaborators to Exploit Their Full Potential

Another application of behavioral insights to improve teamwork is setting up rules that allow the group to overcome biases and fallacies. Sunstein and Hastie (2014) recommend three actions. First, they recommended to silence the leader, which would avoid discouraging the members to oppose authority. They made the case of underserved populations, but in transdisciplinary collaborations some disciplines could be dominant and could be “silenced” to encourage contributions of members of less dominant or non-traditional disciplines depending on the problem being tackled. Second, Sunstein and Hastie recommended priming critical thinking, which consists of specifically asking people to disclose all possible information and ideas. We believe that this action would individuals from uncommon disciplines would feel confidence to contribute. These authors also recommended rewarding group success – not individual success. This will encourage individuals to share knowledge that can potentially benefit the group performance.

Alternate Group and Individual Work to Enhance Ideation.

Perhaps the most widespread technique in the general public to generate ideas in groups is brainstorming. However, as Paulus and colleagues (2015) note, this technique has proven to reduce efficiency and efficacy of idea generation. They report exploratory studies that

point out to alternation of group and individual work to better ideation processes. This technique is known as brainwriting because whereas individuals work alone, they register their ideas before sharing them in a group.

Use the Tools and Techniques According to Possibilities of Collaboration.

The proper use of collaboration tools and techniques influence the effectiveness of teamwork and facilitate distributed asynchronous collaboration (i.e. at different times and places). Sanders and colleagues (2010), in some case studies about collaboration in design fields, noted that some tools for collaboration should be used according to the possibilities offered by the meeting, purpose of collaboration, composition and size of the group, and type of meet (face- to-face or virtual context). Likewise, Koutsabasis and colleagues (2012) identified the potential of human-based interaction technology tools by tracking multidisciplinary collaborative projects in a virtual world-type immersion environment. Their contributions highlight registration as a support for collaborative practices, the collaboration scenario and level of commitment and concentration that digital tools facilitate for distance collaboration. There is a proliferation of software tools to enable and support collaboration in general. It is unlikely that unified generally accepted tools will be developed. It is important at the initiation of transdisciplinary collaborations to make visible the use of different tools and identifying necessary integrating ones.

Structure Decision Making Based on Collective Cognition and Evidence

Decision making is one of the major challenges in teamwork. All the previous best practices can support this activity. The Delphi method is a widely known method for rational decision making incorporating both individual and group wisdom. This collective and social cognitive process is powerful to counter cognitive biases of individuals. (Sunstein & Hastie, 2014). The use of evidence for decisions also helps collaborators to focus on the benefits of the project. In codesign, evidence has shown to reduce controversy and facilitate consensus (De la Cruz & Mejía, 2017).

Heterogeneity and its Discontents

A number of studies of collaborations address both the positive and negative and challenging aspects of group

heterogeneity. Heterogeneity in this context includes aspects the mix of gender, age, abilities, ethnicity and culture, location (Cummings et al 2013). In general, for small groups (< 30) studies often indicate that more heterogeneous groups are more innovative; however, as noted by Cummings et al, as group size, locations, institutional contexts increase heterogeneity can be counter productive. The idea of ensuring heterogeneity is not to lead to a unified world view, but rather draw on multiple ways of knowing. As emphasised by the Science of Team Science toolkits referred above, it is important to understand ahead of time the impact of heterogeneity/ or lack of it, both on collaboration productivity but also on the needed training techniques.

Discussion

Transdisciplinary practices draw on collaboration methodologies as well as the diverse research methodologies within the collaboration. Collaborative work appears as a need for successful transdisciplinary efforts and communal professional activity among individuals with different expertise; collaboration is asserted as a value in itself because of its social consequences. Collaboration frames activities in a scenario of mutual benefits, where each participant contributes with her work to personal and group goals. Collaboration is expected to augment individuality because participants' peculiarities, strengths, knowledge, and skills may articulate and negotiate to achieve an integrated outcome, which could be more successful and constructive.

However, individuals have limited abilities to exploit the personal and collective benefits of collaboration. Formal or informal training methods need to be refined and tested to enhance transdisciplinary work. We are looking for multiple perspectives of training methods, because transdisciplinary work is not a homogenous culture of practice.

We are also interested in inspiration from metaphors from the natural environment. A key issue in transdisciplinary is understanding, and making explicit, the metaphors and terminology used in each discipline; we seek to clarify and make visible the metaphors and language shared in transdisciplinary practice. In nature, some animals and plants master interspecies communal living in some biological relationships and collaborative work. In mutualism, for instance, individuals from different species live together and

benefit from a relationship based on strategic alliances. There could be much to learn from the mutualism as a metaphor in human transdisciplinary collaboration, including training methods, while recognizing the limits of translating from one field of application to another.

As emphasized by a number of authors there is a need to test training methods to develop evidence of effective approaches, while recognizing the singularity of individual projects and the heterogeneity of specific project groups. Some projects are more focused on innovation as such, others on societal or cultural change. Anne Balsamo in her book *Designing Culture: The technological imagination at work* (Balsamo, 2011) emphasizes that individual innovation and transdisciplinary projects are embedded in a larger project of changing culture. Often projects are 'sub-optimal' in that the solution of a specific problem may cause unanticipated problems at the societal or cultural level. Such consequences can be studied using future casting or science fiction prototyping methods (e.g. Johnson, 2011), though the success of these techniques has not been convincingly been demonstrated.

For this project we re-emphasize that in "integrating framework" does not mean "unifying" frameworks; there is a literature on the problem of integration vs unifying approaches such as the work of Edward Slingerland and colleagues (Slingerland & Collard, 2011). A basic assertion is that transdisciplinary approaches bridge different ways of knowing and doing, and there is specific value of multiple approaches. Depending on the field of application, or problem context, some approaches are shared, but also different approaches will be required but that the results could not have been achieved with other means.

Most collaborations fail. We assert that it is necessary to develop methods and train professionals for transdisciplinary collaborations that bridge the arts and sciences.

This paper is presented as a working paper for the ISEA 2017 Panel and Workshop (ISEA 2017) with the intent of producing a synthesis report as an outcome.

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The Mutualism Relation within the Entrepreneurial Ecosystem

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Abstract

In Colombia, a city called Manizales has made a commitment to entrepreneurship creating the “Manizales Más” project to foster an entrepreneurial ecosystem that allows the city to strengthen the six different domains necessary to create and grow companies in a small size city of under half a million people.

Government, academia, and companies have found a way to do co-creation and adjust diverse standpoints to contribute to a bigger vision, a commitment to development and cultural change, a movement that invites to believe, create and grow. In this adventure, every stakeholder has made an effort to put in the table all their abilities to help entrepreneurs. Different multidisciplinary committees were created to propose activities, conduct workshops, boot camps and living labs to improve products and create new businesses. “Manizales Más” shows how through empathy, market test, and several iterations to define the product, entrepreneurs can create and grow a company taking advantage of everything the stakeholders offer.

Keywords

Entrepreneurship, Entrepreneurial Ecosystems, Innovation, Design Thinking, Entrepreneurial Design

What is “*Manizales Más*”?

“Manizales Más” is a public-private-academic alliance that begun with thirteen institutions working together to promote the development of the entrepreneurship ecosystem in the city of Manizales, Colombia. The main goal is to foster the economic development and to allow business ventures of all sizes and ages to grow more rapidly. Within the axis of this ecosystem, there is knowledge and intelligent action to transform the economic conditions of the city. This entrepreneurship ecosystem is based on Daniel Isenberg theory (2010) and has been developed with the help and support of Babson Entrepreneurship Ecosystem Project (BEEP). They presented the six domains necessary to have a self-sustaining entrepreneurship ecosystem: conducive

policy, markets, capital, human skills, culture, and support organizations. (Isenberg, 2011). Every domain has a share in the responsibility of promoting growth and the network expansion. In this case, even the use of the ecosystem metaphor itself explains the importance of symbiotic relations between agents, necessary to have the companies to survive and flourish.

This project was created in 2012 and by 2017 it has various programs that have improved the collaboration among diverse agents. The programs were developed by participatory design and all agents had the chance to give ideas and suggest changes along the way. Some of these programs are: High Potential Ventures, Adventure Más, Startup Más, Mentoring Program, Affiliates, High Potential Teachers, and Entrepreneurship Route. Each of the programs has a different objectives and target audience. The idea is to take advantage of the resources and opportunities different stakeholders have; for instance, academia has talented people, classrooms, and labs that the growing companies can use; the chamber of commerce offers support in the formalization of the companies; from the government side their responsibility is to adjust the legislation so it can be easier to have a business. It should be mention that many of the stakeholders come from the economic and business background; however, the entrepreneurs and advisors come from very different disciplines, there are engineers, lawyers, designers, agronomists, marketing professionals, health care workers, and basically every discipline is represented in what forms a diverse group. One of the biggest questions from other cities in Colombia has been: How can you work with so many institutions with such a diverse set of interests? In figure 1, the main stakeholders are portrayed; institutions from national and regional reach are important participants in the ecosystem and the Universities are main participants and promoters of the project.



Figure 1. Manizales Más Stakeholders in 2017

Why collaborate?

Predominantly in the business world, the typical relationship between companies is more predator-prey, with big business leading small business to extinction. In “*Manizales Más*” initiatives there is a bet on coevolution. The interactions between government, universities, guilds, associations, business and citizens have transformed the way they relate on a daily basis, aiming to a cultural change and a new vision toward entrepreneurship. In a way, it continues the ecosystem and mutualism metaphor mimicking diffuse coevolution, where several species evolve a trait in reciprocity with a trait in another species. Within “*Manizales Más*”, business transforms guilds, which transforms universities, which transform education and so on; creating a new way of relating to each other and developing new mechanisms for collaboration, access to different resources and gaining cross-disciplinary insights. What they have found is that mutualism is vital for the ecosystem development, both in nature and in business.

How is Done?

Collaboration in “*Manizales Más*” started with the well-known brainstorming. Initially, it was a very useful method to generate new ideas, but then it was deformed to an endless conversation about possibilities without taking action, so it had to move to new methods that allowed broader interactions and cocreation. The most used methods are briefly described ahead:

Peer to peer: this method brings 3 company owners together to prepare for the workshops. Usually the companies discuss their difficulties and learn from each other by sharing experiences dealing with similar situations. An interesting outcome of this

experience is that many of the companies begin new business relations after this.

Workshops: These have different audiences but always are conducted by a faculty member, either from local universities or Babson College. In the bigger companies, the objective is to collaborate in the construction of a detailed revenue growth plan. With the startups, the idea is to formalize the business and have a minimum viable product as soon as possible.

Mentorship: Senior Managers and retired CEO’s from Manizales’ companies work with the growing business to solve problems and inspire with their past experiences. An unusual outcome of this relation is the perceived attractiveness of the mentee companies to new potential investors.

Experiential learning: Using a practice-based approach suggested by Neck, H. M., Greene, P. G., & Brush, C. G. (2014). University students use play, empathy, creation, experimentation and reflection to propose solutions to challenges. The classroom space becomes a kind of lab where prototypes for new products and companies are presented each semester with a rocket pitch.

Creativity lab: The chamber of commerce has a space for creativity and problem-solving. The lab is called “Neurocity” and different groups go there to strengthen their creative and innovative capacities. It offers methodologies, spaces and services to initiate and accelerate the ideation processes.

Boot camp: It is useful for startups that need to validate their idea, market, and prototype. It is a space design to receive feedback from other entrepreneurs and faculty experts on the proposed business model.

Stakeholders engagement spaces: This allows stakeholders from different dimensions to interact with the companies, meet the participants and talk about the growing experience. The main idea of the stakeholders is to solicit new concepts to support the business creation and city improvement.

Leadership training: Every year a 3-day event is held to align and engage the leaders from public, private, academic and civic institutions. Here the participants involve themselves in lectures and exercises to redesign and enhance the Manizales Más Programs.

Living lab: This is a collaboration space that allows the participation of many agents from different domains of the ecosystem. It is the space for collective creation; usually the new programs are the result of these labs, where participants are immersed in a creative social space for

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designing and living the “Manizales Más” experience. In Picture 1 we can see the Scale Up Manizales 2016. The participants in the picture belong to all different domains of the ecosystem. There are entrepreneurs, teachers, big company owners, bankers, managers, government representatives, and outside guest invited to believe in the project and build the new initiatives.



Picture 1. Scale up Manizales participants 2016

Every stakeholder put their best into this experience, and some bring knowledge, people, spaces, money, labs, skills, ideas, students, labor, and commitment to growth. If something can be said about “*Manizales Más*” is that it is a good example of how transdisciplinary collaboration can accomplish big transformations in a community.

Discussion

In this five years, “*Manizales Más*” has been a melting pot; it has welcomed the inputs of every agent and has promoted practices like empathy, which allows entrepreneurs to understand the market. But it also has allowed the stakeholders to understand each other. This practice is determinant to the success of the different programs because the needs, desires, hopes, and expectations of every agent are very diverse; and through empathy, they have learned to listen to the others and act in a way that can be beneficial for everyone involved.

Each program in the project has very specific target audience and depending on what results are meant to be accomplished different methods are used. For instance, High Potential Ventures, is a program aimed at companies that have at least US\$200.000 sales. The

goal is income growth and job creation; for this kind of company the workshops focus on the idea of expansion and company improvement. Peer to peer and mentorship meetings become moments to re-think and discuss the entire company with people that can see the opportunities, strengths, and weaknesses with fresh eyes.

Addventure Más, is an eight-week business accelerator. In this case, new companies take the time to plan and rethink the business model. For two months around fifteen companies work together in a living lab, getting to know what they do, how they do it, and most importantly, what they should try to overcome the obstacles they are facing to earn more, have better employees, and sell better products.

Startup Más, is the place for idea exploration and business model construction. It was created with the students and graduates in mind, many of which went to entrepreneurial units asking for help with their ideas. This early stage is the perfect moment to prototype and iterate ideas before launching anything.

The Mentoring Program, takes advantage of the experience senior managers have accumulated; the growing companies get the chance to talk and learn from seasoned businessmen, that advise them based on their own personal experiences. This method has permitted to recognize the expertise and abilities of many CEOs that have a chance to give back to the community and share the lessons hard learned in business life.

High Potential Teachers, was created to promote a new mindset on professors so they can be the catalyst of change in the university. This is one of the most interactive experiences because educators are both learning and teaching in different moments. Sometimes on the learning side, they are with another faculty member, sharing experiences, accompanying mentorships, or attending workshops. And when they are conducting sessions they lead the audience, whether students or companies to use the resources they have to create new things, evolve, and transform the ecosystem.

Entrepreneurship Route with its six courses has become the space for experiential learning. Students are encouraged to create new companies, propose new products, and the most important part, to build a functioning prototype to test their ideas. The students have learned by doing and have had to face an audience to convince them of the importance of the proposal and explain how they solve a problem or have found a more innovative way to do things.

Doing market testing in different stages allows companies to see how the product or service is perceived, within “*Manizales Más*”. Prototypes and prospective client interviews become an input that provides information for decision making. Every time a new version is released, new information is gained and improvements can be made. All of those iterations become part of the secret sauce of growth and ecosystem sustainability.

In the end, the best method to use depends on the size and needs of the stakeholder, whether it is an early entrepreneur or a seasoned company owner, an undergraduate student or a professor, the mayor, a banker or a citizen, all are welcome to participate in the construction of the ecosystem. All of them play a role in the improvement of the city’s conditions to believe, create, and grow.

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Interdisciplinary Innovation, Collaboration and Learning Processes in Academia

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Abstract

This article describes a transdisciplinary and educational experience at the San Francisco de Quito University in Quito, Ecuador. I was a member of the faculty and a researcher from 2014 to 2016. I was also a visiting artist at the Microbiology Institute of the University. As a researcher, my projects require of an intense collaboration with other scientists and the close relationships I developed with many of them allowed me to create a new subject, which was taught for the first time in Ecuador. The subject was called "Transdisciplinary Research Lab". This new course, which was 18 weeks long and was carried out during the second semester of the 2015-2016 academic year, was available to all students, regardless of their level or career.

On this paper, I will explain the work done during this experimental course and the conclusions obtained from it. I am also looking to highlight the importance of implementing transdisciplinary education as an enhancer of the creation of new knowledge, not only in the academic sphere, but in cultural and research centers too. Setting up new "hybrid" labs for experimentation, that work as a venue for two "opposite" fields like arts and science, enables the creation of bolder, contemporary, innovative and creative proposals which would better connected to the social demands of the XXI century.

Keywords

Learning, Academia, Transdisciplinary, "Hybrid" Laboratories, Collaboration, Creation, Innovation, Knowledge.

Introduction

In 1959, C.P. Snow, an English novelist and scientist, presented in a conference at Cambridge University (during the famous lectures called Sir Robert Rede's Lecturer or Rede's Lecture), the distance between humanities and science, a tradition established during the XIX century romanticism. *The Two Cultures and the Scientific Revolution*, as Snow called his lecture, explained the difficulties of creating bridges between the two types of knowledge, due to the specialization process and the impossibility of drawing a horizontal vision in relation to ontological studies (Vesna, 2001, pp 1212-125)

Later, in 1963, he published the second edition called *The Two Cultures: A Second Look*, where he predicted the birth of a new "third culture" as a new common space for the exchange of knowledge between both disciplines, just as it happened during the Renaissance: Science, arts and humanities were considered a "triangle of knowledge" thanks to historical characters like Leonardo Da Vinci or the famous painter and inventor of oil painting: Jan Van Eyck (Edwards, 2008, p. 143).

The position held in the aforementioned lecture by C.P. Snow (a remarkable and crucial fact in the formation of the current tendency reconciliation between humanities and sciences), commonly mentioned in the related literature, is not rare. For example, Lewis Mumford, who published his first book *The Story of Utopias* in 1922, accused the growing gap between science and art as responsible for social, cultural and spiritual ills (Mumford, 1922, pp. 282-284). As presented by the scientific historian, Paul Forman, the world of knowledge and the world of dreams have not always been separated: "Let's think of the time when the artist and the scientist, for all practical purposes, would look upon the 'exterior world' thru the same kind of lenses" (Forman, 2007, p. 280).

According to Forman (p. 299) Mumford denounced the absence of reference of its own research from his American critics: "I never accepted C.P. Snow's division of the 'two cultures'". He continues saying: "Though I find ironic that even American critics who discuss this thesis never refer to various contemporaries like myself who had already dissolved that false dichotomy in practice".

On his third book, *The Golden Day: A Study in American Literature and Culture* (1926), Mumford elaborates on a great story about the degeneration of thought, because of the separation of art and science. Moderns science accepts only that which is objective, abstract and quantitative as real, denying the existence of a mayor part of human experience, specially aesthetics.

Mumford lashes out against the success of the modern scientific method (which is based on the description of natural processes as the origin of new technologies) as a sponsor of a generalized conviction, based in a mechanized view of the world as the only true. The consequence of seeing the world with an inhuman and mechanized view was to achieve the inclusion of technology in the human body (man-machine): the creation of unsensitive automatism. Science meant all the supposed modernity that implies being the result of the most elevated and disciplined form of thought. Mumford places in the arts (composed of aesthetics) all the affective and subjective capacities and the human experience and lays them in front of the scientific community.

Paul Forman (p. 277), insists that Mumford's main demand (as a romantic) was to embrace the values of science and humanism. At the same time, he found common grounds between subjectivism and objectivism, arts and science. This common ground is defended by romantic poets like Novalis (Friedrich von Hardenberg) or Friedrich Schlegel, who states: "All art must become science and all science must become art" (Schlegel, 1991, p. 14). Goethe, German scientist and romantic writer, agreed. He considered that the most elevated forms of knowledge arise from the contact of two seemingly opposites approaches: arts and science (p. 276)

But Mumford was not the only one at his time defending the union between art and science. George Sarton, a Belgian chemist and mathematician, who is considered the founder of academic science, was looking for a new humanism composed of both disciplines. He stated in 1930 (paraphrasing the author) that the "scientific era" was far from being perfect since the elite was divided in two mutually hostile groups: humanist and scientist. This reveals the pressing matter of reducing the ever-growing gap separating them (p. (277).

Despite the considerable number of theoreticians favoring a transversal practice, divided positions arose in the scientific and humanist community during the XX century.

Nowadays, the "gap" denounced by Sarton, still exists in several academic systems in countries like Spain. This makes of the implementation and promotion of transdisciplinary research a pressing and urgent matter. This type of research can be used as an enhance method for the procurement of new knowledge in the field of union-incurion among artistic and humanistic disciplines with their scientific and technical counterparts. The demand for this kind of research was

reflected in Spain with the elaboration and publication of *El Libro Blanco de la investigación en Humanidades* published in 2006 (FECYT, 2006).

Experiences on Transdisciplinary Learning

Ecuador is one of the least developed countries in Latin America when it comes to promoting contemporary art and art studies in museums and universities. This means an obstacle for encouragement of the transdisciplinary practice from the art side, either in cultural institutions or universities. The San Francisco of Quito University, one of the top Ecuadorian universities, is a private institution based on the American "liberal arts" teaching model. The advantage of working in this institution is that it allows an easy and very straight communication with different teachers and researchers. This specific environment makes collaboration accessible. Nevertheless, the biggest disadvantage, since it is a private university, is that there is no financial support for research and the study of the arts since they are not seen as a relevant discipline or a source of research and innovation.

After six months as a full-time professor at USFQ, I was permitted to attend microbiology, botanic and biology classes as an auditor, which allowed me to meet with different researchers and exchange views. I was also able to investigate at the Microbiology Institute as a visiting researcher. In the lab, they taught me the scientific method in the fields of clinical microbiology and food microbiology. Gradually, I got the attention of the scientific community and they started to take a serious look at the collaboration between disciplines (I was lucky that some of the researchers studied in the United States and they knew projects and synergies between artists, designers and scientists).

Transdisciplinary Research Lab

A year and a half after I started working at the university and with the support of the Microbiology Institute, which had invited me on several occasions to participate in conferences to show my research. I managed to convince the Dean of the School of Communication and Contemporary Arts (where I was working at the time), to open a course to promote transdisciplinary practices.

The requisites imposed by the Dean were that the course would be available to all students from the first semester to the last year of their degree. We did not have a laboratory (just a small painting studio with a projector and no Internet connection) and there was no funding for

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purchasing materials.

Attendees were a total of 15 students from different careers such as art and performance, photography, painting, medicine, biology, engineering, psychology and film.

Course and Syllabus Design

Contents were divided into the following parts: Practice and theory studies as well as two sessions at the microbiology laboratory, a visit to the Meteorology Institute, a field trip to help botanists collect photographic documentation, a design and biology experiment, and lectures from philosophy, medicine, art, microbiology, biology and environmental engineering professors with a great interest in transdisciplinary projects.

Students had to develop two projects:

1. A team work in collaboration with the Department of Environmental Communication: Environmental Protection & Sustainability initiative.
2. Groups of two to develop an Art-Science project. One from scientific discipline and the other one from humanities.

This course presented the following units:

- UNIT I: Contemporary Cultural Epistemology: An Unresolved Paradox
- UNIT II: Ecology, Art and Microorganisms: "Hybrid" Laboratories.
- UNIT III: Tissue Culture and Techno-Organic Ontology.
- UNIT IV: Astrobiology, Space Art and Exobiology: Expeditions to the Cosmos.
- UNIT V: Remote Landscapes: Ecological and Aesthetic Characteristics for Artistic Intervention.

Figure 1. Arts and Transdisciplinary research lab (subject students in their first Microbiology lab lesson coordinated with the Microbiology Institute of the San Francisco de Quito University)

Students' Transdisciplinary Projects

I would like to highlight the proposed projects of two teams formed by art and science students.

Figure 2. "Temperamental Skin" is a project that seeks to change people's perspective on the way life on the planet earth has evolved. Making use of smart materials, we have designed special suits that imitate the ability that certain animals have to change their appearance as a response to their environment.

Figure 3. "Engraving with Bacteria" is a new process of engraving using bacteria that produces acids that are very similar to the acids used in the regular process. This new technique is safe and an interesting way of using a non-toxic method.

Conclusions

1-Establish a professional relationship with the scientific academic community was a very slow process and a real challenge. However, I developed an empathetic relationship with most of the scientific researchers at the university. They always helped me by using their labs and materials for my own use or my students'.

2 -I collaborated with environmental engineering, nano-electronics, and robotics researchers who were interested on my ideas to elaborate in their classes and asked me for different ideas to be developed by their students in their final dissertation (thesis).

3-Environmental engineering professors wanted to collaborate with some of my visual-digital art students to develop data visualization projects.

4 - Unfortunately, I never had the support of my own Art Department.

5 - When developing projects made by two students from different disciplines, I can conclude that the ones from the initial semesters were more enthusiastic and cooperative than the ones in their last year.

6 - The UNIT II was the most interesting for my students.

7 - Working without my art department support and with different scientific departments that helped us whenever they could, caused changes in the course's syllabus in several occasions.

8 - Most of the students said to have had a wonderful experience working with students from a different discipline.

9 - The Microbiology Institute's team allowed some of my art students to use their lab and helped them to develop their own ideas as they considered that some of these ideas could be registered as patents.

10 - Some scientific professors requested to participate in the following semester.

11-The Microbiology Institute's team showed interest to offer this course in their program.

12-At the end, the School of Communication and Contemporary Art rejected the continuation of this course, forcing the closure of some of the projects.

13-However, under these conditions it was a fruitful personal experience as a professor and an artist.

Acknowledgements

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Author Biography

Paz Tornero has a PhD from Universidad Complutense de Madrid, her dissertation was a research into the fields of arts, science and technology. She has a B.A in Fine Arts from Universidad Politecnica de Valencia. M.A in Digital Arts from Universidad Pompeu Fabra. She was a visiting researcher at Harvard University at the school of Engineering and Applied Sciences and at MIT's Media Lab. She held positions as a visiting professor at Universidad Complutense de Madrid, full time professor at Universidad Técnica De Loja and

Universidad San Francisco de Quito, Ecuador. She is an Associate Professor and Researcher at the School of Fine Arts at the University of Murcia. Her projects have been showed in international festivals and galleries. She wants to continue collaboration with laboratories and Scientific professionals.

Art, Science and Anthropology Experiments: Inviting other Knowledge about Mosquito-borne Diseases through Transdisciplinary Collaborations

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Abstract

In order to investigate the effectiveness of public health campaigns to reduce mosquito-borne diseases, I have designed a series of “public experiments” that combine ethnography and artistic installations. In these experiments, a collaborative team— including scientists, artists and patients—create relational art experiences using visual and sonic media and performance. People in these collaborations participate by attending “parasite” events in which they gather together as research partners, subjects and objects at the same time. These events provide a means for dialogic and experimental approaches, allowing the hybridisation of “research outcomes” and “the research itself.” My approach to collaborative forms of research aims at ethical and inclusive ways of understanding people’s knowledges and understandings. The best practices for successful collaborations are, therefore, derived from open-ended and process-based events that stimulate debate among the public and the intersubjective exchange of experiences. Based on these premises, I present *Serotype*, *Vampires* and the *Mosquito Kite Project*, public experiments in which the pre-established ways of working for designing health campaigns were put aside. By doing so, I argue that a new relationality, one that includes both the academic and public domain, is needed for thinking differently about mosquitoes and diseases.

Keywords

Multispecies Relations, Health Campaigns, Mosquito-borne Diseases, Coexistence, Public Experiments

Introduction

As humans, most of us believe we have power over other living beings. We think we are superior and invincible. However, mosquitoes, with their annoying buzz and their capacity to transmit diseases, constantly reveal how vulnerable and powerless humans are (Jones, 2012; Valencia-Tobón, 2012, 2015). Mosquitoes eat us alive: by sucking blood they are taking part of our life (Galeano, 1985, p. 27; Jones, 2012, p. 37; Painleve, 1945; Ulrich, 1993, p. 85; Updike, 1960).

There have been many attempts to eliminate

mosquitoes, all based on the premise that these insects could be removed from the earth (Fang, 2010). After hundreds of years, though, mosquitoes not only continue to reinforce blood ties with us but they also bring about new crises for human populations—seen in the latest Zika and chikungunya virus outbreaks, for example. Governments and health authorities respond to such threats by replicating campaigns that were standardised more than 90 years ago to fight mosquito-borne diseases (for examples of how campaigns are standardised, see: <https://goo.gl/Bby5PU>).

Eradication campaigns invite communities to participate in taking action against mosquitoes, suggesting that since mosquitoes breed in receptacles in and near human dwellings, people just need to destroy these receptacles and diseases will disappear. However, this approach has been applied without significant reduction of dengue, Zika or chikungunya cases across the globe.

My work responds to this pattern of ineffective campaigns with collaborative artistic and ethnographic para-site events. Through these efforts, participants develop new ways of understanding the multiplicity of relations between humans, mosquitoes and diseases. I call this approach “multispecies ethnography as public experiment,” for while scientific approaches are delimited by objective and rational theories and the deductive method, the study of social relations in anthropology focuses on subjective realities, and art on aesthetic expressions. In this context, transdisciplinarity implies the problematisation of situations that require novel responses, raising questions and facilitating the interaction of new forms of thought, dialogue and experimental approaches, rather than simply considering problems as obstacles that need to be overcome (Barry & Born, 2013, p. 10; Barry, Born, & Weszkalnys, 2008, pp. 29-30).

This project focuses on the interaction of scientific, public and everyday understandings of mosquito-borne diseases. Interdisciplinary and transdisciplinary relations “portray the microsocial collaborative endeavour between artists and scientists as a crucible for creativity and as itself a focal value” (Barry et al., 2008, p. 30). These events facilitate interactive communication and “participatory engagement” in which the human element and the subjective experience of “real people” (non-expert citizens or publics) are taken into account (Nowotny, Scott, & Gibbons, 2001, pp. 256–257).

Para-Site Events and the Co-existence Criterion

For George Marcus (2000), a *parasite* is a metaphor for the overlapping of academic and fieldwork spaces in contemporary ethnographic projects. It is a site where interpretation occurs within a dialogic model, where experimentation is the key element (Marcus, 2000, pp. 5–6; Rabinow & Marcus, 2008, pp. 80–81). Thus, by allowing the hybridisation of “research outcomes” and “the research itself,” a para-site works against the conventional notions of the “field” and “fieldwork,” creating new relationships between participants (Marcus, 2000). Marcus does not evoke the negative connotation of “parasite,” as it is used in a narrative of resistance of the “weak over the strong”—for example, the capitalist as a parasite on the workers. Instead, the term points to a place for doing things in a different way to how they supposedly should be done, “a site of alternativity in which anything, or at least something different, could happen” (Marcus, 2000, p. 8).

Building on this idea, I wanted to re-work fixed categories—like the discourse of eliminating mosquito-breeding sites and the notion of “human exceptionalism,” where we believe we are more important than other living beings—to create events for thinking critically about contact zones between human and non-human others, where the division of culture and nature is blurred (Allora, Calzadilla, & Chiang, 2015; Kirksey & Helmreich, 2010, p. 546). This implies constructing a mutually constitutive method between art, science and anthropology that looks for new results and explores the unexpected, by working on the aesthetics of human-mosquito life.

To do so, I applied the *co-existence criterion* in both relational art (Bourriaud, 2002) and in ecological terms (Begon, Townsend, & Harper, 2006; Molles, 2015). This criterion indicates that works of art should

be created as a form of sociability and, therefore, a fundamental question should be asked in terms of public participation: *does this work allow me to enter into dialogue?* (Bourriaud, 2002, p. 109). In this framework, people’s thoughts are as important as the artwork as such. Relational art is a way of opening up the context and giving people the possibility to complement the work of art. In ecological terms, the coexistence of two species is possible when “interspecific competition is weaker than intraspecific competition” (Molles, 2015, p. 290); hence, different species coexist by a “differentiation of realised niches, or a ‘partitioning’ of resources” (Begon et al., 2006, p. 238). These strategies are materialised in a series of participatory experiments developed in Medellín, Colombia, and created with the collaboration of virologists, entomologists, artists, members of the public, and the subjects of my ethnography who have had dengue and other mosquito-borne diseases.

Serotype, Vampires and the Mosquito Kite Project

One example of these transdisciplinary collaborations is *Serotype* (Valencia-Tobón & Bimana Producciones, 2014), a fictional character who embodies the experience of having dengue fever. This character was created in partnership with artists and virologists, after identifying that eradication campaigns did not include the experiences of people who have had the disease (Valencia-Tobón, 2016).

Another example is *Vampires* (Valencia-Tobón & 3B Espacio, 2013), a series of interventions in public and private spaces, designed to engage people in different ways with illness narratives and with virological and entomological understandings. Willing to reflect on human-mosquito relations, and knowing that the idea of “love” is deeply associated with the conception of blood as the very liquor of life (Jones, 2012, p. 38), we used the phrase “Vampires: your love hurts down to my bones” to advertise video installations, audio interventions and multi-sensorial experiments.

The last example is the *Mosquito Kite Project* (Valencia-Tobón & Ramírez, 2014), supported by the Royal Anthropological Institute and the Horniman Museum in London. This project went beyond critiquing the discourse of traditional health campaigns to try to re-think how mosquitoes are understood to interact with people. We used a kite in the image of a mosquito to reproduce the form and movement of mosquitoes, and it was also the perfect tool to collect stories while walking

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all around the city (see public responses to my work here: <https://goo.gl/00kwCz>).

In all of these cases, the participants and I were expecting to reach the community in an innovative way, far from the typical approaches usually taken by health authorities. The concept of these events was to radically intervene and deliberately break the frame of reference of these spaces to create a third space, a new space of interaction. Through transdisciplinary collaborations we encouraged people to think of the mosquito as a living being rather than simply as an object to be eliminated. Such a new relationality is needed to think about mosquitoes and diseases not only because a world without mosquitoes is highly unlikely (Fang, 2010) but also because we need to accept that we cannot escape from parasites and viruses (Barnett, 2014, p. 216).

Endings

These art, science and anthropology experiments should be understood as a “negotiation” of intersubjectivities. Through these transdisciplinary collaborations, we have created a third space in which we facilitate new relationships among audience members and between the audience and collaborators.

Now, what insights into the particular qualities of human relations with mosquito-borne diseases are revealed by this kind of work? For one, it offers a critical perspective on the structure of relations among virologists and entomologists in the way that they produce knowledge about mosquito-borne diseases, how the “public” is conceived, and what counts as “evidence.” With this insight, my collaborators and I designed and performed different experiments to reproduce this structure and invited people to take part in their design and operation. The experiments highlighted how laboratory science and state-led education campaigns were premised on particular relations between people and diseases/mosquitoes, and then allowed participants to play with and reconfigure such relations. In this process, we identified how people conceived of the relations between people and diseases/mosquitoes, and then followed the understandings of mosquito -borne diseases that emerged in participants’ responses to this work. Based on these experiences, I argue that health campaigns need to be re-designed, privileging relations and stimulating debate among the different actors who are part of the complex network of biological,

physical and social relations generated by vector-borne diseases.

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Bank (Washington, DC, 2010). With a background in biological sciences at the Universidad de Antioquia (Medellín, Colombia), Alejandro received a MA in Visual Anthropology with Sensory Media in 2012 and a PhD in Social Anthropology with Visual Media from the University of Manchester in 2016. He is currently based in Cali, Colombia, as Assistant Professor in the Faculty of Humanities at the Universidad Autónoma de Occidente.

Author Biography

Alejandro Valencia-Tobón is interested in developing interdisciplinary collaborations and experimental methodologies at the interface of art, anthropology and science. Valencia-Tobón's work has been exhibited at the Festival International de cerf-volant de Dieppe (Dieppe, 2016); 42nd Photographic Art Salon, Universidad Pontificia Bolivariana (Medellín, 2016); Medellín Planetarium (Medellín, 2016); Horniman Museum & Gardens (London, 2013); Miami Science Museum (Miami, 2012); Museum of Science & History (Jacksonville, 2011); Lakino Film Festival (Berlin, 2011); La Plata Audiovisual Art Festival (La Plata, 2011) and the Inter-American Development

Higher Education for Sustainable Transitions by Mutual Learning in Immersive Transdisciplinary Real-world Laboratories (RwL)

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Abstract

In order to address the complex and interconnected phenomena related to planetary boundaries challenges, 'real-world laboratories' (RwL) are increasingly used in sustainability and transitions research for experimenting with sustainability solutions. More recently RwL are also introduced in higher education aiming to create a better understanding for societal sustainability transitions, and furthermore to train competences for personal sustainability by academic-practitioners mutual learning settings. This paper pre-sents insight and experiences with transdisciplinary RwL in immersive urban and rural learning environments following a system-ic, participatory and inventive 'Research Arts approach'. An im-pact analysis exposes early findings of this evolving educational methodology highlighting gains as well as lessons learned.

Keywords

Transdisciplinary Reallab, Research Arts Approach, Community-Design Practices, Capabilities for Collaboration, Mutual Learning by Immersive Settings, Higher Education for Sustainability.

Introduction

Within the context of transdisciplinary sustainability research and transitions research different attempts have been undertaken to address the gap between academic knowledge as e.g. used for designing prospective sustainable scenarios and an their hands-on implementation, often failing due to social realities as habits, convenience or short term interests. The German term 'Real- world laboratory' or 'Reallab' is a concept mostly referring to research that addresses real-life problems and bases on academic-practitioners knowledge coproduction and practical co-implementation by jointly elaborated solutions. Schöpke et. al. (2015) refer to related concepts as living laboratories, urban transition labs, social innovation labs and further niche experiments. The experimental lab environment is combined with the real- world context to test transferable solutions for sustainability challenges

(Schneidewind 2014, Schöpke et al. 2015). However in education, the Reallab-approach is still a peripheral phenomenon (Beecroft; Parodi 2016: 5) despite of its potential for enabling transformative mutual learning processes, strengthening environmental awareness and cultivating capabilities to deal with sustainability challenges.

Higher Education for Sustainable Transitions

RwLs as trained by the author at Leuphana University in Lüneburg are rooted within the twofold framework of 'transitions education' providing systemic understanding of the preconditions and options for sustainable action and 'transformative education' focusing on expected or occurred transformative impact of socio-ecological innovations, both approaches focusing on the transformative power of personal actions (WBGU 2011: 24). Besides, the RwL aims to build students' capabilities for Responsible Research and Innovation RRI (current European Commission Research Strategy) training among other anticipation, self-reflection, openness, transparency and responsiveness through an immersive learning context. In this way, RwL intend to foster societal sustainable transitions by cultivating students personal sustainability (Veciana 2017b) and by exploring ways of up-scaling practitioners' socio-ecological innovations.

Mutual Learning within Immersive RwL Settings

Following a unpublished survey by student A. Lomberg, (2016) Leuphana University students often consider their curricula too predominated by theory, requesting in its place for more practical learning environments, and guidance for further exchange options and formats with practitioners or local actors. RwLs intend to accomplish both.

On one hand, the RwLs offer real-world observation and experiments e.g. by 'immersion in a sustainable lifestyle' of an ecovillage¹ in a rural context (Stützel E.,

¹An eco-village is a human-scale, full-featured settlement in which hu-

personal communication, 23.02.2017, Sieben Linden ecovillage) or by immersion in a challenging urban context. Students e.g. spend some days in an ecovillage and immerse themselves in the sustainability culture they are studying. The immersive character of the learning experience often confronts students with situations that take them out of their comfort zone. This can raise mental awareness e.g. about own pre-conceptions or unsustainable habits. Additionally immersion enables to integrate mental observations with emotional and physical perceptions leading to a long-lasting learning experience for personal sustainability. On the other hand, RwLs support academic-practitioner mutual learning by applying the integrative and participative Research Arts methodology that combines the use of (1) research methods of trans disciplinary research as qualitative interviews, participatory observation, systematic data- collection, etc. (2) community-design methods as trained in intentional communities e.g. Forum or A-B talks, and (3) creativity methods related to artistic practice as urban interventions, human sculptures or co-created imaginative video-documentations. Mutual understanding and authentic communication is stimulated in an intense while stress-free experiential learning environment.

Transdisciplinary RealLabs in Practice

Transdisciplinary Reallabs for future models of sustainable lifestyles

Since 2015 three RwL were realized in close cooperation with German ecovillages (Centre for Experimental Social Design ZEGG, Schloss Tempelhof. community and Sieben Linden ecovillage), some of them within regions of a comparative low level of infrastructural development.

After an introduction into transdisciplinary research and methodology, students discover during an excursion on site stimulating social&technical innovations created by ecovillagers. They learn e.g. anticipating the benefits of humus formation for soil-fertility/food-supply or how innovative community-building/decision-taking

man activities are harmlessly integrated into the natural world in a way that is supportive of healthy human development and can be successfully continued into the indefinite future. (Gilman, R. 1991: 10). The term 'eco-village' covers the most varied forms of communities: from traditional villages to intentional communities to sustainable urban neighborhood projects, which are becoming increasingly networked (Veciana 2016: 39).

processes solve problems of inclusion.

In a world café the students gain the capacity to create with practitioners common responsive research questions. The tandem teaching enables exchanges with ecovillager-experts in specific areas during and after the excursion. In their follow-up research papers, students enhance these local innovations invigorating a community-based research agenda. Some paper proposals were continued in an student-ecovillager collaboration after the RwL, resulting e.g. in a 'keyline design' feasibility study applied on an ecovillage agricultural landscape for maximizing beneficial use of water, recognizing cultivation patterns, etc..

The Reallab is an exciting open process to engage students into RRI from a sciart approach as it: (1) fosters anticipation and reflection about problems that matter; (2) teaches communication techniques that encourage openness and transparency for mutual understanding in academic-practitioners collaborations, and (3) equips students with responsiveness and competencies for adaptive change (4) by introducing students into the complexity of future risks.

Transdisciplinary Reallabs for Good Life

While the previously mentioned RwLs took place in rural environments, the following Reallab-type focused on urban areas of Lüneburg. After an introduction into urban sciart transition initiatives e.g. a sustainable art & renewable energy project to revitalize an abandoned building, students analyse these good practices reflecting on what is meaningful to them for a good life (buen vivir/vivir bien).

The common task for the students is to co-create a participative and local RwL project, by following step by step a particular participative Research Arts procedure: first, students combine in a playful artistic collaborative method their personal research interests and backgrounds, and elaborate a common research question oriented by a shared notion of good life. Second, students experiment with the situationist practice of urban drifting (derive) being drawn by the attractions of the terrain and the encounters they find there. In the meantime, the tandem teachers map their 'psychogeography' through a continuous mobile feedback loop. Through these particular situationist perception students identify an unsustainable situation in a specific urban context. Third, students use qualitative interviews or other research instruments to analyse

the chosen problem in depth while documenting their observations with audiovisual recordings. Local actors are chosen randomly or by further exploration and asked for collaboration. Forth, students co-create a digital collection of data, analyse their findings, and finally integrate them into a solution-oriented video-narrative by applying inventive digital art practices.

As an outcome e.g. one project identified the problem of unused public sports facilities in Lüneburg and created a video for a ‘mobile mini-festivals’ project as a solution to promote local artists, to revalue urban abandoned spaces as shared commons for good life, and to facilitate cultural exchange between all ages and cultural backgrounds.

Transdisciplinary RealLabs impact

In this section, first some initial results for students, teacher/researcher and community-members are summarized. Second, lessons learned are exposed. Findings are based on Leuphana University course evaluation (LVE), the author’s transdisciplinary self-evaluation analysis (Klein 2008), and an unpublished survey by Leuphana students Lomberg A. and Muser J. (2017) of all three RwLs for future models of sustainable lifestyles.

Academic advances Academic-practitioners tandem teaching in RwL resulted in a fruitful co-design of the theoretic contents and practical exercises including students’ ideas and feedbacks. By integrating mixed collaborative methods in RwL an attitude of reciprocal academic-practitioners support and of mutual trust in each other’s knowledge, skills and capabilities. Furthermore, the theoretical RRI principles could be implemented in to real-life experiences in higher education for sustainability as an innovative approach for Education for sustainable development (ESD).

Students knowledge and capabilities gain Students (1) discover new fields of sustainability research integrating the four dimensions of sustainability, (2) learn about sustainable life-stlyes and experience community life, (3) experience how theory and practice can come together in their respective research fields becoming actively engaged in socially relevant issues, (4) get the opportunity to develop their re-search questions on sustainability through personal contacts with ‘pioneers of change’, (5) can contribute with their paper in a participatory study on the research needs of intentional communities contributing to a research agenda in this

area, and (6) cultivate curiosity, creativity and critical think-ing skills by artistic tools.

Key capabilities for sustainability (Veciana 2017b) resulting out of the immersive learning experience that combines research methods with community-design practices are particularly self-reflexivity and openness to others beliefs or values, conflict culture and self-responsibility, self-empowerment and leadership.

Community and Society at large The communities remarked encouraging outcomes as: (1) specific relevant outputs to the community, and few being continued in further research or practical projects, (2) recognition of intentional community as learning environment for academic partners, (3) research approaching the challenges of the everyday life of ‘pioneers of change’ (WBGU 2011), (4) creation of new local or regional alliances and new inter/national connections via networks (e.g. GEN, ICSA, ECSA, ECOLISE). For society at large, the outcome of a survey on research needs based on the co-developed findings of young future re-searchers and ‘pioneers of change’ can contribute to good governance recommendations and a research agenda for sustainability research that integrates the four dimensions of sustainability.

Lessons learned for improving the transdisciplinary RwL experience: Students need more (1) time for field trip as some students felt overwhelmed by the amount of information and new experiences, (2) and personal support for students to overcome challenging feelings coming up while experiencing the gap between their everyday life and the ecovillage live-style and how to make a relevant contribute to the well-thought socio-ecological innovations of ecovillagers. (3) More supportive funding is required to pay honoraria for practitioners and travelling costs for students.

Acknowledgements

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Conclusions

By linking the transdisciplinary RwLs approach with higher education for sustainability, the author aims to enrich the panorama of transformative learning environments for personal and collective sustainability. This paper shows how the systemic, participatory and inventive ‘Research Arts approach’ stimulates mutual learning processes to nurture key capabilities for lived sustainability as by immersion in the sustainable lifestyle of an ecovillage. Further research need concerns long term transformative impact of transdis-ciplinary RwL on different educational settings, diverse social contexts and research practice itself.

AuthorBiography

Dr. Stella Veciana lives at Sieben Linden ecovillage and teaches at Leuphana University, Lüneburg. She worked at the Civil Society Platform Forschungswende for a participative research governance. For the German Agency for International Cooperation (GIZ) & Fondo Indígena (FI) she created a transdisciplinary research program for indigenous communities. Studies in experimental arts (UdK Berlin), computer arts (SVA, New York), MBA in research management (UPC/ESEA Barcelona), PhD in transdisciplinary artistic research (UB Barcelona). Research fields: sustainability research, community-based research, artistic research, open science, transdisciplinary collaboration methods, participatory governance. Veciana is founder of the Research Arts platform: www.research-arts.net

Bio Visualization and Cinematic Experiences

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Abstract

The panel's goal is to explore art / science / technology relationships amidst the proliferated production of scientific and artistic data and the various forms of representation beyond traditional two-dimensional static interfaces. This panel is interested in gathering an interdisciplinary intercontinental group that includes producers of biological data, artists, and producers of the moving image, scientists and architects to provoke a dialogue about how bio visualization is becoming an intensified avenue for scientific and artistic exploration and knowledge production that had not been possible until recently. This panel will explore the relationship between data and its imaging in interactive environments, mediated by biological concepts. The panelists will address how the representation of the big data in virtual or interactive environments have moved beyond metaphor and bio mimicry and how they provide a vital contribution to all living beings that must find creative ways to coexist and survive the Anthropocene.

Keywords

Visualization, Data, Interactive Environments, Bio-Creation, Moving Image, Organic Processes, Liquid Architecture.

Introduction

Data visualization has evolved from a marginalized practice to a developing science whose ramifications are increasing daily. But, have we not historically been slaves of data, to survive, to organize crops, to determine the course of societies? Why this boom occurs at the height of the computer age?

While it is true that the rhythms of life have accelerated, and with it the production of data, it is also true that the radical change has been in the way the data is obtained, the way they are interpreted and the spaces where they are published. And the novelty is that now data visualization is transversal to this chain: it is mediating all the moments and is present in all the scenarios.

Bio Visualization and Cinematic Experiences panel is a comprehensive approach to data visualization. From different perspectives the authors address the complex fact of grouping data and communicating ideas and messages through digital applications, in different contexts and disciplines, mediated by biological concepts: Grisales and Correa reflect on how to generate greater learning processes in bioinformatics combining multimodal ways of cognition and multimodal technology experience; Restrepo abstracts the problem of visualization and transfers it to visual realistic representations that translate the multiple and simultaneous data produced by body movements into scenarios and avatars, rather than hierarchical schemes, since computer-based interactive spaces in real time are defined as dynamic, iterative and organic processes; Brakke criticizes architectural representation systems based on movement mapping and simulation work, through concepts of warm behavior like silk worms that enrich and change the perspective of the concept of bio-visualization; Finally, Rivera explores the possibilities that result from understanding the visualization of data from the categories of moving image and how the union of these two universes could produce richer experiences, where its own logic would generate a new relationship of the user that navigates the data with the data navigated, creating a sensitive experience.

We hope that this panel will expand the horizons of those who attend the discussion, in a subject that is crucial to understanding and putting into practice the representation of the millions of data that we are seized today.

Multimodal Interaction, Medial Arts and Education

A case applied in the multimodal learning of bioinformatics concepts and the visualization of biological data

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Abstract

Bioinformatics and computational biology seek to apply computational tools mainly to make decisions based on the visualization of the biological data [1]. For this reason, it is now stated that both belong to the group of sciences with greater projection in the acquisition of scientific knowledge [2], which will bring with it and globally, a crucial change in biological research [3]. This rapid scientific progress suggests that bioinformatics will play a fundamental roll in our daily lives and in this sense, interacting, visualizing and learning about the manipulation of these biological data gradually becomes more relevant to enhance the public domain of this knowledge. In a mega biodiverse country such as Colombia, learning the principles of bioinformatics is essential for the public to make informed democratic decisions about the benefits and perceived risks associated with bioinformatics. Educational interventions based on project research to expose students to biological data are urgent to meet these needs.

Keywords

Multimodal interaction, multimodal learning, biological data visualization, medial arts, bioinformatics, education

Introduction

These sciences (Bioinformatics and computational biology) study molecular biological structures such as genes and proteins, which come from a sample and are converted into discrete data for analysis. The visualization of these macro structures cannot be drawn with pencil and paper that is why computational tools are necessary for visualizing them and to learn how they works.

Human learning can be described as a multimodal perception experience, where senses help human beings to apprehend concepts, skills and meanings. In this perception process, sight linked to the visual cortex as the sense with greatest incidence in the capacity of our brain to store information [4] works together with

hearing and kinesthesia in order to generate a greater quality in the learning experience.

How to generate greater learning processes in bioinformatics combining multimodal ways of cognition and multimodal technology experience, is central to this paper.

The key aspects to structure critical learning about the basic concepts of bioinformatics lie in the reflection on the composition of molecular macrostructures and the understanding of the impact their visual representations have on the making of decisions.

To expose the student to an environment communicating these aspects, two contrasting scenarios are defined:

First, they have to complete the process, from DNA extraction, the intervention in a sequencing process, the analysis of contrasting aspects in the recording and the analysis proper of the visualization of data. Second, they will have a confrontation to real cases so that they judge and make decisions on the manipulation of this information. The possibility of advancing in the resolution of these scenarios resides in the appropriation of the scientific process and the ability to judge and to make decisions on the possibilities.

Palmerius [5] identifies at least four relevant actors who play a role in designing and implementing the virtual environment as a platform for interaction and user learning:

- Scientific understanding
- Task Scenarios
- The actual user interaction
- The theory of interaction design.

The approach of this project is novel given that in the case of bioinformatics, although there are platforms for engineers to interact in a game-like mode with protein chains and even some apps that teach the basic pairing of DNA, there is not much availability of

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learning virtual objects in Spanish that allow students to interact with the visual representations of these data and learn how to make value judgments about the use and manipulation of this information.

Sections

The sections below, describe the process in the development of a multimodal educational environment prototype to learn the principles of bioinformatics through different visualization and interaction tools. The methodology includes a preliminary exploration process in the design of interactions, which will later lead to a simulation of the process of bioinformatics analysis scenario from sampling, sequencing, and recording, in order to give sense to the visual representations of this information.

Multimodal Learning.

It has two ways to be applied in this context. [6] On the one hand, the semantic multimodality of concepts, understood as the multiplicity of languages, signs and symbols that can account for a concept is found. On the other hand, the technological view as the combination of different devices or channels to deliver the message or give a sensory stimulus is found. The research question asks for the impact in the interaction between semantic and technological multimodality for the creation of a digital learning environment in bioinformatics issues.

On multimodal semantics, the content was presented to the students using partially visual and auditory modes in Mousavi's experiment [7]. The split attention effect suggests that it is possible to expand the memory capacity when working in a dual or multiple mode to display the information.

This statement was confirmed by Tindall-Ford and Mayer and Moreno [7] who worked on the line of cognitive load theory, which assumes a limited memory of work in which all conscious learning and thinking occurs, and a long-term practically unlimited memory that carries out many automated schemes that can be entered into the working memory for processing. Oviatt [8] applied these results to design the interface of education in testing several different principles and strategies of user-centered design, demonstrating that the UI design that minimizes cognitive load can free mental resources and improve students' achievement. One of the strategies to achieve this is the design of a multimodal interface for students.

In addition to the theory of cognitive load, the short-term memory model of Baddeley & Hitch [8] is added, which has 3 main components:

- The central executive: controlling the flow of information
- The phonological loop
- Visuo-spatial canvas
- Auditory-verbal information
- Visuo-spatial information

This model was developed from an experiment to perform 2 simultaneous tasks where it was possible to conclude that human performance per se is improved when interacting with two modalities that can be co-processed in independent storage.

On the other hand, Palmerius et al. [5] designed a system of multimodal interaction to accelerate the learning about subjects related to nanotechnology.

The problem with their study was to make understanding around nanotechnology topics able to match the speed at which these developments are produced and installed in the world around us. The circuit included:

1. Immersive 3D Technology
2. Hand Detection and Interaction
3. Haptic Technology
4. Audio Technology
5. Nanoparticle Simulator
6. Motion and Dynamics of Nanoparticles
7. Flexing of Nanotubes
8. Short-range Inter-particle Interaction
9. Solvent Interaction

Interaction Design Technical Exploration.

In the experimental creation of interactive environments 2 scenarios of multimodal interaction have been developed: one was exposed in the Book Fair 2016 and the other for the GILABI Acid Lactic Bacteria Research Group and its industrial biotechnological applications of Universidad Nacional de Colombia. These scenarios allowed exploring the creation of interactive spaces with different mixtures of technologies from the guidelines for the development of a multimodal interface [8] by Bruno Dumas, Denis Lalanne and Sharon Oviatt. These environments included:

1. App of augmented reality that allowed visualizing 2D and 3D objects in relation to a reading in addition to the direct download of reading texts.

2. Video cabin
3. Audio books section
4. Interactive reading with kinect
5. Interactive reading by voice power that activated a lighting system
6. 1 transmedia infographics



Figure 1. Short sample from technical exploration.

Semiotic Cognition and Technological Multimodality.

Once the technical possibilities were experimented, the experimentation of interactive design that dialogues with the semiotic multimodality of concepts followed. To that end, a methodological practice of design thinking was formed as an interdisciplinary group composed by 2 thematic experts in bioinformatics (PhD and magister), a social communicator, a visual designer, 2 system engineers, an expert in pedagogy and a design researcher.

The proposed methodology is based on the one described by Zimmerman, in which the interaction designer, in this case the researcher in design, channels the information to create the interactive artifacts; added to this aspect, design researcher has to resolve the conversion from a classical semiotic cognition to multimodal technical possibilities.

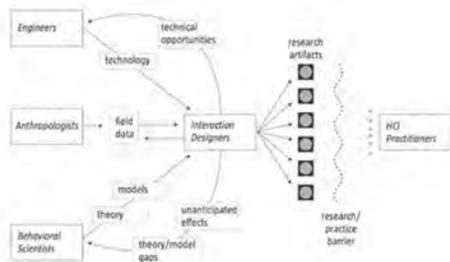


Figure 2. An illustration of the pathway and deliverables between and among Interaction Design Researchers and HCI Researchers. Zimmerman.

Future Work

The development of the described system is part of an ongoing project focused on the study of visual and interactive systems for teaching concepts in bioinformatics to be applied in the transfer plan of the Wall of Visualization of scientific data available to the city in the Bioinformatics and Computational Biology Center of Colombia. For this purpose, a system has been projected with some central capabilities: Immersive 3D graphics with interactive simulation of the structure of a protein with kinetic and auditory feedback. This system takes advantage of the available local technological infrastructure as a result of the strengthening of training and knowledge management capacities. The contents are designed to run on other platforms as well, allowing their use depending on the learning situation.

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Author Biography

Born in Manizales on July 29, 1989. She graduated as a professional in Mercadeo Nacional e International and since, her last practice has been working in the digital marketing sector. There she led the development of projects such as Project manager related to web pages, applications, video games and multimedia content development for various platforms. In parallel, she studied a technology in Graphic Design and participated in technology and innovation scenarios such as startups + and CampusParty. At the end of the studies on graphic design, she started working at the Bioinformatics and Computational Biology Center of Colombia BIOS, to be part of the marketing and communications team. There she became involved in communication practices of science and market studies of the biotechnology sector in the region and the country. Based on these lessons, a strong interest in the relationship between design, art, science and technology was consolidated, also discovering that there is a strong lack of knowledge of the use of this technology in the local environment of the country while in the world some sustainability practices involve this technology as a tool to evolve and seek alternative adaptability towards the future.

Digital Threshold. Art, Body and Self-reflection on the Screen.

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Abstract

This paper focuses on new possibilities for individual and collective expression on the screen by the use of digital remote sensing of actions and bodies. In particular, the paper studies representational environments (like biological datasets) that allow users to have aesthetic and cognitive experiences via an active exploration that integrates mental and physical perception. Users may expand their self-perception in the present moment (here and now) by their emotional connections with their representations or avatars on the screen; connections that can produce three relationships with the idea of the self: assume identity, confronting split personality, and live alterity. In the paper, computer-based interactive spaces in real time are defined as dynamic, iterative and organic processes. These processes relate to the procedural nature of digital media and unfold over time under a structural narrative that is actualized through human movement. This narrative utilizes the user's body and gestures as primary sources for the representation in twofold scenarios, the physical and the digital.

Keywords

Representational Environments, Self-representation, Mental and Physical Perception, Remote Sensing.

Introduction

Computer based interactive spaces in real time can be understood as representational environments that allow users to have aesthetic and cognitive experiences via active exploration guided by mental and physical perception. Based on the depiction of the interactors' bodies or actions in the audiovisual imagery projected on the space or screen, there is a correlation between building a sense of presence and active participation in the configuration of the emerging representation and developing a sense of empathy with those depictions or avatars. In these space interactor experiences "the feeling that one's self is located inside the biological body or an avatar's body" (Kilten, Konstantina, Groten, Raphaela, & Slater, Mel, 2012, p. 375), a sort of split

sense of presence: on the physical space, on the screen.

In terms of the dynamic of designing and reception of these real time interactive projects it is possible to talk about iterative and organic processes that relates to the procedural nature of computer media proposed by Janet Murray giving their "ability to represent and execute conditional behaviors." (Murray, 2012, p. 51). At the same time, viewer's interactions unfold over time structural narrative that goes beyond the traditional conventions of written textuality to pave the way for emerging narratives resulting from human movements, requiring the user's body and gestures as primary sources for the representation in twofold scenarios, the physical and the digital. According to Katja Kwastek: "the chronological order of the actions represented in a linear narratives may be variable, the process of reception nonetheless produce a chronological progression that orders the different fragments of represented time." (Kwastek, 2013, P. 113).

Tracing the roots of these sort of interactions it is important to highlight some references that goes beyond the digital giving that were presented in explorations in the art on the 20th century. In particular, this paper intertwines those media that include or anticipate the presence of the viewer body in the representation, such us: Ives Klein in painting, Piero Manzoni in sculpture, and interactive viewers on Happenings and Fluxus works), and on those media that express a transition between the structured real time moving image (video art, quasi-cinemas, video installation) to interactive moving images in space such as Responsive environments, Augmented reality (AR) and Virtual Reality (VR) installation, among other.

The social and cultural uses of this interactive spaces in art has so much in common with other contemporary interactive spaces designed with other social and cultural uses, so it is possible to say that, although this analysis departs from an artistic perspective, the

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social and cultural dimensions' overpass aesthetic dimension and impact society in a way that goes beyond the museum, galleries or traditional spaces for artistic projection.

Distant Contact: New Relationships Between Body and Technology

This first part of the research focuses on determining the characteristic of the interactive spaces that combine physical and digital representation in real time. and the ways in which these characteristics allow the spectator to build a sense of presence in relation to the sense of realism that we tend to attribute to visual representations based of the depiction that they do of elements as: shapes, details, movements and perspectives. The characteristics established here are: Real time, procedural process (algorithm), capture of the interactor's body, position or action, capture the environment, representations on the screen that combine virtual and real representations. In the present computer based interaction is delimited to those spaces with some sort of remote sensing that captures human activity without the necessity of a relationship between human body and technology that involves physical contact. Thus in these spaces became a system with inputs and output as those describe by Phillip A. Laplante y Seppo J. Ovaska in the book *Real-Time Systems Design and Analysis. Tools for the Practitioner*, 2011. Specifically, cameras, sensors, or Global Positioning Systems, GPS, are the most common device for controlling the inputs in the analyzed interactive spaces and the outcomes are visualizing in different kinds of screens.

Self-reflections on the Screen

After discovering their self-reflection on the screen people have the possibility of expanding their experience of themselves in the present moment (here and now). They live the now in a splitting space, here (physical space) and there (screen or audiovisual emerging representation). Their emotional connection with their representations can produce three relationships with the idea of the self: assume identity, confronting split personality, and/or live (encounter) alterity. The active presence of interactors on these digital environments encourage them to consider interactors as digital immigrants that potentially live a unique transformative experience of the present in a split space that takes them out of their homeland, to a place where new

rules, structure and systems need to be learn. At the same time, these kind of interactive space open new cognitive an under the responsibility of the interactor. So, as Brenda Laurel described on the book *Computer as Theater: "Designing human-computer experience isn't about building a better desktop. It's about creating imaginary worlds that have a special relationship to reality –worlds in which we can extend, amplify, and enrich our own capacities to think, feel, and act."* (Laurel, 1993, pp. 32-33). A Colombian example of an interactive space that was design to invite people to think, feel and act is the augmented reality piece *Entránsito* (2008-2011), a piece developed by the research groups *Hipertrópico*, arts and technology and *GEPAR*, from Universidad de Antioquia, which reflects on the topic of motorcycle in the city of Medellín. The piece was designed to unfold two possible interactive narratives: one under the responsibility of two actors who follow a pre-structure narrative that emerge of real time, and the second one that one the space to the audience and allow them to freely interact with the component guided by the premises of what they saw from the actor or by the images on the screen. In both cases, bodies were remotely sensing by a web cam and people's action immediate affects the visualizations on the screen. This double possibility for interaction, performer and the audience, aligns with the interaction in the renowned interactive work *Messa di voce*, 2003, developed by Golan Levin y Zachary Lieberman.



Figure 1. Image from the augmented reality interactive piece *Entránsito* with the resulting representations of actors on the screen. ©Hipertrópico, arts and technology research group, Universidad de Antioquia



Figure 2. Image from the augmented reality interactive piece *Entránsito* with the resulting representations of actors on the screen. ©Hipertrópico, arts and technology research group, Universidad de Antioquia

Digital Threshold: Cultural Dialogues on the Screen

By defining the elements that constitute the interface in real time (computer, algorithm, sensing devices, space, screen, users, and space of visualizations), I define the representational (demarcated) space as a digital threshold, or in other words, as a frontier that combines physical and digital logics and creates an organic language, characterized by iterations, and in which cultural messages are created by a collective configuration (creation) with different levels of participation. The configuration could be defined in terms of a media equation, resulting in the combination of coupling perspectives of different actors: human, machines and images. This equation can be represented visually as a spiral that moves around establishing departing points.

Given the strong aesthetic audiovisual component of these kind of interactions on real time, and as a way to understand their potential in culture, there are multiple connections between these interactions in relation to media in art history that expresses procedural logic and includes some sort of viewers' presence and participation in the artistic work. However, these kinds of interactive spaces enable cognitive and physical movement of the interactors in two different ways. From an individual perspective, the interactor's actions have the potential to empower physical expression and mental development, a potential that relates to body expression and gestures as the medium to create significant messages (in the terms propose by Amy Cuddy this is relating with the idea that "body language affects how others see us, but it may also change how we see ourselves"). From a collective perspective movement can impact at a social

and political level in a sort of a collective choreography for creative and emotional thinking.

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She was a Fulbright-Colciencias Scholar from 2004-2006. Restrepo has directed researches as: *Interactivity and Augmented Reality and Imaging and Artistic Education: A Pedagogical Model*. Such work has led to the creation of the pedagogical multimedia *Líneas Digitales*, based on the use of GIMP, and to creation of *Entránsito*, an augmented reality piece that deals with motorcycle accidents. She is currently directed the research *Puppets, humans and machines: an interdisciplinary circuit for the creative learning and expression*.

Evolved Architectural Representation: From Orthographic Drawings to Corporal Mapping and Swarm Behaviour

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Abstract

Traditionally architecture has employed a limited oeuvre of drawings and two-dimensional representations to communicate what a design is. Sketches have served as a means to share preliminary ideas. The development of a project then resorts to orthographic projections that include scaled versions of the plans, sections and elevations. Axonometric, isometric and perspective drawings are also commonly utilized. Computers were adopted by architects at the end of the twentieth century to aid in the creation of these drawings. The desktop computer is still predominantly used for computer aided drawing (computerization which is representational) and to improve efficiency. However, this posture undermines the use of computation (algorithmic processes that require the definition of variables and actions) which is laden with potential for much more powerful operations that may deduce fitness and effectiveness which help to achieve greater levels of performance. “Systematic, adaptive variation, continuous differentiation, and dynamic, parametric figuration concerns all design tasks from urbanism to the level of tectonic detail.”(Schumacher, 2008) This shift towards computational design thinking is occurring and requires designers to shift the focus of design operations towards iterative processes. Furthermore, morphogenetic design processes, inspired by Goethe’s work on natural morphology, mark a turn from the predetermined end-product of form towards formation. On one level biology has inspired designers towards an evolutionary paradigm that seeks emergence order from chaos. (Frazer 1995, Holland 2000) At another level, design inspired by nature and biomimetic practices have led to a questioning of the degree to which an architect can engage with living matter. This paper highlights some of this development in relation to science (biology) and visualization. The text is illustrated with the work of the author and his students.

Keywords

Anthropocentric Design, Motion Capture, Computational Design Thinking, Morphogenesis, Architecture

Introduction

A building is understood as the aggregation of inert matter to form shelter for human inhabitation. The practice of architecture can be described as a painstaking labor that articulates the formation of earth, dust, sticks, metal and glass. The odd reality is that the architectural design process is an estrangement from the tangible and physical materials themselves. “Architects do not make buildings; they make drawings of buildings.” (Evans, 1989, p. 369) The use of scaled drawings and models has been the vehicle to mediate the *virtual* and the *actual*; to bridge thought and ideas with the physical construction. Traditionally orthographic projections have enabled the architect to communicate the geometrical properties of the form. Computer Aided Design software has continued to function within the paradigm established by Jean-Nicolas-Louis Durand in *Précis des leçons d’architecture données à l’École royale polytechnique* which was written over two hundred years ago. However, the matured use of computation is starting to demonstrate the potential to disrupt architectural practice in interesting ways. A fundamental shift is occurring that questions authorship and design as a linear process; computational design thinking coupled with greater access to computational processing power and sophisticated digital design, visualization and fabrication tools enables a complex interplay of human and non-human actors. (Ahlquist and Menges, 2011) This introduction takes a step back to the Renaissance to bring the issues of authorship and of nature to the surface: The scope of this paper is limited to a description of architectural design and an identification of some of the fissures that new (non-traditional) forms of visualization are affording the discipline.



Figure 1. This series of images includes (from left to right) the Vitruvian Man by Leonardo DaVinci(top left), the Modular by Le Corbusier(bottom left), photograph of my student in the motion capture facility (middle) and our version of the point cloud spherical envelope surrounding the body(right).

An Evolving Sense of Disegno

The etymological seed (Latin) of the Italian *disegnare* signifies “designation” which alludes to an ownership of marks that embody thought and have meaning. Key figures of the Renaissance employed drafting, drawing and the geometry of the perspective as the means for the intellect to be transmitted. In Giorgio Vasari’s introduction to *Lives of the Artists* (2nd edition of *Vite*, 1568 translated by Quek, 2007, p.47), he posited “we recognize a certain notion of the mind, and this we refer to as *disegno*... that is not other than a visible expression and a revelation of our inner conception, or that which others have imagined and given form to in their idea.” This simple notion that design is substantiated through a visible form of expression persists. For the sake of the discussion of this excerpt, distinguishing between pencils, pens and paper of the analog world and screens, VR and/or AR of the digital realm is not necessary; each tool serves as an interface to make, designate and communicate. However, there is another notion worth examining further which is that of input.

In the writings of Vasari, Alberti, DaVinci and Dürer, there was a displacement of the notions of divine intervention. Where Greek mythology had described the role of daemons which were vessels sending messages from sky to earth, Vasari credits the Divine Architect of Time but negates any mediator. The sculpting of formless clay matter into man became the ideal example to employ as he described the pursuit of artists on their quest to achieve godliness. On one hand, Vasari places high value on the ability to give form to the formless. On the other, the human object gains traction as an ideal form itself; not only as a form to sculpt, but the

human body has served as the central source to measure all. For example, the imperial system uses the foot as its primary unit of measurement. The inch is derived from the width of the thumb, which is explicitly noted in languages such as Spanish that use “pulgár” for thumb and “pulgado” for inch. In architecture, the dimensions of the Vitruvian Man drawn by DaVinci serve as the geometric corporal model at the center of it all (metaphorically and literally). There are multiple limitations that exist with this type of anthropocentric framing and modulation. Within the field of architecture, several problems were addressed. The first of which is the lack of accountability for variations in size and shape of humans. The second issue aims to address movement. While DaVinci’s diagram suggests a range of movement, the image is static. We asked ourselves how this work could be recast in productive ways.

This led us to analyze a variety of other graphic standards used in furniture design and in architecture. Some, such as Neuferts, acknowledged a range of dimensions, yet not to a satisfactory level. Other diagrams accompany interior typologies, yet privilege moments. For example, in the kitchen the sink of a kitchen is shown in plan and section. The plan includes a human figure and illustrates that there is a radius of motion from a central point (feet) and the section shows where outstretched arms reach. As a guide, this may suffice. However, we sought to critically examine what other possibilities may exist. At this point we were granted access to SENA Tecnoparque’s Motion Capture Laboratory. We created large scale mock-ups to give a sense of scale and enlisted various students to engage in role play. Each participant acted out his/her day. The data gathered was imported into Motionbuilder and point clouds (Figure 1) were developed. Though not practical, this crude experiment clearly demonstrated a similar, yet wide variety of human movement to the same tasks. Another important finding was the gestures and movements at interstitial spaces of the acting. For example, the space needed to get out of bed, stretch and move towards closet. Our preliminary literature review had encountered data includes size of objects and guides for buffers between objects, yet this level of documentation that we undertook superseded the existing information available.

Panels



Figure 2. This series of images includes the prototype subtraction model being inhabited.

Participants garnered a mouse and navigated around the “residue” of their actions. An important observation is that our findings were legible when viewing the point cloud in 3d space: One was able to infer what combination of activities had occurred. This is one example that confronts the traditional use of representational devices. As a final exercise, the human body was metaphorically and literally removed from the box. A subtraction procedure was realized to view the negative space of this movement in a 1:1 scaled model (Figure 2). Though the aim is not to propose this as a design strategy, one is able to see an abstraction of authorship.

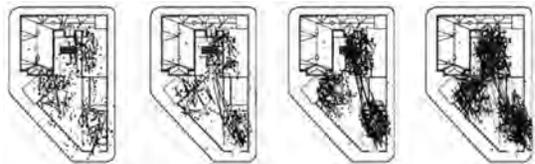


Figure 3. First attempt of author to use flocking simulation for pedestrian flows at a cultural institution – Moma's site PS1.



Figure 4. This series of images shows how foot traffic was studied at an urban scale. These simulations impacted the design of the park as flow was used to help articulate ramps and terraces.

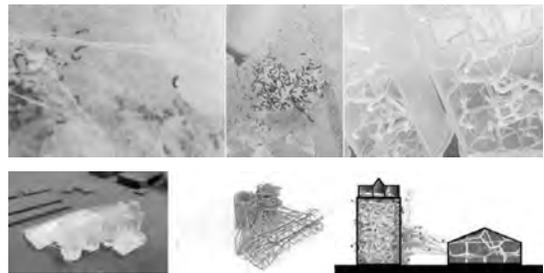
Nature is the Baseline

The use of “Nature” in architecture has existed ever since there was a notion of built environment. Think

no further than Greek temples to see the creation of ornament and proportions that mimic nature. The storied evolution of the column includes anthropomorphic descriptions of Doric, Ionic and Corinthian typologies. The last of which is recognized for the fact that it is ornately adorned with the Acanthus leaf. Though the use of nature for representational and symbolic purposes continues, it is relatively recently that architects have begun to mine the biological realm for something more.

The baseline for excellence was found in Nature. “Disegno, father of our three arts of architecture, sculpture, and painting that proceed from the intellect derives from many things a universal judgment of form or idea of all things in nature, and is unique in its measurements.” (ibid)

I am convinced that anyone who will discreetly ponder this matter will agree with me, as I said above, that the origin of these arts was Nature herself, that the inspiration or model was the beautiful fabric of the world...



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Brakke spent a decade in the city of Bogotá, Colombia where he founded Whiteknee and was a Professor of Architecture at the Universidad Piloto de Colombia. At this institution, he founded and directed the Center of Innovation which blends digital fabrication machinery with tools for Simulation and Visualization (VR and Augmented Reality). His primary research interest is situated in understanding how the evolution of technology has impacted the construction practices and the vernacular epistemology of indigenous communities located in the Andes mountain range.

Moving Image + Data Visualization = Connection Visualization

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Abstract

Data visualization takes on different dimensions when analyzed from the categories of digital production of the moving image. This typology of image not only presents information, but also allows us to visualize data in both rational and emotional way. Contemporary examples provide scenarios where a total viewer can flow as a vector through a navigable, interactive space. Furthermore, this type of work becomes interactive when the viewer/participant is able to alter the piece and build his/her narrative that creates a unique and sensitive experience. When moving image is used to create data visualizations, we fit into a fissure in the visual landscape, which have the potential to enhance the human experience related with data reception and cognition.

Keywords

Data visualization, Moving Image, Navigable Space, Interactive Space, Sensitive Experience.

Introduction

The emergence of large volumes of data poses a major challenge for the analysis of information. The problem has transcended the collection of the same to be located in the field of selection and forms of visualization for data to make sense. This has traditionally been supported by two-dimensional fixed graphics. In the last decade, however, different people and research groups have contributed tools that allow the visualization of data with the help of interfaces that allow controlling more than two dimensions and in some cases provide the possibility of generating graphs that are modified in real time and even allow for the generation of videos that facilitate the study of this data to be realized in the 4th dimension of time.

However, in almost all cases the use of data is given as an input to generate statistical reports or analysis, without taking into account the interactive, sensitive exercise of working with the data.

Scenario and Facts

“If the interface between man and computer is an interface to computer data, and a book is an interface to the text, you can think of the cinema as an interface to facts that are developed in a space in three dimensions.” (Manovich, 2006, p.403). With this statement, which Manovich launches near the end of his book *The Language of New Media*, a different view is taken on the role of cinema beyond the twentieth century: it is a proposal that is interesting for us because it makes us think that the metaphor of cinema is not yet exhausted, but is hardly subverting the established order. From the outset, we could assume that, despite being immersed in electronic media, we continue to work with data from the territory of text. That is, although we use the computer as an interface to access computer data, it seems that this data is worked on more from the logic of the text than from the logic of cinema. Now, why should data be thought about from the logic of cinema?

The first thing we want to discover in Manovich’s statement is why cinema should be assumed as a 3-dimensional space, if it is in its essence, in its characteristic feature, two-dimensional: it just so happens to exist within a three-dimensional space. What we stop to reflect on is what we perceive, the projection of the moving image, which lacks volume. Its tri-dimensionality is, like everything related to the moving image, a mere illusion (Rivera, 2015, p.1). Manovich not only places it as a real three-dimensional space, but also puts it in conversation with some “facts” that happen there.

Let us then ask ourselves, what are these facts? Does it refer to stage actions, which respond to a script that is predetermined by a director? In the context of Manovich, we could deduce that the facts refer to all the elements that compose a cinematographic image and add visual complexity or conceptual complexity and affect its narration.

In the section of his book on *The Forms of New Media*, Manovich identifies two main principles: 1) the database; and 2) virtual and interactive 3D space (Manovich, 2006, p.279). In this chapter, the author broadens his idea of how interactive 3D spaces are ideal scenarios for navigating a database. Manovich's interest in this exploration focuses on how databases have generated a tension between narration and description, of which he makes an extensive analysis. He makes reference to Vertov, the great Russian filmmaker founder of film language, who states: "Vertov is able to achieve something that designers and artists of the new media still have to learn: how to integrate the database and narration in a new way" (Manovich, 2006, 311).

The database is a fundamental pillar of the new media for Manovich, to the point that it studies it as a new cultural form, a new way of structuring the experience of ourselves and the world (Manovich, 2006, 284). However, lonely, without intervention, it does not allow further progress: "the database can admit the narration, but there is nothing in the very logic of the medium that encourages the creation of a story." In fact, it profusely illustrates how different types of artists, directors and filmmakers try to generate possible paths in their interactive pieces (artistic DVD's, videogames, physical installations), with the aim of achieving hyperrnarration.

At this point we could use the clues that Manovich gives us to extract a first idea: *three-dimensional space could be a form of scenario for the data of a database, which when being navigated a certain way could, in part, constitute into the facts that generate a narration.*

In this chapter about Forms, Manovich ends by recovering Augé's distinction between modernity and supermodernity. If we did a correspondence of theoretical categories, these would look like this:

- Modernity | "Supermodernity";
- Narration | Database, hypermedia and network;
- Target space | Navigable space;
- Static architecture | «Liquid architecture»; and
- Geometry and topology as theoretical models for cultural and social analysis | Trajectory, vector and flow (Manovich, 2006, p.356).

According to what is discussed to arrive at the first idea, this table allows us to generate a second idea: *navigable spaces, based on liquid architecture and constructed from databases, allow trajectories as vectors that generate hypermedia narratives.*

From Cyber-ecology and Interactive Spaces to Immersion

We will now investigate the possibilities within these navigable spaces. The first approximation that we will do comes from the ecology, but understood from the perspective of artists.

Already by the end of the 60's, there was an important consciousness related to ecology among artists in the United States. "Ecology is defined as the totality or pattern of relations between organisms and their environment. Thus the act of creation for the new artist is not so much the invention of new objects as the revelation of previously unrecognized relationships between existing phenomena, both physical and metaphysical" (Youngblood, 1970, p. 346).

Youngblood documented the evolution of the cinema and the new forms of cinema of the time in his book *Expanded Cinema*. Within this compilation he dedicated a complete chapter to "The artist as an ecologist", and he shaped some concepts with the ideas that we have already developed. In this regard, we want to highlight this fragment of the creation manifesto of the Intermediate Systemas Corporation group during the 1960s: "Meaning is communicated not by coding ideas into abstract literary language, but by creating an emotionally real experience through the use of audio visual technology. Originally conceived in the realm of art rather than in science or engineering, the principles on which intermedia is based are grounded in the fields of psychology, information theory, and communication engineering."

Here we get a new input: we can construct interactive spaces to visualize data, but especially focusing on creating a "true emotional experience". At this point it is worth asking: when we navigate the graphs of a database in Excel, or when we interact with complex information systems that show us data, or even when we visualize sets of data in multiple dimensions, are we living true emotional experiences? For the Intermedia group, the scenario was clear: "The term "light show" must now be expanded virtually to include the aurora borealis, since hemispherical lumia displays are possible in the creation of artificial plasma clouds in space (see color plates), the launching of rockets to generate atmospherical events, or urban environmental generators such as Nicholas Schöffner's monumental Cybernetic Light Tower, which transforms the skies of Paris into panoramic fantasias of color."

But as the great world of entertainment evolved, another underworld emerged: that of virtual reality and its metaphor of the world condensed into a computer-helmet. It is when “subjectivization in digital media” occurs and we explore *immersion*, that singular mode “in which the subject ‘enters’ or ‘dips’ into the images and virtual sounds generated by the computer.” (Machado, 2009, p. 147). Machado identifies how to live within the images is perhaps the greatest dream of the whole cinematic adventure (Machado, 2009, p. 148) and shows how assemblies were made in the 18th century and experiences were designed to finally arrive at this.

Total Cinema and Cinematic Experiences

Barjavel, even before Bazin, had anticipated these technologies and had referred them as, those in which the images would come with smells and the characters would leave the screens and the darkness of the rooms to walk around our houses, achieving the perfect state, *total cinema* (La Ferla, 2009, p.44). However, total cinema is only realized in the total immobility of the spectator. Only in this way can you guarantee your total concentration in the dark room, so that you can see the moving images of reality that are projected as intended on a vast screen, planned, assembled and displayed. But if a total spectator arises (La Ferla, 2009, p 124), that is able to move, to look around, to think the images, to feel them, to reflect on them, to touch them, to react because of them and to interact with other total spectators like him/her, then we are no longer in the cinema, much less in the total cinema.

It is when the concept of cinematic experiences is configured, in which the digitally produced moving image far exceeds the concept of traditional cinema (Rivera, 2013, p.2), which leads us to develop a third idea, which we will concatenate with the previous two:

The total spectator is the one who can flow as a vector through a navigable, interactive space, and alter it to construct his own unique and sensitive experience and his own narration.

Total Spectator

Let us now assume that navigable space is constructed from data coming from a database. Under that premise, what could a total viewer do with the data presented to him/her? He/she could only navigate the data, or in Manovich's words, “instead of thinking about the games in terms of narration and description it might be better if

we did so in terms of narrative actions and exploration.” (Manovich, 2016). That is to say, the total viewer would be ready to carry out *narrative actions*, which could be translated as generating unique, non-predetermined relations between two or more data of the underlying database.

Returning to the cinematic image, let us now imagine a three-dimensional space to which we have access, where an innumerable quantity of data floats and is part of a logical structure (for example, the results of a field investigation that included nutritional, ophthalmological, social, photographic, visual, literary and genetic data, among others were collected in the same indigenous community in a same period of time). We are navigating this data, which as we have said is offered from a database and suddenly we see an image floating in the air that strikes us, a genetic result that is interesting and a variable age that is disturbing. What would happen if at that very moment, by mere investigative curiosity, but also mediated by the sensitive experience that we are living in the midst of the data, we as total spectators take a *narrative action* and find relationships that might unite the data? If the result of the relation does not satisfy us, we would be able to modify the algorithm that generates the parametric relation between data in real time. In this scenario we would also be subverting the hypermedia narrative, which has predetermined a path, which we will not follow. This seems to be the scenario that we could point to, to generate a new relationship with the data from the sensitive experience.

The Ordering of Data and Multi-agents

Finally, we have to ask ourselves about the nature of the ordering of the data. In the scenario we have discussed above, what would happen if data were presented in an autonomous way, regardless of the creator and that this data environment interacted to the stimuli that we as total viewers are sending?

The application of the theory of multi-agent systems, where there are reactive, proactive and social agents, would open another wide spectrum to the visualization of data in the midst of immersive experiences based on the sensitive experience of the total viewer. In some ways, these agents act as living beings: they recognize, group, divide tasks and can recombine their activity according to how they want to respond to external stimuli. A multi-agent system resembles, for example, an anthill, a colony of bees or flocking birds. While

the concept of mutation or evolution, or reproduction is still debatable in these systems, its functioning is that of living being(s). Through artificial intelligence, generative algorithms of a multi-agent system can, for example, simulate the behavior of a guide (a bot) that takes us through the data maremagnum and suggests data to relate to.

The day that this happens will be the day that we can state, as Youngblood did in the 70's: "The limits of our language mean the limits of our world. A new meaning is equivalent to a new word. A new word is the beginning of a new language. A new language is the seed of a new world. We are making a new world by making new language" (Youngblood, 1970, p. 419). A language spoken by machines and people, in interactive environments, where the freedom to flow corresponds to the possibility of generating relationships. That is the result of the digitally produced moving image based on the display of data that exists with its own logics.

Conclusion

We have highlighted some ways in which the field of data visualization might find fertile ground in cinematic experiences and expand to provide emotional and interactive experiences. The hypothesis explored in this article is a speculative armature about how moving image can impact and enrich data visualizations, to enhance the human experience related with data reception and cognition.

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Bio-medical Signals in Media Art

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Abstract

This panel undertakes a deep and critical reflection about the general usage of biomedical signals from the mid 1960s to nowadays and their inclusion in artistic work, in regard both to the artistic application of these signals as well as the consequent theoretical implications. The members of this panel discuss concrete applications of biomedical signals in dance, performance and installation, the role of the enacting self embodied in these systems and the implications interactive installations have for the self-perception through technology. They focus on the complex and hybrid relationships between body, technology and environment, the perceptual qualities emerging from it, as well as the ethical implications of employing these systems.

Keywords

Bio-data, Bio-feedback, BCI, HCI, New Media, DYI, Machine Ethics.

Introduction

The use of bio signals was introduced in the arts and music in the mid 1960s after it had been pioneered by psychologists using biofeedback methods in order, for example, to reduce stress and therefore with the intention of creating a certain degree of internal peace. One of the first works was the famous composition using brainwaves by Alvin Lucier: *Music for Solo Performer*, for *Enormously Amplified Brain Waves and Percussion* (1965) that used an EEG (electroencephalogram) interface. Nowadays, other composers and media artists such as Eduardo Miranda, Joel Eaton, Kiyoshi Furukawa, China Blue and Claudia Robles-Angel continue to develop new works using EEG data, employing a variety of scientific methods and artistic strategies. The usage of biomedical signals in art is not limited, however, to EEG only, but it also extends to a wide range of biological data, such as ECG (electrocardiogram) and EMG (electromyogram), the latter with well known examples by the *Palindrome* German dance company and *Atau Tanaka* at the start of

the XXI century. After more than 50 years of successful use of bio signals in diverse art practices, it is now time to discuss the numerous methodological, aesthetic and epistemic implications of these developments.

Topics of the Panel

The panel will address diverse questions with regard to how artists use biomedical signals as well as its theoretical implications, focusing on the impact of scientific developments in the field, the question of access, and the aesthetic and epistemic implications of art using biomedical signals.

Scientific developments. In science and engineering the use of biomedical signals during the past decades has gradually moved from diagnostic investigation towards real-time assessment of mental states and affect, spawning emerging fields like *Brain-Computer Interfaces* and *Affective Computing*. With these developments, novel ways of offering objective access to subjective experience are created. How does the use of bio signals in the arts reflect these developments?

DIY access to biomedical signals. Most developments in the field historically have been tied to research facilities and expensive equipment, raising the question of the accessibility of biomedical signals for artistic inquiry and public debate. However, since the early days of biofeedback, numerous *DIY (Do-It-Yourself)* approaches have accompanied scientific research and informed artistic practice. In regard to this topic, the panel will address questions such as, for example: how can artists access the equipment and methods necessary to produce meaningful work with biomedical signals? Does the advent of EEG game controllers and bio-signal monitoring apps mark a democratization of these methods or will we only have access to our own bio-data via the opaque interfaces of apps and games?

Aesthetic and epistemic implications. By integrating

biomedical signals into artistic work, the reception of art and the participation in art by an observer goes beyond the usual “channels” art is communicated through. This raises the question if there is an aesthetic of bio-data and bio-feedback. In addition, the development of new forms of access to affective and mental states puts in question the nature of these very states. How does our notion of, for instance, affect change if it is reformulated through experimental systems? How can artists critically reflect on these methods and their implications? Does the use of biomedical signals enhance or change our concept and perception of self? How do we interact with our own bio-signals?

Contributions to the Panel

Johannes Birringer: Somatic Gestures in Mixed Reality/Virtual Reality Immersive Choreographies

Recent danceworks created by DAP-Lab feature immersive mixed-reality environments or *metakimospheres*, offering multi-sensorial and intimate spatiotemporal experiences. Dancers and audiences enter into a deeper awareness of what we consider a form of somatic and tactile choreography. In my presentation, approaches to intraactive flows between human and technical beings are examined through attention to gestural choreographies in a bio-sensorial framework. At the same time, if the framework is considered an engineered atmosphere or environment, its affects and resonances need to be studied in order to articulate the processes that conjoin bodies, materials, and technologies in the becoming of sensory embodiment. The notion of becoming is necessarily contingent on the relational, dynamic and metastable states of the atmosphere.

Metakimospheres are kinetic atmospheres staged for visitors that pass through them, listen to them and feel them, unconsciously, attentively, distractedly, blindly, kinaesthetically. Performers are also present and embedded in the kimospheres, exploring the tactile and sonic interfaces, as well as the visual moisture, that animate the growth, slowness, scale and direction, the breath of their movement, their gauzeous entanglement. Some of the performers wear sensors built into their costumes or attached to their bodies. Their behaviours are c, yet the emergent immersive choreographies are not focused on control-based mapping of data derived from body-worn sensors or bio-sensors but are always already entangled with spatialised stimulations. Kathleen Stewart (2011, p. 448) argues that: “the senses sharpen

on the surface of things taking form. They pick up texture and density as they move in and through bodies and spaces, rhythms and tempi, possibilities likely or not. They establish trajectories that shroud and punctuate the significance of sounds, textures, and movements”. The intra-actions between human and technical systems are not pre-programmed or determined.

These stimulations interconnect vibrations of the body with vibrations of the world, creating an intermingling, which is of course also related to energy (and electrical) tangencies and transductions. The performers are conductors, and I mean this in a double sense of guiding visitors through the “score” of the *metakimosphere*, as well as engaging visitors through totemic sounding objects and conductive costumes. The visitors can touch these conductive fabrics and become aware of the sonic ripples, the noises that emanate from porous membranes.

The performers’ incubating presence is felt and their transceiving role can be grasped when one realizes their costumes are sensorised and signal-generating. What distinguishes our work from other advanced research in music technology or dance technology/somatic practices is our focus on both the atmospheric architecture and what we call the “tactile narratives” that can evolve in temporal relationships between wearable performance and mediated environments. For a discussion of such bio-relational frameworks, see Naccarato and MacCallum (2016).

The performers in the *metakimospheres* are a part of the real-time engineering of the atmosphere, especially of the sound that emanates (in localized intimate circumstances as well as through the spatialised and dispersed sonic gestures).

The dancers do not always invite looking, as their role is not necessarily one to be looked at. When they offer their costumes to be touched or hand one of the sonic objects to a visitor to invite listening to its electro-acoustic sound, the materials or objects also act, transmit, vibrate and resonate. Yet their bodily presence, and what I imagine to be the *expanded choreographic*, is affecting the body of the architecture in-between or beyond the thereness (*meta* referring to such “between” and “beyond” notions of presence/atmospheric space) – in the duration and circulation of space-time. The architecture’s thereness can also be a wave, a flutter, touching bodies; there are suspended elements in the architecture that have movement capacities and can react to motion in proximal space. In the first two prototypes

of the *metakimosphere*, the dancers' motion or stillness animates the elastic veil-like gauze draperies that are suspended from the ceiling and slouch down on the floor. In turn, they are also animated by the behaviour of the pro-active, dynamic and interactive architecture (for example the */S/caring-ami* polypropylene prototype created by Hyperbody [TU Delft] for *metakimosphere no. 2*, featuring a computationally generated origami pattern based surface with integrated lighting, motion capture and robotic actuation based on proximity-sensing).

In the expanded choreographic there is no real stillness, not even when there is only breath. Breath not only moves space – inhaling/exhaling, expanding/contracting – but also is audible. In all *metakimosphere* installations the biophysical, etheric sound is amplified. The elemental thereness of the environmental atmosphere includes the audience as experiencers who are “inside” the atmosphere, and the atmosphere is in them. *Meta*: through them. Both, so to speak, reciprocally make up the materialities of the interaction merger. There is black porous gauze on the perimeter, and soft white veil net inside, and these insides-outsidess – or “interskins” as Haein Song, one of our dancers, called them – are housed inside a darkened gallery space (circa 10 by 12 meters wide). This first envelope, for a test performance in London (March 2015), was small and intimate. The second envelope was a huge auditorium in the Medialab Prado (Madrid, July 2015), and here the perimeters expanded as an architectural skin with its own properties and behaviours. The third instalment was multilayered and a more complex dynamic spherical environment that included separate enclosures for intimate listening. The German philosopher Peter Sloterdijk (2004) has devised a philosophy of *spheres* and *envelopes* which contributes to the current interest in atmospheres, much as Philippopoulos-Mihalopoulos's critical study of “lawscapes” as atmospheres draws attention to embodied social and political norms in the conflict between bodies “moved by a desire to occupy the same space at the same time” (2015: 179). For the tactile narratives, see Birringer, (2016).

This *kimosphere* featured various sonorous qualities and vibratory intensities, voices, intonations and choral elements, a meta-language structured like music and gestural, tonal extrapolations in rhythm and timbre: the somatic here expanding outward into a spatial acoustic instrument or “polytope” (Xenakis).

This choreography and the dancers' (and the system's) gestures envelop spectators physically in the particular kinetic atmosphere or directly solicit and engage it as part of its very functioning. In the future version of this presentation, the signal processes, audio-visual interactions and tactile dimensions of the wearables created for the *kimospheres* will continue to be examined, in order to raise questions about what we mean by embodied, embedded, durational and attentionally rich environments (augmented reality/virtual reality) that can act as new conceptual frameworks for cognitive and biological/technological processes.

Furthermore, the notion of immersion will also be scrutinized in order to draw attention to interactive and participatory potentials of dance environments that allow visitors to have concrete tactile and auditory experiences while at the same time being challenged into somatic (inner) bodily sensations afforded by the new kinetics of VR. The DAP- lab is currently exploring narratives that can be composed through choreographic process derived from biophysical data (registering intimate bodily states of arousal, excitation, listening, breathing, moving etc.) in conjunction with interface architects and fashion designers rescripting the data mathematically to generate wearable objects with 3D printers and as avatars inside virtual worlds that are accessed through (HIVE) goggles. We plan to use “choreographic objects” (miniature 3D printed creatures) that become scaled-up avatars in immersive virtual landscapes where they can be encountered to develop sensorial dramaturgies.

The next instalment, *metakimosphere no. 4*, therefore combines two atmospheres, a real architectural space and a virtual (computational) space, both actuated through the same tactile narrative. The crucial aspect for us is the immersant's sensory participation: the resonances of the real and the virtual spaces are to be rhythmically entwined, and the occurrent gestures are envisioned to become reciprocal – pushing the kinaesthetic into a perceptual virtuality (VR) that so far is largely contained in the visual (the ergonomic challenges with virtual reality headsets are well known: the more powerful headsets must be tethered by thick cables to computers or consoles, which can tangle up immersants' legs when these rigs occlude their view of the real world). The kinematic, then, is the challenge for a social VR choreography, which does not insulate/isolate the immersant but allow for an expanded (virtual) synaesthetic perspective and embodiment.

This will require a process where the virtualizing instrument is not perceived as an enclosure- object or prosthesis but as a wearable that becomes a part of the body as a metamorphic changeable and emerging process and hyperobject. Given the precarious experience of a technological body or technical being that is mutable and relational, movement becomes a vector of affect. The immersant can enact, or fail to enact, specific bodily gestures or movements, and there is no correct way of executing a particular movement but only actualized potentials derived from resonant (narrative) stimulation. Performances in such augmented reality can let movement emerge from the rhythm of sound, vibration, graphics and light produced by the machinic.



Figure 1. *Metakimosphere no. 3*. Hongye Deng and visitor performing with soundobjects (left), Vanessa Michielon in OrigamiDress (right). Design by Michèle Danjoux. DAP-Lab, Artaud Performance Center, 2016 ©DAP-Lab

Thus, the way the somatic is performed, compromised, interpreted or created anew is crafted by the performer, the instrument and the relational context. The objective is to explore a certain level of entrainment, which enables movement and sensual intensity to arise. If the immersant's intentions are constrained, in regard to physical performance or kinaesthetic experience, it is still vital to come to a realization of the bio-relational feedback, the continual flow and fluid relations between the enacting self, the coupling with technical system and atmospheric environment. The embodiment in augmented/virtual reality, I propose, is always subject to such a mingled or torn multiplicity, a hybrid octopus-like creature that must push its limits further.

Claudia Robles-Angel: Using Bio-signals in Interactive Installations: Revealing the Hidden Side of the System

The following contribution to the panel consists of

an artistic approach to the main topic of usage of bio-signals in media art by introducing a selection of interactive works of my authorship using diverse types of bio-interfaces and software – from open source to commercial devices – and therefore discusses methodological, aesthetic and epistemic implications of such developments. These works have been conceived aesthetically as art-works, although frequent exchanges with scientists were necessary as well as essential to their creation. Their main characteristic lies in the fact that they were created as installations, with the main intention focusing on the participation and reaction of visitors. My contribution hereby concentrates on installations instead of on performances, because installations provide for a direct contact of audiences with these technologies and their interaction with their own bio-signals. Hence, while performances with bio-signals raise epistemic questions such as for example about the credibility about the data used or questions about what is really happening between performer and visuals/sound, installations such as those introduced in this paper were conceived to reveal to the audience the hidden side of this type of works, inviting them to experience with their own inner emotional states, eliminating those doubts about the accuracy of many performance works in the field.

This raises questions about methods to be implemented in those installations, namely:

- (i) which bio-signal and which interface should be used in order to invite participants to create an audiovisual environment with their own bio-signals?;
- (ii) which are the advantages/disadvantages of the selected interfaces and their respective physiological parameters in each particular situation/art-work?

Two Bio-signal Installations: SKIN and WEB-MINDSCAPE

My experimentation with bio-signals started in 2004 for the composition and production of multimedia interactive performances and installations creating immersive spaces that invite visitors and audiences to dip into an audiovisual environment shaped by imperceptible physiological manifestations. This was driven by the idea of *how to perceive the imperceptible*, particularly related to the human body and those internal signs that are usually imperceptible in our daily life. Those afore-mentioned bio-signals can be of diverse nature, for example brainwaves, heartbeats, muscular tension and many others.

As described in the Proceedings of the NIME 2011 (Robles-Angel, 2011, p. 422), my first work using bio-signals was the performance/installation *Seed/Tree*, which was developed at ZKM – Karlsruhe, Germany, and which consists of a Butoh performance combined with the usage of an EMG (Electromyogram) interface for one of the dancers, whilst microphones were used to amplify the breathing and the heartbeat of the other two. The strong connection achieved in *Seed/Tree* between sound and performers was an experience, which revealed to me the potential for further experimentation of the impact of bio-signals in my work, which could be made extensive also to audiovisual environments made by internal emotional states.

In the following years, I continued my research and practice using other interfaces such as for example EEG (Electroencephalogram) and GSR (Galvanic Skin Response), creating interactive multimedia works such as *InsideOUT*, *SKIN* and the recent *WEB-MINDSCAPE*, all of these with the intention not only to make *perceptible the imperceptible* but also to raise awareness about the human body and its internal subtle signs and the possibility to control them in a conscious way, inviting visitors to create audiovisual environments from their own emotional and physiological parameters.

Thanks to the accessibility of several devices/software such as, for example, the *Arduino* project, I was able to create in 2009 an interactive biofeedback performance called *InsideOUT*, where the performer uses an EEG interface in order to influence both images and sound surrounding him/her via real-time data stemming from the conversion of Alpha and Beta brainwaves. The EEG interface in this occasion was an open source board from *Olimex*, assembled without the need of expensive and difficult-to-access hardware.

Due to the increasing interest of audiences to experiment with both the interfaces and their effects by themselves, in the past few years I started to create installations in which visitors are able to use the interfaces. One of the problems with this approach is that the interfaces afore-mentioned (e.g. the EMG and EEG interfaces from *Olimex*) require complicated methods to attach the devices to the user (for example, gel for each electrode, utmost precision in positioning electrodes, etc.), all of which are difficult to implement with large audiences of participants in interactive installations. In order to avoid these complications, I started to experiment with the *GSR2*, a Galvanic Skin

Response or electrodermal bio-interface developed by the Canadian firm Thought Technology Ltd., specialised in biofeedback instruments. The advantages of using this commercial interface were, its ease of handling, its data accuracy and seemingly direct understanding of the results. The interface measures the skin's conductance, which similar to other physiological parameters, is directly connected to the nervous system and the variations of these values indicate physiological arousal, such as for example the appearance of stress or relaxation. The GSR is very sensitive to diverse emotions such as for example anger, anxiety or relaxation.

This interface was used in *SKIN*, an audiovisual interactive installation for three video channels and octophonic sound (creating an immersive space), in which visitors use the GSR interface, where the values received from the GSR are transmitted to a computer in order to interact with sound and images. Visitors are therefore invited to sit in the middle of the surround sound space and use the hand-held interface in order to transform the audiovisual environment with their own emotions, basically projecting either levels of stress or relaxation. The visual part of the environment consists of two basic textures: one orange and the other blue, which correspond to the two mainly inner states: relaxation and anxiety/stress. Users are normally confronted at the beginning with the normal tension state, with rare exceptions of people normally unstressed at the start. This tension state is reflected in the visual part as an unstable surface, which moves chaotically according to the level of stress, the pre-recorded image is infinitely multiplied in small images or screens that move randomly within the large screen. After some minutes sitting quiet in the middle of the audiovisual environment, concentrated into their own breathing and being aware of their own inner states, visitors start getting relaxed. In this first step of calming down, a blue line appears, getting bigger, helping people to realise, that they are relaxing: the more the screen turns blue, the more signs of relaxation. A full state of relaxation is achieved, once the entire visual space is blue. The sonic part of the installation consists of a sound produced by the *GSR2* and which becomes high-pitched when the user reached high levels of tension/anxiety and low pitched when they reach relaxation levels. This sound is further sent to the computer in which a granular synthesis process is applied and spatialised in eight audio channels, creating a surround immersive space.

Both, image and sound were programmed with the *Max* software.

After using a commercial and ease of handling interface with SKIN, I turned again my attention to the use of brainwaves in a new work: WEB-MINDSCAPE. Having already experienced a DIY interface INsideOUT y (Olmex) and aware of the disadvantages this interface could produce in an installation situation, I decided to explore a commercial and seemingly accurate interface by the firm *EMOTIV*. There are two versions of this interface, one for scientific research purposes (*EMOTIV Epoc*), which consists of 16 electrodes that must be previously wetted, and which – due to the long process of setting up – was not appropriate for usage in installations, and a light version, the *EMOTIV Insight*, developed for health and well-being purposes. The latter consists of only 5 polymer sensors that absorb the humidity from the atmosphere, thus it does not require the application of gel or saline solutions and is therefore appropriate for usage in art installations. After exploring several possibilities, I used the software *MindYourOsc* together with the *EMOTIV Insight*, which makes its own interpretation of the EEG data divided in five basic emotions: Engagement/Boredom, Frustration, Meditation, Excitement and Excitement Long Term. Although these five emotions were used at the start of the development, participants could not fully understand how their brain activity was influencing the audiovisual environment. As an important aspect of my work is that participants are invited to control the interactive space and experiment with their own internal emotions, I decided to reduce the set to only two emotions: Meditation and Excitement, which helped users to be more participative, understanding how to control these two opposite emotional states.

The audiovisual installation WEB-MINDSCAPE concentrates on my exploration of the influence of external inputs in our daily life and particularly on the current and profuse usage of social media. The goal is to make visual and audible unconscious internal reactions that are produced in the subject in front of a well-known social network inviting people to reflect about and how this outside input is reflected inside their own self. In the installation, visitors are confronted to Twitter messages while the computer measures their brain waves and analyses their emotional reactions. The visual part is created by a light structure made by electroluminescent wire (EL wire), which glare when applied to an

alternating current (AC). Hence, once the AC has been activated, the data of the subject's brain waves from the EEG interface is utilised in order to turn on/off different cables in different tempos. The subject is immersed in this luminous structure, surrounded by light cables and sound, the latter diffused in 8 audio channels, creating an immersive audiovisual environment. Visitors (one at a time) are connected to the EEG interface, which is continuously measuring their brain activity whilst listening to messages via Twitter from all over the world. Simultaneously, a community is invited worldwide to joint a Twitter account.

The sound section of the work consists of a soundscape which changes depending on the information coming from the EEG: when the subject is in a relaxation state, the sound creates a balanced and subtle soundscape composed with frequencies received from the brain waves; when, on the other hand, the subject's relaxed condition is altered by the messages received from the outside, the sound combines words coming from the instant tweets in real-time, creating a sonic environment made of words as whispers, and which increasingly becomes more chaotic according to the data received from the brain activity.

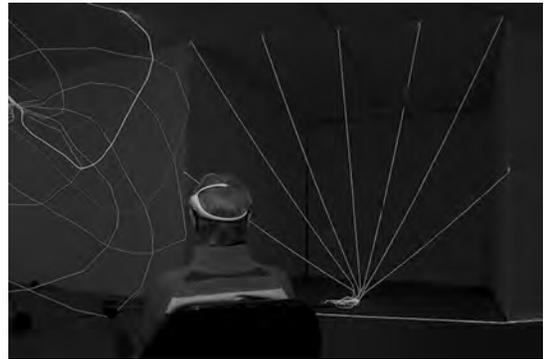


Figure 2. WEB-MINDSCAPE at IK, Vlissingen, The Netherlands. Photo by Michiel Vermet. ©2016

The installation WEB-MINDSCAPE is at this point still a work-in-progress with two important aspects needing revision: firstly, to be in a position to manipulate the *EMOTIV Insight's* raw data, in order to further develop the visual and sound aspects of the piece, due to the limited information available from the software *MyndYourOsc*; secondly, the idea of seeing and hearing internal reactions in front of a social network

needs further research in order to extract the exact information from the EEG for which I have the support of the department of musicology at Cologne University.

To finalise and with regard to some of the questions addressed by this panel, as an artist I consider highly relevant the intersection between art and science, as it opens the possibility of working with scientists, not only to have access to professional equipment (with possible impact on the scientific research within the area), but also to produce meaningful artworks applying both the professional equipment and the scientific knowledge related to bio-signals. One of the main difficulties of making art pieces with bio-signals, is the fine line between either having a scientific result rather than an artistic one at the end, or, given the complexity of the management of the interfaces, that results may not be accurate, and therefore, distorting the very core issue of making art through bio-signals.

Lasse Scherffig: Interacting with Bio-signals: What do We Enact Here?

Cybernetic and, more recently, enactive accounts of perception, understand perception as an activity. One implication of this idea is the conclusion that the objects of our perception emerge from the actions we carry out with them (von Foerster, 2003). This may be especially true for virtual objects and environments (Scherffig, 2016) . Integrating bio-signals into interactive experiences thus opens a path towards the perception of biological states as objects of experience. Art using bio-signals and other forms of biofeedback hence fundamentally changes the relationship between us and such “hidden” states. The latter used to be defined as “epistemic objects” that are products of research programs, scientific cultures and their material conditions (in terms of apparatuses, experimental procedures, discourses, see Rheinberger, 2006) and that primarily exist within the realm of academic research. Instead, they now become accessible as objects of experience, that are enclosed in a loop of perceiving them and acting on them in real-time. They become subject to sensory substitution (Bach-y-Rita, Collins, Saunders, White & Scadden, 1969) or sensory enhancement (Clark, 2007).

This not only implies the emergence of new objects based on bio-signals. These objects are, moreover, mediated and shaped by the technologies that render them perceivable. Tools such as *Max/MSP* , scientific equipment, gaming gear like the *Emotiv* EEG headset,

and self-built DIY solutions all carry their own built-in assumptions about the nature and relevance of (bio-) signals and the possibilities of translating them – assumptions that often are based on the tradition of signal processing. Artistic practice, in turn, brings its own traditions into this mix, as artists working with bio-signals draw from such disparate fields as electroacoustic music, dance, performance, installation, and interactive art. More recently, the use of bio-signals has also surfaced in commercial applications and games, adding game-mechanics and gamification, quantified self, and medical applications to the range of possible strategies.

Artists working with bio-signals thus navigate a territory in which the various dispositives of the production and mediation of these signals are confronted with artistic and commercial strategies and traditions and together shape the experience of new objects of perception. We can therefore ask: How, in the light of this, do these objects look and feel? Or: what is the phenomenology of these objects? In the panel, this question is discussed as a conversation between scientific and artistic experience.

Uwe Seifert: Brain-Computer Interfaces, Mobile EEG and Robotic Systems: New Media Art and Entertainment in Need for Machine Ethics and Android Epistemology?

Not only digitally advanced societies such as Japan, Korea and the USA but also other societies relying heavily on information technology are now increasingly introducing (autonomous) machines – i.e. artificial computational systems – with capacities for learning and decision making in social domains such as warfare, healthcare, education, and economy. In new media art and entertainment artificial computational systems with learning and decision making capabilities acting to some extent autonomously are also rapidly increasing. In particular, interactive installations using brain-computer interfaces and robotic and mobile EEG-systems come to mind. At the same time there is a strong tendency to conceive art as research or science and bring together scientific research and art. For example, the Synthetic, Perceptive, Emotive and Cognitive Systems group led by cognitive scientist Paul Verschure is one the most advanced scientific research groups exploring the human mind/brain as a computational system by combining robotics, new media art, and experimental research using bio-signals (Verschure & Manzolli, 2013).

In general, the use of artificial computational systems with learning and decision-making capabilities in connection with brain-computer interfaces, robotics and mobile EEG-systems in art, entertainment, warfare, healthcare and education raises ethical questions, which need urgently be addressed. The United Nations Educational, Scientific and Cultural Organization (UNESCO) has already undertaken first steps to deal with an ethics for robotics. In August 2016 UNESCO's World Commission of the Ethics of Scientific Knowledge and Technology (COMEST) released a "Preliminary Draft Report of COMEST on Robotics Ethics." The point to be kept in mind is that this report deals with ethics for researchers. This must be carefully distinguished from machine ethics, i.e. an ethics for machines (Moor 2005; Anderson & Anderson, 2011), in particular for robotic systems in warfare, healthcare, and education. For example, Anderson and Anderson (2010) claimed to have implemented for the first time ethical principles on a NAO robot. Both issues, i.e. an ethic for researchers and an ethic for machines, are barely addressed for art and entertainment. For example, the article by Veruggio and Operto (2008) about roboethics touches only briefly upon robots in art and entertainment.

So, in this context some main future challenges arise for new media art and entertainment:

1) Do we need an ethics for new media artists parallel to an ethics for e.g. roboticists? How would such an ethic look like? What then about artistic freedom?

2) Do we need a machine ethics, i.e. an ethics implemented in computationally bounded artificial artistic agents? What kind of rules might be implemented in a feasible manner? In general: Does new media art need an android epistemology for computationally bounded artificial artistic agents?

Let us deal first with questions concerning an ethics for artists. Given that an ethics should be grounded in human rationality the question pops up whether we have some kind of normative theories on which a rational ethics might be grounded. If we are interested in such an ethics first-order languages, subjective probability theory and decision theory provide a core for the best normative theory of rationality we have to date (Glymour, 2015). According to Clark Glymour (2015) first-order languages tell what an agent ought to believe if he wants to believe all and only the necessary implications of what he believes. Subjective probability tells the agent how his degrees of beliefs ought to be

distributed. Decision theory, then, tells an agent what to do under given degrees of beliefs and specification of his preferences and utilities.

If cognitive science is correct and the human mind and especially human reason are computationally bounded systems – and at least it seems that cognitive science offers the best approach today to investigate the mind-brain scientifically – then a theory of rationality based on these theories does not provide a guide for human actions, i.e. for an ethics, that applies to humans. Computability and complexity theory impose limits on the capacities of computationally bounded agents. According to Glymour (2015) evaluation of human behaviour and beliefs can be thought of as functions to be evaluated and according to his computational thesis these functions are Turing-computable. So, computability and complexity theory impose – as for any computational system – limits on the evaluation of human beliefs and actions: thus, humans are computationally bounded agents. For computationally bounded systems, there is – assuming in addition the Church-Turing thesis – theoretically and in principle only a "small" class of functions that is effectively computable. Therefore, for such agents there exists an epistemological limit of what can be known and formulated in an explicit and communicable way. Moreover, practically, there are time and space restrictions on computations, e.g. computations of functions without polynomial-time algorithms are not tractable or feasible and it is also not possible to keep all the parameters needed to represent an arbitrary probability distribution over a state description, i.e. over all possible logically non-equivalent conjunctions of n (two-valued) atomic sentences, in the "head". Such a state description consists of 2^n possible states. In the worst case the space requirement for representing a probability distribution increases exponentially with the number of atomic sentences. Which means for realistic situations the computationally bounded human mind-brain is not capable to represent such a distribution. What does all this mean? Briefly, there are normative theories of rationality but computationally bounded agents cannot act as required by them. This applies to humans conceived of as computationally bounded agent and a fortiori for artificial computationally bounded agents. So, how can humans cope with the challenge to develop an ethics for certain special areas such as for researchers in robotics or artists? Is an ethics for artists in new media art especially those who are dealing with

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art as science necessary? How could it look like given such odd situation?

Assuming that cognitive science is not correct and humans are not computationally bounded agents, then still, questions remain whether a machine ethics, i.e. an ethics for computationally bounded artificial agents, and android epistemology are needed for interactive works of new media art which integrate artificial agents with capacities for learning and decision making.

Unfortunately, as already indicated, the odd situation transfers to this situation: computationally bounded artificial agents are not capable to fulfil requirements set by current normative theories of rationality.

At stake are not only a machine ethics but also (artistic) creativity and learning capabilities of computationally bounded agents in new media art environments: in general, an android epistemology for new media art. Why is an android epistemology for media art necessary?

Imagine the simple case that a learning and decision making interactive installation might cause some harm to its visitors. Will the artist be responsible? The artist did not pre-specify the actions of the system, the system learned through interacting with visitors. In addition, the system evaluated and decided to choose some action sequences by itself. Think of another case, a system might – because of its learning functions – become capable to create aesthetically more interesting products than the artist or user it is supposed to support in creating art works. Should it be allowed to do so? How could this be implemented? Here android epistemology is needed to clarify the epistemological, ethical, and esthetical limits of computationally bounded artificial artistic agents. The main question android epistemology asks are (Glymour 2015, p. 370):

1. What might be normative principles of rationality for a computationally bounded agent?;

2. How can a computationally bounded agent possibly do what humans do?

Thus, being aware of these epistemological questions and questions and problems raised by cognitive science new media art – especially conceived of as “art as science” – will reflect on and cope with questions concerning the human condition and participate in forming human’s future socio-cultural as well as economic environments.

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Electronic Art in Brazil: Exhibition Spaces, Museological Strategies and Digital Archive

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Abstract

This panel intends to discuss operational strategies for public and private exhibition spaces, proposed by artists, curators, professionals in expography and museology in the field of Brazilian Electronic & Digital Art, from early experiences to a contemporary perspective. It also aims to analyze and discuss museological strategies for electronic art exhibitions as well as for interdisciplinary exhibitions involving art, science and technology. In this discussion we question not only the innovative functions of these spaces for electronic/digital art, but their necessary functions as promoters of processes for preservation and archiving. The panel comes from broader discussions among artists and researchers, many responsible for curatorial and exhibition projects, from the second and third generation of Brazilian Electronic Art in Latin America.

Keywords

Brazilian Electronic Art, Expography, Museology, Pioneers, Archiving, Art Laboratories, Digital Art, Latin America.

Introduction

This analysis addresses some issues from pioneer artists and more recent generations, to study groups, laboratories and curatorial experiences in electronic art in Brazil, to problematize exhibition spaces, museum strategies and digital archives in the field of contemporary art. It begins by proposing a digital archive of electronic art in Latin America, with a focus on Brazil in this study. This is followed by a sampling of some laboratories and research groups in Brazil, with which these authors have more direct contact. It presents a historical perspective of electronic art pioneers and the beginning of research in Brazil's midwest. It discusses exhibition spaces, museum strategies based on the experiences of artists and curators from the midwest, south and southeast of Brazil, and concludes with questions to think about concerning Art and Digital, from past and present exhibitions.

The Digital Humanities initiative is very intimately concerned with archival practices, especially as it tends to subsume information on art and heritage conservation. The archival program appears to be imminently necessary for the preservation of Latin America's digital/electronic art heritage, in countries like Argentina, Chile, Mexico, and especially Brazil which is the focus of the panel. We have been trying to create a database of artists spanning six decades - from what a section of electronic art historians are beginning to call pioneer electronic artists. We could focus on the chronological aspect of the new arts in Europe and the New World, as well as Asia and Western Europe and the Middle East - i.e. everywhere where new media have been invasive. Latin America, especially with a great country like Brazil, is no exception. In this article, we look at issues surrounding any attempt to preserve, protect and organize bibliographical information on the new arts in Latin America, but especially Brazil.

The prototype for archives are already up and running with such conventional web based encyclopedic efforts as Wikipedia. Brazil's electronic arts, as in the case with most Latin American countries, have minimal exposure through international networks, which are dominated by pro-globalization capital. This is the way economies work. Privileged economies share greater access to information and also to the archival repositories that have been developed for a digital humanities index. For example, the major art indexes of multinationals like Google, Ghetty Foundation Archives, freebase.com or Proquest are more relevant to the archival concerns of the countries in which they operate. What categories are to be included in the construction of a digital archive for electronics arts, and new digital media culture in Brazil? The answer to that question has to be found in a large historical rendition of the context and categorization of art practices from the sixties. In Mexico, for instance

Manuel Felguerez, was creating visual arts using computers. Julio Le Parc in Argentina, and Mariotti in Peru anticipated more kinetic and hardcore electronic art genres whose parallels and exemplars are also visible, sometimes with great magnitude and impact, in the art works of some pioneering and ingenious artists who discarded the older formats. Visual arts worlds were already surprised by and attracted to the punch card abstractions generated by Waldemar Cordeiro¹ and Giorgio Moscati². Then there are kinetic works like those of Otavio Donasci³. Another significant category, again parallel to what was happening with kinetic arts in Mexico, were the works of Abraham Palatnik⁴.

The Qt multiple platform format, based on C++, was used to develop a catalogue format appropriate for a digital archive interface of art works created by Latin American artists in the last forty years (Figure 1). A basic formatting program incorporating links to these artworks could be envisaged as an additional step. This would use the Qt *catalogue raisonné* information to connect to most of the foundational archive links such as are available freely on the web: these include WorldCat, ULAN, SUDOC, LCCN and the ISNI resources common to such encyclopedic sites as Wikipedia for example.



Figure. 1

In conclusion we would like to suggest a categorical format (program) for the Brazil archive, which already demonstrates promise and possibilities of heritage construction. Perhaps kinetics, installation, and computerized visual imagery constitute proto-genres in technology based pioneering art. From these three filters

¹. Waldemar Cordeiro. Visual Art *Cinecromatico*. 1951.

². Waldemar Cordeiro and Giorgio Moscati. 1969. *Derivatives of an image*. 47 × 34.5 cm.

³. Otavio Donasci. 1980. *Video Creatures. Human Body and Computer photography*.

⁴. Abraham Palatnik . 1951. *ART MACHINE* . Installation.

we can deduce the complex branching network of the great variety of contemporary digital art in Brazil, some of whose specimens have been nurtured and conceived, albeit not yet preserved in any archive, in forums such as the São Paulo Biennial, and the Itaú Cultural Institute⁵. In either case a *catalogue raisonné* should acknowledge the broad primitive categories within the early electronic art of Brazil so it could evolve into a broad digital humanities archival resource for the more contemporary arts of this culturally advanced nation.

Electronic Art in Institutional Laboratories: Some Brazilian Research Groups

Since the time of Waldemar Cordeiro and Giorgio Moscati, the development of electronic art combines artistic and scientific knowledge. The first works of Brazilian computational art emerged from this composition and place, collaboratively in a laboratory. Before this, Brazil had known the kinetic art of Abraham Palatnik, whose training in electronics and art brought together the desired qualities in one person. With increasingly complex processes, electronic art began to be incubated in the laboratory, research center or university. The model has spread, not because it's a fad, but because of the idiosyncrasies of this branch of art: specialized knowledge and equipment. Everything led to laboratories being the optimal spaces for the production of electronic art.

The laboratories, in their various formats and compositions, became the “ateliers” of the technological branch of art, fostering collaborative work in multidisciplinary teams. In this context many teams and specialized places were created, especially in Brazil, but we will present only those with which we have more direct contact, such as the info-aesthetic group, later computational art, at the University of Brasília and, also in the midwest, the research group in interactive media development and innovation at the University of Goiânia, both of which are Medialabs. In São Paulo, they include the digital poetics group based at the University of São Paulo and the inter-institutional research group on the crossovers between art, science and technology at the State University of São Paulo. The movement expanded in the southeast with the art and new organisms group at the Federal University of Rio de Janeiro and in the south of the country with the art and technology group of the

⁵. “Major exhibitions at the Itaú Cultural Institute include Imateriais (1999) and the Emoção Art. ficial Biennale (2002-2012)”

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Federal University of Santa Maria, among others. It should be noted that many state capitals, such as Natal, Salvador, Porto Alegre, Belém and Belo Horizonte, among other cities, founded laboratories focused on electronic art research and production, underpinned by collaboration as a frame of reference. The relationship between art, science and technology set the tone for production, which has followed a poetic vein based on interactivity, immersion, multi-sensory experience, agency and connectivity.

With its production based on national territory, technological art was consolidated in Brazil in the 1990s, with events, publications and exhibitions that showed the poetic strength of this area. Born from the confluence between kinetic art, video arts, performance and participatory art, Brazilian electronic poetry created its own territory and marked out its place in the world, finding the incubator it needed in laboratories and research centers. The multidisciplinary teams were not just necessary but fundamental for the technological and poetic density ingrained in the works, resulting in internationally renowned artists whose works reflect the complexity and simplicity of the art, in its electronic, computational and technological facets.

Computer Art: Pioneers and events 2004 a Turning Point

In Brazil, around 1987, a small group of artists and scientists called the Infoesthetica Group began to explore an art form that was emerging at the time, in which sensory, poetic and aesthetic experiences would be inter-mediated by computers. This group was formed by Aloisio Arcela, Bia Medeiros, Homero Picollo (software creator), Paulo Fogaça, Suzete Venturelli and Tania Fraga. The procedures that characterized the works proposed at that time were very specific and required programming knowledge from the artists to break the codes (Diamond, 2008). Their main goal was not the development and research of computer science algorithms but to acquire this type of knowledge in order to create meaningful sensory, poetic and aesthetic environments with it. The Brazilian group was not the first of its kind. They followed artists such as Bernard Caillaud (France), Waldemar Cordeiro (Brazil), Yoshiro Kawaguchi (Japan) Paul Brown (UK), Hebert Franke (Germany), Nicholas Schoeffler (Hungary), John Whitney (USA), Lilian Schwartz (USA), Frieder Nake (Germany), to name just a few. Theoreticians such as Arlindo Machado (Brazil), Lúcia Santaella (Brazil), Vilém Flusser

(Czechoslovakia-Brazil), Philippe Queau (France), Edmund Couchot (France), Roy Ascott (UK), among others, had also already written about this emergent art form. These theoreticians had been awakening artists to the experimental potential of computer technologies. Flusser, for example, lived in Sao Paulo for 30 years. He investigated the role of artists and philosophers in contemporary society in the post industrial age pointing to the possibilities for technical objects.

By the end of the 60s the pioneering artist Waldemar Cordeiro began to use computers in visual arts in Brazil. In 1971, he showed his computer artworks at the exhibition Arteônica and presented a manifesto with the same name, which has since influenced many Brazilian artists. In 1972, he created the Arteônica Center at the Art Institute of the University of Campinas. In 1994, after much struggle, these ideas began to be more generally accepted by the Brazilian art community and the first Brazilian art graduation program, focusing on these issues, was created at the Art Institute of the University of Brasilia, in Brasilia, and a few exhibitions were held in important institutions. From 1997 until 2015, the Brazilian Itau Cultural Institute has had a leading role in the field of art and technology. It has been showing and awarding artists and has promoted very important international art and technology biennial exhibitions named *Artificial Emotion*.

A second generation of artists, theoreticians and curators, working with art and technology, was emerging around 1996-2008. They followed Machado, Bousso and Santaella's leadership, and have begun to investigate this specific type of art. Consequently, what used to be a small biannual meeting at the University of Brasilia was transformed into an annual International Congress always held in conjunction with a Computer Art exhibition.

Exhibition Spaces, Museum Strategies and Archiving

In 2004, during one of the annual congresses quoted above, the exhibition $\geq 4D$ (*Greater or Equal to 4D*) was held at Bank of Brazil's Cultural Center in Brasilia. For that occasion Tania Fraga and Wagner Barja curated the show and Fraga introduced the concept of meta-installation. The focus of almost of all the works was interactivity. The idea was to create space-time dialogues among these artworks, and not a set of separate independent installations. In it, human and artificial intelligence were united to create a symbiotic

communion among the interactors' minds, the artists and the machines that run the software within the exhibition spaces. These artworks entwined subjective sensations with mathematics and art.

Summing up, it is necessary to state that, obviously, our ability to manipulate computer languages trans-codified into feelings and sensations is still very limited. Brazil may play a leading role in this field due to the speed with which Brazilian society has been absorbing the changes prompted by the development of computer technologies. Brazilian artists have been challenged by theoreticians to develop new identities for a society which desires development and access to technologies and the benefits they bring to contemporary life. Computer Art may become one of the answers for these challenges. The University of Brasilia has been a pioneer maintaining the commitment that guided the establishment of Brasilia as a hub of contemporary values, appreciating the blend of Brazilian culture with the arts.

The Symposium of Contemporary Art started in 2006, promoted by Postgraduate Program in Visual Arts (PPGART/UFSM) and the Laboratory of Research in Contemporary Art, Technology and Digital Media (LABART). Each year there is a distinct theme related to digital art and technology research. Until 2013, art exhibitions bringing together Brazilian artists of international renown, second and third generation pioneers with research in digital and computer poetics, were held in tandem with this event in the south of the country. Festival of Art Science and Technology of Rio Grande do Sul (FACTORS) with artists from a more recent generation began in 2014. FACTORS 2.0 was held in 2015 at Santa Maria's Museum of Art in conjunction with the 24th National Association of Plastic Arts Researchers (ANPAP) anual meeting with the artists Andrei Thomaz, Bruna Dias, Carlos Donaduzzi, Fernando Codevilla, Flavya Mutran, Gabriel Mascaro, Gilberto Prado, Jack Holmer, Joana Burd, Matheus Moreno, Suzete Venturrelli, Yara Guasque.

These exhibitions are interdisciplinary in nature and also generate the study and analysis of other exhibition styles and museographic strategies, from the Museum of Art, Science and Technology project, promoted by LABART's art and technology research group, at the Federal University of Santa Maria since 2011. During these years, three different exhibition actions were carried out: the first, the Art-Science-Technology Interactive Museum: "Mata-200 milhões de anos

Árvore Pedra" ("Mata-200 million years Tree Stone") was attended by the artist Anna Barros and took place at Santa Maria Museum of Art (MASM) in 2011, with an emphasis on nano art. The second, "Art-Sustainability-Science", took place at UFSM in 2013, bringing together the artists Anelise Witt, Guto Nóbrega, and Malu Fragoso, among others. The third, "Neuroart", presented a work by the artist Alberto Semeler in 2015, and a new version of "Neuroscience and Art: sensory perception", together with FACTORS 3.0 in 2016, with the artists including Mariela Yeregui, Manuela Lopez, Raquel Zuanon, Raul Dotto, Rosangela Leote, and Tania Fraga. Neuroscience is the guiding curatorial principle of this exhibition bringing together participatory, interactive projects, videos and performances at the convergence of art, science and technology.

In this sense some questions are raised regarding 2016's exhibitionary action. One question concerns the provocation that these works impose on perception. Neuroscience is the guiding curatorial principle of this exhibition bringing together participatory, interactive projects, videos and performances at the convergence of art, science and technology. In general, contemporary art concentrates its forces on deconstructing pre-established perceptual and sensory experiences, and in a certain way, the appropriation of new technological devices makes feeling art become extremely fluid. Another issue relates to understanding how these exhibitionary actions, together with the constant updating of knowledge in the different areas involved, have opened up a distinct and collaborative path for rethinking museum strategies for the group involved. The third question highlights how these exhibitionary actions contribute not only to questioning whether [thought-out], up-to-date expographic practices and processes for conserving and archiving Digital Art can have the potential for upgrades, but to think critically about whether current survival strategies are not wrong.

Imateriais (Itaú Cultural, 1999) was developed using 3D videogame technology similar to Half-Life (Valve, 1998) and made reference to the exhibition Les Immatériaux (1985, curated by Jean-François Lyotard). In the Imateriais exhibition, visitors were first photographed at an ATM machine, where they also selected their virtual body, their avatar. Then they received a password and proceeded to one of 25 terminals that ran the multiplayer videogame. Inside the virtual world, each visitor could see everyone else and recognize them by the photos

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which were displayed in their avatars. They could also talk to each other using headsets, through a real time voice system, which located their voices inside the virtual world, controlling sound volume and stereo effect according to their virtual position. The whole exhibition stimulated a reflection about what it would be like “to feel” for a virtual body. *Desertesejo* (Gilberto Prado, 2000-2014), a dreamlike, immersive piece developed originally in VRML in 2000 as a networked virtual web browser based environment, that allowed 50 simultaneous online participants. The VRML plug-in used in 2000 became obsolete after about a decade, and the piece was entirely restored in 2014, at Itaú Cultural, using a web browser based video game engine (Unity 3D). “*Descendo a Escada* (Descending a Staircase) (Regina Silveira, 2002)”, also developed at Itaú Cultural, is an interactive, staircase projection on three planes which follows Regina’s own graphics rules of perspective. For this piece, it was necessary to change the “standard” mathematical perspective rules. This was done in two relatively simple steps: first a regular perspective projection was generated for the whole staircase, frame to frame, and then this sequence was cast, using a conical projection, into the three planes that compose the piece, creating the intended perspective distortion.

Finally, the Itaú Cultural innovation team has been working with Regina Silveira since September 2016 on her new piece, a yet to be named work due to be released in June 2017. It will be a multiplayer experience in a VR environment, based on Regina’s well known labyrinths, but created with genetic algorithms in a Cray XC-40 supercomputer.

Art and Digital: Exhibitions Past and Present

The idea of a history of exhibitions is fairly recent. Emerging in the wake of the process of cultural globalization and the proliferation of mega-exhibitions in contemporary art, interest in a narrative of the history of exhibitions is not only a reflection of consolidating curatorial practices on the art circuit, but also of understanding that curatorship can be a fertile instrument for the construction of diverse narratives and outlooks in relation to the history of art, especially in relation to the history of art and technology in countries outside the hegemonic blocs. To speak of the history of art and technology exhibitions in Brazil means, in the first instance, not forgetting the work of the curator Walter Zanini, not only in the 16th and 17th editions

of the International Biennial of São Paulo (1981 and 1983 respectively), when he abolished exhibition spaces reserved for countries, but also exhibitions and proposals such as JACS, Prospective 74 and Visual Poetics (1977) held when he was director of the Museum of Contemporary Art (MAC).

For example, in JACS (1972), in addition to Zanini opening up space for production that was in dialogue with new media (xerox, video, etc.), he raffled spaces for artists to produce their works in the museum requesting, in the rules of enrollment, that artists focus more on the artistic process than on the finished object.

Prospectiva 74 was innovative, too, by forming a network of known artists, in which each artist could invite one more and so on. This network of friends resulted in an exhibition with over 150 artists who produced works that went beyond the limits of conventional media such as video art and mail art. Visual Poetics (1977) also had innovative aspects and gave the public the chance to choose the works they might like to take home, giving out photocopies of the documents and works displayed, configuring the spontaneous participation of visitors in creating numerous “mobile exhibitions” and thus highlighting the value of the collaborative network between artists.

It is important to emphasize that the end of the 1960s and early 1970s in Brazil coincided with the period of the military regime’s revival and its mechanisms of censorship and repression. As a reaction to the dynamics of an art trade sympathetic to the dictatorship, experimental artists in art and technology of the time took up the challenge not only to work with styles outside the legitimized canons but also with works that functioned as guerrilla tactics against the system then in force.

In 1971, in parallel with other protests in the field of art and technology, Waldemar Cordeiro organized the *Arteônica* international exhibition at Fundação Armando Álvares Penteado (FAAP). In the exhibition catalog he highlighted the democratizing aspect of *telematic arts*, put into practice in the country mainly from the 80s. By assigning to art the function of “communicating communication”, Cordeiro understood the computer as an instrument of social transformation. For him, the modern artist was the one in a position to create new communication techniques.

If the popularization of the internet allowed us to imagine a world where information could be more accessible - as Cordeiro thought at the time - on the other

hand, we cannot fail to notice the intrinsic relationship between archiving, surveillance and the monitoring of user data by large companies and corporations within the current context. Initiatives such as Wikileaks, organized and led by Julian Assange, who made secret documents public, prove the lack of privacy in the network environment. In this sense, it seems to me that, rather than focus on exhibitions that work with the specificities of particular styles, or to ask ourselves what are the details of curatorial activity in art and technology exhibitions, it might also be of interest to verify which projects can contribute to our thinking and reflections on the urgent context in which we live. Among them, the Arquivo Vivo curatorship in the Paço das Artes whose idea was to work with issues relating to the database and the archive as a device of control and power.

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Marcos Cuzziol is in charge of Itaú Cultural's Department of Innovation. Responsible for the "Emoção Art.ficial" Art and Technology Biennale from 2002 to 2012. An engineer and 3D game developer, he holds a doctorate in Arts from the University of Sao Paulo.

Nara Cristina Santos is Post-Doctorate in Visual Arts at the Federal University of Rio de Janeiro 2012-2013. PhD in Visual Arts at the Federal University of Rio Grande do Sul 2004, with an emphasis on History, Theory and Criticism of Art and PhD internship in Paris VIII, France 2001. Her doctoral thesis: Art (e) Technology in sensitive emergency with the digital environment: Brazilian projects. Currently professor at the Visual Arts Department 1993 - Federal University of Santa Maria, where she works in the Postgraduate Program in Visual Arts, PPGART. She coordinates the Laboratory of Research in Contemporary Art, Technology and Digital Media, LABART and leads the research group Art and Technology-CNPq. She was part of the Digital Art of the Ministry of Culture/MINC 2009-2011. A member of the Brazilian Committee of the History of Art/CBHA and the National Association of Plastic Arts Researchers/ANPAP, where she is president for the 2015-2016 biennium.

Priscila Arantes is a researcher, curator, professor and museum director. Currently she teaches Masters and PhD students in the design program at the School of Arts, Architecture, Design and Fashion of the Universidade Anhembi Morumbi. She holds a PhD in Communication and Semiotics from PUC/SP and a postdoctoral degree in Art Criticism and History from the Penn State University. She is currently artistic director and curator of the Paço das Artes, a museum in São Paulo, since 2007. Her publications include *Arte e Mídia: perspectivas da estética digital* (Art and Media: perspectives of the digital aesthetic), *Arte: história, crítica e curadoria* (Art:

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history, criticism and curating) and *Re/escrituras da arte contemporânea: história, arquivo e mídia* (Re/writings of contemporary art: history, archive and media). She has curated a number of exhibitions. Recent curatorial projects include *Arquivo Vivo*, *Projeto 5X5* and *MaPA*, held at the *Paço das Artes*.

Tania Fraga is a Brazilian architect and artist with a Ph.D. in Communication and Semiotics at the Catholic University of Sao Paulo. She is vice-president of the Sao Paulo Institute of Mathematics and Arts. In 2010-11 she developed a Senior Post Doctoral research project at the School of Communication and Arts, University of Sao Paulo, with a research grant from Sao Paulo Research Foundation, FAPESP. In 1999 she developed a Post Doctoral research project at the Centre for Advanced Inquiry in Interactive Arts and Science Technology and Art Research, UK, with a research grant from the Agency for the Improvement of Higher Education Personnel, CAPES. In 1991/1992/ 2010/2011 she was a Visiting Scholar at the Computer Science Department at The George Washington University, USA. In 1986 she received a grant from the Fulbright Commission. She has been showing and publishing her work in many national and international events.

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Reynaldo Thompson is a Mexican scholar, architect and artist who holds a PhD on Aesthetic Studies. His artwork has been shown internationally. A background in visual art and architecture helps him interact with space and time in almost unusual but repressedly delightful ways. He participated in artist residencies in the United States of America and has curated exhibitions in Mexico and the USA. At present he is associate professor at the University of Guanajuato, Mexico where he also chairs the Department of Art and Management in the

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Archiving Digital Heritage: Pioneers of *Fin-De-Siecle* Latin America

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Introduction

This panel tries to open a discussion on the history of the hybridization of art and technology in the last five or six decades, with reference to any specific country, in the Latina American region. It consists of 33 countries of all sizes, from the extensive Brazil to the small islands of the Caribbean.

The idea and main purpose of the panel is to address the under-representation of this new form of art in the global discourse of the art – something that arises out of neglect and assumptions about the world order. Panelists focus their attention on the sunrise of an experimental art that began to embrace more and more of the new technology since the 50s; at times we witness the incipient promises of the art technology hybrid as early as in the 40s just as much as the phenomenon energy oriented art were visible in labs established in other regions of the developed world.

From Argentina, Ricardo Dal Farra, speaks of his experience of rediscovering, in a junkyard of the past, some of the most innovative electroacoustic music composers and creators of new forms and the new aesthetics of sounds and music. Dal Farra who has been closely working with the Langlois Foundation in Montreal has put together perhaps the most important archive on electroacoustic music of Latin American. Our other panelist from Argentina Andrea Sosa complements this history with a discussion of the visual art of light effects from the same period, namely in the works of Julio Le Parc, active from the same era as when the *Torcuato Di Tella Institute* began functioning as the most important supporter of these emerging trends in art world.

The beginnings of art and technology in Brazil, the largest country in size and population of the region, are represented in the presentation of Andres Burbano who analyzes its artistic scenario. He finds the seed for

electronic art and digital photography in the works of Geraldo de Barros who used punched card to modulate abstract photography and whose photography now remains as Burbano shows a pioneering landmark in computational art. Representing the same geographical context, our other panelist Rejane Spitz brings into the discussion the work of three pioneers in Kinetic and electronic art, namely, Waldemar Cordeiro the precursor of electronic art in Brazil, Abraham Palatnik a precursor of kinetic art, and Otávio Donasci known for his theatrical video performances in the psychological dimensions of social relations. No doubt on about Spitz argument that *electronic art in Brazil has found a fertile ground to grow and flourish*.

Another important perspective in the evolution of kinetic, electronic or digital arts, as well as in evolution of a critical turn in art in Latin America, is valorized by Gabriela Aceves Sepúlveda's presentation. Her objective is to highlight on women artists from Mexico. Aceves anticipates the importance of *Telematic Art* of the seventies, *Lorraine Pinto* (born in New York and working in Mexico since 1959) working with sound and light during the 60s, and Pola Weiss a pioneer of video art.

From Peru we have Jose-Carlos Mariátegui who studies the contribution of the Swiss born pioneer electronic artist Francesco Mariotti who is an established artist now in both, Switzerland and Peru. In his analysis, Mariátegui focuses attention on two works: the *Project Geldmacher-Mariotti* presented at the *Documenta* in 1968 and the *Circular Movement of Light* shown at the *X Sao Paulo Biennial* in 1994 representing Switzerland together with other three artists.

Speaking of recent developments in the new media arts, Jose Manuel Ruiz-Martin analyzes the evolution not of the work of any specific artist from Ecuador, but of the laboratories of digital experimentation, the

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first one of them being inaugurated in 2012. With that context in mind, it is meaningful to start documenting the history of those media labs that will most likely reap the harvest of the new art for the generations to come. Thus the panel stands unique in its diverse range of interest and analysis of art and technology through the entire span of our geographical region and of our cultural identity in the new world.

Author Biography

Reynaldo Thompson is a Mexican scholar working at the University of Guanajuato, Mexico. At present, he is planning to launch a database on the evolution of Digital Art in Latin America (DALA) together with a team of international experts.

Feminizing the Archives of Digital Art: Recovering the Work of Female Artists Working in Mexico, 1960-1980

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Abstract

Given the recent interest in developing archives to recover the contributions of Latin American pioneers in digital arts, in this paper I take issue with the lack of attention given to female artists born or working in Latin America. I argue that the process of recovery needed to build such archives needs to adopt a feminist lens that speaks to particular conditions of production and unpacks the local and international mechanisms of exclusion that have hindered the recognition of female artists. It should also consider debates on Latin American art and the recent contributions of media historians who have opened up art history to understand the shared histories of art, science, and technology. Finally, I give a brief overview of the work of three female artists working in Mexico who anticipated features of digital art by experimenting with publishing networks, broadcasting technology and kinetic art.

Keywords

Latin American Art, Digital Art, Mexico, Female Artists, Publishing Networks, kinetic Art, Video Art, Mail Art, Archives.

Feminizing the Archives of Digital Art

The lack of visibility of women in the histories of art, science, and technology extends geographical regions and time periods. This invisibility is the product of deep-rooted patriarchal structures that have historically defined intellectual and scientific fields of action as predominantly masculine spaces (Plant, 1997; Pollock, 1999). Female artists born or working in the region of Latin America have been double excluded from these histories due to their gender and the ambivalent position that the region occupies as neither entirely western nor fully modern. As Canclini has put it, Latin America is the region of the semis “semi-modern, semi-developed, semi-indigenous, semi-European” (Mosquera 1996, p. 231). This ambivalent context has not only complicated the definition of Latin American art but has, until recently, consigned the early histories of digital arts as out of reach for a semi-developed technological region.

How should an archive of Latin American digital art pioneers look like considering its uncertain position as neither wholly western nor fully developed? What does it mean to be a “pioneer” from this complex condition of imported references and cross-breedings? Should simply mapping Latin American artist’s contributions into the dominant cannon will suffice?

These are all important questions that need to be asked to define the limits of an archival endeavor. Given the limited scope of this paper and the inherent exclusionary characteristics of any archival endeavor one of the objectives is to pose suggestions on how to feminize this effort to undo a historically gendered and geopolitical position of subordination that have defined the cultural production of the region. Richard defines feminization as a process that breaks down the barriers of biological determinism and fixed symbolic roles, becoming thus a practice of continued contestation which is not only relevant to those who define themselves as women but also to a multitude of experiences that contest normative and fixed definitions of sex, race or ethnicity (Richard, 2004). Then, I propose that the process of feminizing an archive of Latin American digital art should entail questioning the relevance of the dominant structures of recognition imposed by the Western European-U.S. art cannon as well as the patriarchal configurations of the Latin American art milieu. It should make a point of recovering the work of artists that define themselves as female, but it does not propose to exclude those who not identify as such. It should aim to map out categories, networks, and experiences that speak to the ways in which people and ideas cross borders and art is produced as an interconnected lived experience and not in a vacuum.

This process of feminization should also build on significant contributions by scholars who, in the last few decades, have debated the usefulness of the category “Latin America” to describe the cultural production

of more than twenty-two nations (Mosquera, 1996; Ramírez, 2004, Camnitzer et al., 1999). How useful is then the category “Latin America” to build an archive that proposes to undo the dominant structures of recognition of the art world? For many, the solution resided in putting emphasis on networks of exchange rather than cultural identities and difference. And yet, others returned to a national model to argue for local conditions of production (Debroise, 2007). In *The Age of Discrepancies* (2007) Debroise and Medina turned their gaze to 1960s Mexico City to recover the works of artists born or working in the country at the time. The thematic structure of the exhibition, which prioritized local conditions of production, was a significant contribution. However, the minimal attention given to the ways in which technology and scientific discourses influenced art during the period and to female artists visà-vis well-known male counterparts signaled the project’s adherence to the national art cannon.

In contrast, feminist and media art historians have made important contributions to dismantling the dominant structures of the art world— whether national or global. Feminist scholars have recuperated the role of female artists across geographies and historical periods (Pollock, 1999; Butler 2007). But the ways in which female artists intervene within the broader fields of art, science, and technology remains relatively unexamined. For their part, media art historians have successfully shown how digital art did not develop in an art historical vacuum (Grau, 2010; Paul, 2015; Shanken, 2014). Several have pointed out the connections between algorithmic procedures and avant-garde and postwar art (Paul, 2015, p. 11; Weibel, 2010, p. 21). However, these narratives rarely account for artists working outside the Western Euro-U.S.-Canada matrix. Hence, a process of feminizing the archives should consider and expand on all the aforementioned contributions. Conversely, it should carefully scrutinize the ways in which dominant patterns of exclusion continue to surface in unexpected ways. As an initial effort of recovery in what follows I briefly describe the ways in which some of the work by Margaret Randall (b. 1936 New York City), Lorraine Pinto (b. 1933 New York) and Pola Weiss (Mexico City, 1947 - 1990) anticipate the arts of the digital era through their experiments with audience participation, movement, optical illusions, networks of communication and relations of self and technology.

Female Artists Working in Mexico, 1960 -1980

The 1960s was a decade of unprecedented transformation in the field of media arts. Artists, scientists and technology enthusiasts experimented with new and old technologies leading to the development of interdisciplinary media practices. Magazines became important sites of artistic creation and exhibition. One such magazine was the bilingual (English and Spanish) magazine *El Corno Emplumado/The Plumed Horn* published in Mexico City from 1962 to 1969 by U.S. poet Margaret Randall, who moved to Mexico in 1961, and her husband, Mexican writer Sergio Mondragón.

El Corno, as its collaborators called it, emerged as a response to the ideological pressures of the Cold War. With a printing of 3000 magazines per quarterly issue and a distribution that extended across the Americas and to several cities in Europe and Australia, *El Corno* emphasized art’s potential to bridge barriers between nations and political ideologies. For Randall, *El Corno* “was never just a magazine; it was never just a collection of words and images put together by two people...*El Corno* was a network” (Randall, 1978, p. 412).

To create a network, *El Corno* adopted the spirit of mail art, using postal mail as a means of distribution and exchange. The letter section provided its readers with alternative information on important issues of the time. Ultimately, the letters constituted the basis of the magazine distribution. In publishing visual art along with the poetry, prose, and critical essays of both established and emergent artists, *El Corno* showcased artworks that would otherwise not have been seen together at the time (Aceves, 2017). By facilitating these encounters and conversations through their open editorial approach and their post mail distribution system, *El Corno* was in a parallel dialogue with Fluxus artists, whose aim was to create networks of artists outside the art establishment by making creative use of technologies of communication. *El Corno* spoke to the ways in which Fluxus endeavors challenged traditional notions of the artwork and used existing means of communication to distribute art and create networks (Aceves, 2017). *El Corno*’s use of mail art as a form of communication and distribution anticipates Ascott’s notion of Telematic Art and other works that began to experiment with slow-scan TV, fax and radio in the 1970s. Experiments with these broadcasting technologies, as Paul has noted, “represent early explorations of the connectivity that is an inherent characteristic of networked digital art” (Paul, 2015, p.21).

In the context of the celebration of the XIX Olympic Games in 1968, a year before *El Corno* come to an abrupt end, the international movement of kinetic and op art took root in Mexico City. The games adopted the aesthetics of op art to develop an image of Mexico that would position the country as a modern and developed nation. Due to the political turmoil experienced in the country, which resulted in the massacre of students on October 2nd a couple of days before the inauguration of the games, art critics in Mexico have tended to disregard the categories of Kinetic and Op art because of their connection with the government and the games. For example, in the *Age of Discrepancy* the category “Systems Beyond (the so-called Mexican Geometrism)” is used to describe the experiments of Siqueiros, Felguerez, Cueto, Goertiz, Sakai, Hersúa, and Sebastian with optical illusions, illusory or mechanical movement and audience participation rather than Kinetic or Op art.

In contrast, for Lorraine Pinto, an artist working in Mexico City since 1959 and not included in the *Age of Discrepancy*, the category of Kinetic art has always defined her practice. In 1964 she established the experimental lab of kinetic art along with the electrical engineer Leonardo Viskin and the physicist Roberto Domínguez to integrate light movement and sound to her sculptural practice. The establishment of this lab represents one of the first deliberate efforts to work collaboratively across disciplines integrating science, technology, and art in the country. In 1968 she participated in the *Solar Exhibition* organized as part of the XIX Olympic Games cultural program with the work *Quinta Dimension*, a futuristic model of an urban environment. Made up of two modular city prototypes encapsulated in two plexiglass bubbles, *Quinta Dimension* incorporated sound and light. Viewers were invited to walk around and experience it from different perspectives. As Garza notes Pinto’s use of light and sound emphasized the temporal nature of art and opposed the ocular regime that dominated the postwar painting canon (Garza, 2011). After winning a prize with *Quinta Dimension*, Pinto continued to paint and create kinetic sculptures and large-scale public works that incorporated movement and sound. However, it was only in 2012 in the context of Garza’s revision of kinetic art in Mexico when Pinto’s early experiments were recognized more fully in the company of the male artists mentioned above (Garza, et al., 2012). As Pinto recently acknowledged “it took almost 40 years for her kinetic

artworks to be recognized and understood” (XGusto, 2016).

Like Pinto, Pola Weiss also stepped out of the boundaries of traditional artistic disciplines and turned to technology as the basis for her art practice. Weiss began to experiment with video in the early 1970s to propose new ways of thinking about televisual images and broadcasting. After collaborating with both private and state television broad-casters in 1978 she declared herself to be a *teleasta*, a producer of experimental televisual images. From then until she took her life in 1990, she produced a series of television programs and videos in which she experimented with live performance, visual poetry, music, and visual effects.

As one of the first artists in the country to experiment with video, Weiss developed a unique approach. She conceived each of her videos as an act of giving birth, and her camera was at times her daughter or an extension of her body. By using the video camera in this manner and adopting television broadcasting as a conceptual model to reach audiences outside of the art world circuits, Weiss sought to break with the media border to interpellate critical and embodied viewers (Aceves, 2015). Her work was also in dialogue with Telematic Art’s emphasis on networked communications and anticipated notions of hybrid constructions of self and technology. For instance, her *videodanzas*, which consisted of live events in public spaces in which she combined performance and video, Weiss transformed her video camera into an eye or a limb as she danced with it in her hand, filming her movements. Simultaneously, her camera broadcasted her movements through video signals transmitted to monitors and reflected through mirrors. At the same time, through visual effects and the incorporation of live feedback, she merged her body with that of the spectator. In doing so, she developed an analog virtual screen space in which the object and subject of representation could co-exist and be merged into one through analog visual effects (Aceves, 2015). In this manner, Weiss’s experiments with televisual images challenged passive relations between self and technology

Conclusion

The process of feminizing the archives of digital art involves much more than mere acts of recovery. Critical questions about which artists make into the archive and what categories should the archive consider cannot be taken lightly. As an initial step, I’ve discussed how

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the work of three self-identified female artists working in Latin America was in meaningful dialogue with local and international experiments, and hence, offer different pathways into the histories of art, science, and technology.

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Proto-Computational Arts and Photography

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Abstract

How Geraldo de Barros obtained abstract photographs using disposed punched cards makes evident that the origins of the interaction between algorithmic devices and the arts are deep and there is a clear need to describe the visual artifacts, and the historical and technological contexts as well to better understand his work. José Oiticica Filho and de Barros expanded the use of photography beyond the camera operation focusing on experiments in the darkroom. I have proposed that Geraldo de Barros must be recognized as a pioneer of computational arts “because he developed a method for using punched cards instead of the negative Film in the darkroom, exposing the photographic paper several times while changing the distance of the enlarger lens to the photographic paper in order to magnify or minimize the size of the rectangles through which the light would pass creating complex abstract compositions in the photographic paper”.

Keywords

Proto-computational Arts, Algorithmic Devices, Early Computers, Geraldo de Barros, Jose Oiticica Filho.

Konrad Zuse

The opening phase of my research about early computation and the arts was the examination of the work of engineer Konrad Zuse (1910-1995), the responsible of developing the Z1 and Z3 computers, the Z3 made in 1941 is arguably the first fully programmable computer. In several of his pioneer computer devices, Zuse used punched film stock as a storage medium (to store data and instructions). Fragments of celluloid with frames showing cinematographic scenes punched with digital code remain as a mysterious trace of intersection “between cinematographic image and computational code” (Rojas, 2002). After writing about the meaning and significance of Zuse’s method I had the impression that the relationship between binary code and the cinematographic and/or the photographic image was a unique feature of that isolated example (Burbano, García, 2016). The findings of the work of

Geraldo de Barros showed the relationship mentioned above could be explored in depth in other scenarios. More importantly, there is a need to find possibilities to elaborate a discourse capable of articulating these two phenomena.

Introduction

This research must be contextualized within a larger scope project that is systematizing early interactions between computation and the arts. This project identifies several layers in time, starting with proto- computational initiatives in which the notes written by Ada Lovelace about the Analytical Engine (1839) and its potential capacity to compose music occupy a unique place. Nevertheless, there are several other examples in the modern history of computation where it is possible to trace early encounters between the computers and the arts. For instance, the interactions between computation, the visual arts and cinema in the case of Konrad Zuse in Germany in the decade of the forties (Burbano, 2013), the interactions between literature and electronic writing in the case of Christopher Strachey in the UK in decade of the fifties (Link, 2006), the case of Electronic Music production in the CSIRAC in Australia in early fifties too (Doornbusch, 2005). The experiments made by Geraldo de Barros in Brazil with punched cards storing binary code translated into photographic experiments are a rare case in which a Latin American artist anticipates the deep relation that computation and photography will have several decades after (Burbano, 2013).

Barros and the Darkroom Experiments

Between 1949 and 1951 Geraldo Barros produced seven photographic works made with punched cards, these experiments are notorious nowadays and some of them are part of important collections worldwide like the photography collection at MOMA in New York. Today is clear that Barros “played” with the punched cards in

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the darkroom controlling the light exposition and the sensitive photographic paper. A new material analysis shows that he was using other additional materials in the process like cellophane paper. In the absence of a photographic negative, there are no physical sources from which make copies of these seven works. These pieces have no particular title and are part of the “Fotoformas” series, an influential photo collection of more than fifty works (Girardin, 1999).

Photographic Context

Originally when conducting research about Barros, there was not much information about the context to explain his experiments at the photographic level, in the last two years I have had the opportunity to re-collect information about that aspect. We can start with a glimpse of the history of photography in Brazil. In the transition between the forties and the fifties, there are exquisite examples of experimental photography there; these works have been linked to

the Concrete or Constructivist art movements (Espada, 2014). Amongst the practitioners is José Oiticica Filho, father of influential artist Helio Oiticica. Oiticica Filho who made abstract photographic works like “Forma D-10 A” was part of the artistic scene in Rio de Janeiro while Barros was part of the one in Sao Paulo, both can be seen as key figures of the photographic modernity in Brazil in a period where Biennale de Sao Paulo was founded, and several important transformations in the local art scene took place (Herkenhoff, 1983). Both of them started to work with photography more or less at the same time and contrary to other contemporary creators using the same medium they focused on the dark room and the materiality of the photographic process as key elements of their creative practices. These two artists also have in common their heterodox careers, as far as Oiticica Filho was originally trained as an entomologist and Barros was working for the Banco do Brasil part time, this double action opened several doors to unknown fields for both of them.

Thinking about the historical context to explain the apparition of experimental photographers like Barros and Oiticica Filho I would like to refer to the work of another important Brazilian pioneer in the field of photography. In 1901 Valério Vieira (1862-1941) made the influential photographic composition “The thirty Valerios” a rich photography with significant elaboration in the dark room, an image that can be seen

as an anticipation of the manipulation of layers in the computational photography and that can be clearly seen as a premonition of what Photoshop, and other software to process photography based on the layers principle, does to contemporary photography. However, at the conceptual level we can observe that the promise of computer imaging that Vieira examines in his picture is based on the figurative front of photography, while in the case of Barros his investigation occupies the abstract side of it.

Technical and Technological Context

Of course, Barros made his experiments before any computer was actually able to produce computer graphics or digital images. At that time the calculators or tabulating machines were unable to produce any visual output, no computer screen was even implemented therefore computer graphics were not in the plans of the most audacious computer makers at that time. The first commercially available computer, the UNIVersal Automatic Computer I, was available the same year that Barros was working in his experiments with tabulating machines, an IMB machine at the Banco do Brasil, it is clear now it was not a computer as such, as far as the first computer, a Univac-120, was imported to Brazil in 1957.

The typology of the punched cards used at that time is relatively easier to track. Because of the shape of the rectangles seen on the photographic experiments by Barros is possible to identify that the cards used were the IBM “80-column punched cards” introduced in 1928. Those cards were a global standard for several decades. When Barros made his experiments IBM had bases in several Latin American countries (Medina, 2008). At the time I came across the work done by Barros, “I found myself confronted to a constellation of phenomena that emerged at that moment in history more or less pointing in the same direction: unusual, unseen, often misunderstood creative phenomena made with binary code punched cards or punched film stock, two examples that can be regarded as instantiations of the same phenomenon: the early interaction of the digital code and the photochemical image” (Burbano, 2013).

Proto-Computational Photography

The originality of the photographic experiments made by Barros and Oiticica Filho are based on their creative use of the photographic equipment in the darkroom. They were building upon the basic idea that not only

the photographic negative but, in fact, any transparent object or surface with holes can be used to interfere with the transit of light, the photons, from the enlarger light bulb to the sensitized paper. This can be seen, of course, as the manifestation of a deep understanding of the photographic equipment functionalities. Nevertheless, a characteristic that remains distinctive of the work done by Barros is his use of cards with binary code punched, this process shows an additional sophisticated level of creative relationship with the machines, in this case, the IBM tabulating machines used at Banco do Brasil. His approach shows an imaginative view of the material elements and the technical processes, how a piece of equipment used here could be used there, how a material disposed from one process could be used in another one. This particular method is no doubt one of the patterns of technological innovation nowadays (Johnson, 2010).

The survey about other artists or technicians working in a similar path to Barros has been fruitful in some ways. First of all, the investigations exposed that in the experimental level there is indeed a good close example in the manipulation of photographic material in the dark room. The quality of the work of José Oiticica Filho shows how advanced was the scene in Brazil and reflects well the inspirational changes in the artistic world at that time (Oiticica Filho, 1983). Nevertheless, I was not able to identify other photographers doing experiments with punched cards; this remains a distinctive path of Barros creative endeavors. Finding another experiment in that specific way is hard if no impossible.

However, there is a novel way of exploration that has started. This short text began with the mention of pioneer Zuse's work, which has an important signification for the computer history but also for the media art history. After doing a general review of Brazilian computer history in order to find possible examples of computational creativity related to the work done by Barros I found a new interesting track that can connect this story in Brazil and the one of Zuse in Germany. Zuse had a partner in the development of the Z1 and Z3 computers (Rojas, 2002), who actually helped him to use telephone relays and who later on suggested to use vacuum tubes to make computations.

Zuse's friend is Helmut Schreyer who was a computer pioneer and partially responsible for the achievements of the construction of first computers made with Zuse. Schreyer after the World War II immigrated to Brazil, to Rio de Janeiro specifically, where developed an academic career joining the *Instituto Militar de*

Engenharia (Rojas, 2010) and he also used to work at the *Departamento de Correios e Telégrafos*. Therefore there is a new branch to explore on the intersection between computation and Brazilian art history.

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Author Biography

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Andres Burbano is doctor in Media Arts and Technology from the University of California Santa Barbara. Burbano is currently Assistant Professor in the Department of Design at Universidad de los Andes and is Academic Chair of ISEA2017 and Gallery Chair of Siggraph 2018.

Was part of the media arts history swept under the carpet? (Latin America's lost ark)

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Abstract

Who tells history? We can find multiple versions of electronic art history, most of them with subtle differences, but it has been unusual -until recently- to find references pointing to countries out of a small group from Europe and North America. Several projects have been developed to change that situation. The Latin American Electroacoustic Music Collection, hosted by The Daniel Langlois Foundation for Art, Science and Technology, represents an example of the relevant role that the archiving of electronic artworks and public access to them could have in forming another perspective about (electronic arts) history.

Keywords

Latin America, Archiving, Electronic Art Preservation, Electroacoustic Music History, Cultural Decentralization

Introduction

The journey from cultural memory and ethical concerns to practical strategies on preservation and the impact of disseminating knowledge generated by electronic art has been navigating a sinuous road.

Memory's death could benefit some as much as the desire for immortality could block the way to innovation open naturally to new generations. Electronic art's memory has been partially dead, or perhaps deaf or blind or simply looking to the other side, maybe to avoid the perception that the so-called digital revolution has reached most of the known world and that history does not happen only in a few "central" countries. The desire of immortality and for being a cultural lighthouse as much as the guardian of the right values and the significant art should not take us all to mislead that intelligence and sensibility belongs to a few.

Who tells history? Who knows about it or who has the opportunity to do it? We can find multiple versions of electronic art history, most of them with subtle differences, but it has been unusual -until recently- to find references pointing to countries out of a small group from Europe and North America. Inequalities

have always existed and if we want to see a change, probably we will need to work hard ourselves to produce new results. There are many lost and hidden stories about electronic art that probably should be part of the official history and not just left aside. There have been people, ideas and concepts, artworks, discoveries and inventions, and we expect someone to take care of preserving the memory of all that for us but sometimes it simply doesn't happen that way and when we look around after a while, it seems that the history has not been the one we thought it was and we remember, but a different one that is being told by others.

Between the obsession of archiving everything and the difficulty and strong responsibility of deciding what to preserve, the opportunity to archive electronic art makes us face a challenge involving technical issues and political, social, cultural and economical aspects.

How many histories can be told about the same subject? To who is their narrative directed? Today, the digital divide could be not linked to who has access to the web but to who dominates the inclusion of content or develops strategies to keep our attention on certain places and not others. It looks like we are bombarded with cues guiding us to consider that the art conceived by some cultures are the only ones to be recognized as valid.

The Daniel Langlois Foundation for Art, Science and Technology in Montreal has been a leading organization heavily focused on studying theoretical aspects related to preserving electronic art and actually archiving it. A number of major projects have been developed or hosted there since the late 90s, including the Steina and Woody Vasulka Fonds, the 9 Evenings: Theatre and Engineering Fonds, the Collection of Documents Published by E.A.T. and the Latin American Electroacoustic Music Collection, among many others.

Music & Technology Innovation in Latin America

Political and economic instability in most Latin American countries has been deeply affecting the life of its inhabitants for decades. Support for artistic activities has usually been postponed to solve urgent social problems. In spite of that, the development of electronic arts in general and electroacoustic music in particular in the region is really astounding. To name but a few examples: Mauricio Kagel composed eight electroacoustic studies in Argentina between 1950 and 1953, according to the Hugh Davies' International Electronic Music Catalog published in 1968. Kagel was one of the pioneer composers laying the foundations of a rich history of experimentation and creation in the region. Reginaldo Carvalho and Jorge Antunes in Brazil, Juan Amenabar in Chile, Joaquín Orellana in Guatemala and Horacio Vaggione in Argentina are only some of the many names in the ocean of electroacoustic music creativity that has always been Latin America.

José Vicente Asuar composed between 1958 and 1959 in Chile his piece *Variaciones Espectrales* using only electronic sound sources. The Estudio de Fonología Musical was created in the University of Buenos Aires of Argentina by Francisco Kröpfl and Fausto Maranca at the end of 1958. During those same years, and also in Argentina, César Franchisena was experimenting with electronic sound sources at the National University of Córdoba radio station. A landmark in the electronic music history of Latin America was the lab created in Buenos Aires during 1963 at the Centro Latinoamericano de Altos Estudios Musicales - CLAEM of the Instituto Torcuato Di Tella (the Electronic Music Laboratory was part of the Latin American Higher Studies Musical Center of the Torcuato Di Tella Institute). Peruvian composer César Bolaños created *Intensidad y Altura*, the first piece for tape produced at that lab, in 1964. In Cuba, Juan Blanco composed *Música para Danza* for tape in 1961 and *Texturas* for orchestra and tape between 1963 and 1964. Blanco composed about a hundred works using electroacoustic media, including music for mass public events and large venues. Carlos Jiménez Mabarak composed in Mexico El Paraíso de los Ahogados, a piece on tape, in 1960. The same year engineer Raúl Pavón built the prototype of a small electronic musical instrument featuring an oscillator with multiple waveform outputs, a white noise generator, a variety of filters, an envelope generator and a keyboard. Named Omnifón by Pavón, his creation was among the first voltage-controlled

electronic sound synthesizers. Well before that, in the early 40s, the aforementioned composer Juan Blanco designed an innovative electronic instrument similar in concept to the Mellotron. His Multiorgan was based on 12 loops using magnetophonic wires. It predated the Mellotron -considered the predecessor of the digital sampler, the instrument that changed the way of doing music - by several years. Fernando von Reichenbach invented in Argentina the Analog Graphic Converter in the 60s. It was used to transform graphic scores -from pencil drawings done on a paper roll into electronic control signals adapted to work with analog sound equipment. José Vicente Asuar produced in Chile a hybrid analog-digital computer system in the mid 70s, exclusively devoted to create music.

Latin American Electroacoustic Music Collection

Unavailability of musical recordings, bibliography and almost any basic reference to the electroacoustic music activities that were developed since the early 1950s in several Latin American countries was commonplace when I started to work in the field around the mid-1970s. That situation did not change much during several decades. In various Latin American countries, universities and state organizations or major private foundations have taken initiatives to support art research and the use of electronic media since the early 60s, but most have stopped before developing enough resources to document their processes and preserve the results. As a consequence, many early tape compositions have been lost or the master recordings damaged.



Figure 1. The Latin American Electroacoustic Music Collection. Ricardo Dal Farra © La Fondation Daniel Langlois.

The Latin American Electroacoustic Music Collection with over 1,700 digital recordings of compositions by almost 400 composers, accompanied by photographs, interviews, scores, a trilingual historical essay and over 200,000 words in its database, represents an example of the relevant role that the archive of artworks and its public access can play in having another perspective about (electronic arts) history. Today this resource is being consulted extensively by people from around the world (e.g. researchers, composers, performers, musicologists, historians, artists and the general public) helping to transform the traditional perception of “ownership” that has existed in some countries with respect to electronic art history. While all recordings are available online for listening to researchers who ask for an access code to The Langlois Foundation, 558 works are freely available to the general public. The digital recording of a composition can be found by its title, the name of the composer, the country linked to that composer, the year or decade when the work was composed, etc. In addition, there are two playlists to access and listen to the compositions: one sorted alphabetically by the last name of the composer, the other sorted chronologically, following the year in which the piece was composed. Part of the 200,000+ words available in the database comes from two previous research reports

I wrote commissioned by UNESCO between 2002 and 2003: *Historical Aspects of Electroacoustic Music in Latin America: From Pioneering to Present Days* and *La música electroacústica en América Latina*. They are available online through the UNESCO’s Digi-Arts knowledge portal. These texts include references to hundreds of composers who were born or pursued a portion of their professional careers in Latin America.

Final Words

The Latin American Electroacoustic Music Collection has recovered and made accessible the creative work of many electronic artists otherwise almost forgotten. It has defied the hegemonic narrative of electronic art history, breaking some memory’s death roads and slowly shifting and widening the way the history of electroacoustic music has been understood.

Archiving and disseminating electronic art history findings is crucial to comprehend the present and to build a better future.

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- Latin American Electroacoustic Music Collection.

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Mariotti's Ritual Artefacts and the Origins of Media Art.

In search of the Lost Multisensorial Characteristics of New media

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Abstract

This paper will give an overview of the seminal works of Francesco Mariotti, an artist of Swiss origin (Bern, 1943) who has lived between Peru and Switzerland since 1952 and can be regarded as one of the pioneers of media art both in Latin America and Europe; more importantly, his work linked both continents in distinctive dialogues relating social processes, natural phenomena and technology. In 1968, during the 4th Documenta in Kassel he produced one of the first interactive installations in media art history: "Project Geldmacher – Mariotti". A year later, in 1969, during the X Sao Paulo Biennial, he presented "The Circular Movement of Light", a multisensorial (light, smell, sound) installation. Through extensive research of the archives of both Documenta and Sao Paulo Biennial, this paper focuses on these two seminal works with emphasis on their main characteristics and explores how these projects are an early example of works on participatory and social processes, natural and multisensorial phenomena, arguing that through the use of technology, these should be regarded as significant works of the history of media art in Latin America.

Keywords

Multisensorial, Documenta, Sao Paulo Biennale, Mutisensorial, Mariotti, Media Art.

Introduction

Francesco Mariotti (Bern, 1943) is an artist of Swiss origin who lives between Peru and Switzerland since 1953 and can be regarded, though relatively unknown in some circles, as one of the pioneers of media art and whose work linked Europe and Latin America through distinctive dialogues relating participatory and social processes, natural and multisensorial phenomena and the use of technology.

The work of Mariotti is extensive and most of it is well documented and available online on the artist's web site^{*1} However, we will concentrate mainly on two

of his early significant works which are perhaps his most emblematic and historical ones during those early years.

Francesco Mariotti comes from an old Ticino family but spent his youth in Lima. In 1964, he returned to Europe, attended the École des Beaux-Arts in Paris in 1965 and then from 1966 to 1968 he studied at the University of Fine Arts of Hamburg (HFBK). During this time, along with his friend Klaus Geldmacher, they worked on experimental installations as well as mixed media shows.

Documenta 4: Project Geldmacher - Mariotti

While still at the university, the young Mariotti, along with Geldmacher, were invited to present a proposal for Documenta 4 in 1968. The proposal comprised of a model and cost estimate for the deployment of a large cube-shaped metallic structure from which 9,000 light bulbs of 22.5 kw, 1,000 fluorescent lamps and several loudspeakers were arranged. This installation generated a "photo-acoustic ambience" where the audience could enter and experience it. Documenta's selection committee voted in favor of the project but it was denied being located at the Federicianum among more established artists such as Robert Rauschenberg or Roy Lichtenstein. Therein, Mariotti and Geldmacher's project work was to be installed at the Orangerie, where most of the sculptures were located, next to another remarkable project presented at Documenta 4 by Christo: a white large packed air structure (an "inflatable sausage"). Both Christo's and Geldmacher – Mariotti's projects were ready weeks after the opening of Documenta 4. In those weeks, Christo and Mariotti developed an enduring friendship which influenced the young Mariotti to understand the importance of art, not for its aesthetic or technical value, but as a host for discussing and thinking about society.

The Project Geldmacher - Mariotti was based on a manifesto in which they stated, among other things

* <http://www.mariotti.ch/> (accessed 17/03/2017).

that in an art exhibition as Documenta 4, financed to a considerable extent with government grants, art appears equitable when it is reinforced as an information carrier not only for a minority but for the larger audience. In this way, art's function must illustrate facts and arguments in favor of social change. The main objective of their project was to question the usual superficial beautification of art and to use art products as a communication medium towards a critical analysis of its use in society.

The Project Geldmacher – Mariotti's light and sound effects became one of the landmarks of Documenta 4. It attracted many curious people who participated in the immersive sensorial concert. Inside the cube, a large fan was placed to produce a profound and radical sensation. As it was mentioned in their manifesto, Geldmacher and Mariotti hoped that these structures, based on thousands of electric light bulbs was going to be able to generate a flow of relevant discussions. From the documentations of that time, there were several cultural activities organized around the installation, so it was used not only as a piece of aesthetic pleasure, but also as stage for discussions on topics such as sexuality, war, philosophy or politics as well as a space for spontaneous live performance and electro acoustic music. Even during daytime, the zinc plated installation covered by large plates of Makrolon plastic plates, was seen as a beautiful architectonic piece drawing a lot of attention from the visiting audience to Documenta.

The Documenta 4 experience was somewhat shocking for Mariotti: he felt that most artists, curators and writers that took part of Documenta were part of a system which evolved into a superficial spectacle of society, instead of using art to bring social, political and ecological change. However, in Documenta he met Rinaldo Bianda who at that time had a gallery in Lugano, named Flaviana mostly dedicated to printed and experimental media. Mariotti started to work with Bianda on artefacts in which the flow of electricity transformed sound into electrical impulses. It was an uncanny system of cables. They both were interested in producing artefacts that through their aesthetic and technical properties could also stimulate more thoughtful discussions, ideas and knowledge sharing. Later, Bianda, would become the founder of the well-known Video Art Festival of Locarno.

X Sao Paulo Biennale: The Circular Movement of Light

After the successful and impressive installation made

for Documenta 4 and while collaborating with Bianda, Mariotti, at that time only 26 years old, was invited by the Swiss Federal Art Commission to represent Switzerland at the X Sao Paulo Biennale, along with three other Swiss artists (Camille Graeser, Willy Weber and Herbert Distel).

At the time, Mariotti was just starting to get involved with Eastern religions; in particular, the study of the Indian philosophical religious text, the "Bhagavad -Gita" (which could be loosely translated as the "Song of the Lord") in which the Lord Krishna answers fundamental questions about life posed to him by Arjuna at the helm of going to war in the Mahabharata. Experiments in the field of aesthetics interested Mariotti, only to the extent that they were conducive to a more profound meditation which could gather a group of like-minded people. A new project for a kinetic sculpture increasingly took the form of a sort of Hindu temple for the "circular movement of light".

Mariotti chose a penta-dodecahedron with sharpened pentagonal faces for the sphere-shaped temple. The twelve pentagons were in turn composed of five triangles, which in turn were each made up of four triangles and resulted in a structure with a total of 240 triangular faces. The interior of the structure was determined by a central multi -beam light cone with a flame tip. Four electronic systems made

the penetrable structure, reminiscent of a crystal-kinetic object.

Beyond the infrastructural and technical complexity of the work, its aim was to comprise a deep multisensorial experience for the visitors. The idea of the work was that within one-hour one could experience a 24 -hour day cycle through continuous changes of light, color, scents, temperature, and sound frequencies. It was meant to be not an individual experience but a participatory one, which also generated a very different perception from the individualistic western practice of art we are used to.

For Mariotti, existing knowledge tools were extremely limited to perceive and understand the rich and deep complexity of the world. Western cultural forms of perception of senses were quite limited and many of the canons we had established for each sense act as opposed to the others (Ong 1991, Howes, D. et al. 2014). Thus, Mariotti thought that only by observation and straining all his or her senses will the visitor be able to perceive the continuous change of all these optical, acoustic, olfactory, and thermal effects. Mariotti deemed

necessary a relaxed-tensed stay of at least thirty minutes for the audience in his installation, to truly experience the “floating alone in the infinite,” that he seeks with this meditation room. He himself claimed:

Upon each assembly of the temple of light I recognize new messages. The sculpture increasingly strikes me as a spaceship. A spaceship from the astral world.” [...] “I must also say that this astral ship has a therapeutic effect on the visitors. The sound frequencies massage the backbone from bottom to top up to the brain (Rotzer 1972).

But what was more surprising at that time, and even for today’s standards, was the installation’s complex setup in which several technical and mechanical components orchestrated an intermingling production of different senses that acted together in unison resulting in a rather holistic experience. The acoustic changes were produced by two tone generators with 36 sound-light channels and two variable sound frequencies oscillators ranging from 10 Hz to 10 kHz can be heard in the interior of the light object over the course of an hour. In some determined frequencies, the sound of water was amplified and at some moment it was heard very loudly. The light program was emitted by the central cone from under the glass floor daily in an hourly cycle with its subtly changing color spectrum, including infrared and ultraviolet rays. During the day, the color program was determined by the natural change in the direction of arrival and the incident angle of the Sun. The olfactory program and the AC-regulated temperature, were modified by the sound state and ranged from ozone to pine, eucalyptus, mint, violets, lavender, caramel syrup and incense –it was based on the sound frequencies to generate thresholds from cold odors to hotter ones–. The idea was to simulate a very special and radical atmosphere.

As it was the case in Documenta 4, Mariotti’s installation for the X Sao Paulo Biennale was also highly commented and appraised by the media. The press at that time mentioned the striking size and complexity of the work: “a structure of 7 meters high and 5 meters width, which symbolized a temple dedicated to oration”. Even for Brazilian standards, the press was quite surprised about the size and logistics required to bring up such complex work which comprised of 29 boxes (Lux Journal 1969a). Additionally, in contrast to “Project Geldmacher – Mariotti” which was situated quite far from Documenta’s main building (the Federicianum), the “Circular Movement of Light” was located inside

the Biennale building, just right of the main entrance, making it not only noticeable by every single visitor but also becoming one of the most iconic pieces, and thus gathering a significant amount of press.

Coincidentally, a special focus on art and technology was prompted by three exhibitions to be organized during the Biennale. One was by the Smithsonian Institution and MIT’s Center for Advanced Visual Studies (led by Gyorgy Kepes) on the existing relations between art and technology that was celebrated significantly in the news (UPI 1969). The second one, organized by French critic Pierre Restany, titled “Art & Technologie” included works of Raysse, Le Parc, Kowalksi, Kosice and Quentin. Lastly, England was due to participate with an exhibition titled “Cybernetic Serendipity”. However, none of those exhibitions, along with many others, ever happened as an international boycott gained momentum against the exhibition due to the evidence of cultural repression in Brazil, governed at that time by a military junta, though some of those countries did participate with other representatives (Lux Journal 1969b).

Such a significant turmoil and the lack of shows related to art and technology also contributed to increase in an interest towards the work of Mariotti, mentioned in some news as the “Swiss attraction” which emphasized its “translucent plastic with lights in movement and mutation”. Mariotti’s “sculpture and Hindu temple” was also mentioned to be “opposed to the creation of serialized art” by proposing a “Krishna Temple, a place for religious contemplation, dedicated to the Hindu god”, he added “after the opening I want to organize a sort of spiritual symposium inside the temple, with all artists” (Almeida 1969).

It is understood that a work such as “The circular movement of light” cannot be measured or classified within aesthetic or formal standards as it wanted to address the visitor in an entirely different way than a work of art usually was able to do. Mariotti’s piece wanted to be nothing less than a kind of total work of art with an emphasized sacred character, an instrument, an impetus for meditation and introspection.

After it was exhibited during the Sao Paulo Biennale for six months, it was partially rebuilt again in June 1970 for the Art 70 Fair in Basel and then in November 1971 it went to Lima, where it was made into a gift by the Swiss government to the Peruvian State as part of the Pacific Ocean International Trade Fair, considered one of the most popular events visited in Lima at that

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time. Families from different ethnical backgrounds who migrated to Lima may have perceived a completely different experience from the most artistic western-centric one at Sao Paulo or Basel. Interestingly for local passersby in Lima, the luminescent Hindu temple might have been a closer reminiscent of a mystic space within the Andean cosmovisions, traditions and myths.

The art system is still mostly controlled by the visual sense. Mariotti's seminal works questioned the status quo of art as a purely visual form by introducing a more holistic form of beauty, one that is maintained through the collective practice of rituals in which the audience congregates in a profound and spiritual multisensorial experience that integrates, invigorates and restores the balance and order in our soul.

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Laboratories and Digital Experimentation Centers in Ecuador: First New Technologies Art Experiences

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Abstract

The Ecuadorian art circuit is feeding on a plastic artists generation based on pictorial practices inherited by modernity for years. They achieved great national and international recognition and even nowadays they occupy privileged places in the most important Ecuadorian art fairs. However, a new generation of artists is abandoning traditional art practices to approach different ways of art making. This change comes hand by hand with the arrival of digital technologies to Ecuador in recent years. On one hand, younger artists have a growing interest in using new media for their creative processes and, on the other hand, different private and public institutions are betting on creating centers and labs for creative experimentation. They are using digital technologies like fab labs, media labs and university laboratories. Considering this, we will analyze the organizational models, the media, the concerns and the needs of the institutions mentioned above. Also, we will address, copyright management and its relation to the social sphere. All of them are relevant data related to the core of current participatory practices. This talk, will allow us to generate a cartography of the new paradigm in the Ecuadorian artistic creation, and, its connection with other international realities.

Keywords

Art & New Technologies; Experimentation Centers; Ecuador; Creation Labs; New Art Practices.

Introduction

Art practices related to new technologies are in a pre-birth stage in Ecuador. But, we perceive few symptoms of life, statistically, we can forecast a successful bloom for these art practices. In Ecuador people are starting to gain access to new technologies and understanding in a broader spectrum the possibilities that these offer to art, we can see also an increasing number of contemporary cultural centers and exhibition spaces, where people can connect to new technologies art experiences.

In Ecuador artistic practice in the visual arts field has not overcome twentieth century foundations yet. Most of the artists follow principles of the beginning of the

mentioned century, and some of them are attached to conceptual art. Artworks related with twentieth century bases are still popular between pieces presented in art fairs and gallery spaces. These aesthetics also prevail in the courses offered by University and academic art schools.

Nonetheless, new technology centers and laboratories are slowly appearing in academic institutions. Being the most notorious, University of Cuenca Media lab, UIO Media lab, FAUCE's extended graphics lab and UArtes lab. An analysis of these centers and their artistic outcome, will provide us with information about the position new technology art practices are having in Ecuador. We will be able to see the first relations that art and new technologies are having in this country.

Art Labs: Brief Historical Summary

Medialab centers model has its beginnings with paradigm change related to artistic creation, this changed was directly influenced by the birth of digital and electronic technologies in the second half of the twentieth century. Although "Bauhaus" was a pioneer in this area, new technologies labs were more prolific in the USA. During the sixties and seventies there were prominent faces in new technology artistic research. Billy Klüver and his teamwork directed experimentations under the parameters of E.A.T. (Experiments in Art & Technology) projects, they had a big influence in New York, György Kepes (M.I.T.) and his C.A.V.S. (Center for Advanced Visual Studies) based in Boston and Sonia L. Sheridan and her research project The Generative Systems in Chicago. They were pioneers in making visible the relation between new technology and art. All of them faced traditional conceptions about art discovering a new perspective on the possibilities of artistic creation.

In these collaborative projects, artists were the protagonists and representatives of their teamwork. However, these teams were composed by engineers

and technicians, who contributed with their work and knowledge to achieve the goals that artists envisioned. With the artist as a leading figure, interdisciplinary organization had the mission of artistic experimentation. Therefore, we understand the model of media lab, as places that possess technological resources to develop investigations, experiments and artistic works (Ruiz, 2014).

During the eighties and nineties several art centers were established, following the organizational model of the former media labs. Some of them are V2 – Institute for the Unstable Media (Rotterdam, Netherlands), ZKM – ZKM - Zentrum für Kunst und Medientechnologie Karlsruhe (Karlsruhe, Germany), NTT InterCommunication Center and Canon Art Lab (Tokyo, Japan), Centro Multimedia CENART (Mexico), ARS Electronica Center (Linz, Austria).

Slowly, the former organizational model lost its prevalence and dominance. Suddenly it was not necessary to have full equipped laboratories with expensive machines. The arrival of digital and compact technologies and the revolution of social networking democratized the access to technology, giving birth to a new concept of artistic laboratory. The current medialab is a new basilica to the organization of discourses, a meeting place for the voyager, and, a scenario of all the collective experiences that require individual pliability to the foundation of new rules of the game (Alcalá, 1993). Rules that resonate according to the new digital culture, especially social networking websites.

This new artwork, needs to be understood, not only as a production of exhibition objects but also, as a bind to new ways to experiment reality. Artwork that desires to sustain communicative territories between man, machine and society, hence, artwork that creates new interfaces as a vehicle of connection to supply data exchange. (Alsina, 2007, p. 29)

Considering this historical background, a new concept of the media lab has been established. The laboratory is now a metaphor image of a world that is not a familiar and a consolidated system anymore. This is a new metaphor of a system where the relationships between us and the system itself are constantly modified, inherently changing our knowledge and appraisal of its phenomena (Alcalá & Maisons, 2004, p.8). This new system adopts and implements the main features of Internet communicative practices: transdisciplinarity, read & write culture, free & open sources and copyleft.

These medialabs have become dialogue spaces, they are creative ecosystems dedicated to aesthetics reflection and debate. They are also places to investigate and produce artwork, and work as well, as places for art education and socialization. These mentioned activities encourage changing processes that belong to an emerging culture, processes that work parallel to the democratization of communications, a phenomenon that has never happened in human history (Ruiz & Alcalá, 2016).

Medialabs and its Linkage to Electronic Arts in Ecuador

During the last few years in Ecuador radical changes on the use of new media for artistic creation are happening. These changes are worth to study.

The first Ecuadorian medialab was inaugurated in 2012, it was the Ecuadorian institution Universidad de Cuenca's medialab. This place is located at the art school building. The University endeavors to create a medialab introduce artists, students, teachers and designers to actively participate in the use of new media. In this center research projects oriented to the analysis of digital art and sensitive design are developed. Most of them are funded by the research department of Universidad de Cuenca. I am going to highlight some of them to recall some of the most successful projects. *Cuenca Sound Map (2016)*, *The most remote place in the world (2015)* and *Dialogue Interfaces(2013)*. At the same time the University has conducted an increasing number of courses open to the community, this introduction of new media to the public has shown the benefits of using new technologies in art practices. The University of Cuenca's medialab has acquired electronic kits and sensors, technologies that border on open source software and freeware. Their technological resources go hand in hand with the standards and processes that most of the international Medialabs apply in their own practice.

Another laboratory is Medialab UIO (Quito), which recently opened in 2016. This lab is in Quito, the Ecuador capital city, as part of the facilities of CIESPAL (International Center for Higher Education in Communication for Latin America). Socially oriented, Medialab UIO was founded as an innovative technological space for creation and experimentation, where trial and error method is fundamental in the artistic learning and development process. This place offers

workshops, conferences, expert talks and meetings. This lab has implemented a visual exhibition circuit, where the thematic core is sustained by the following axes: urbanism and citizenship, technology and human body, ludic and inclusive education, innovative entrepreneurship businesses, digital arts, techno-politics and social movements, ancestral technologies and memory retrieval researching. The Medialab website <http://www.medialabuio.org>, positions this laboratory as a confluence for innovative initiatives, which promote in a social way, symbolic and political technological processes. These processes are based on free culture and inclusive education for academic and popular knowledge. Medialab UIO works under the parameters of collaborative and community oriented creative processes. Without doubts, this center is one of the best models of adaptation to the international concept of Medialab. Here, the artwork relevance is relative to the trans-disciplinary dynamics of the teamwork.

Another medialab created in 2016, the FAUCE's Extended Graphics Laboratory. This center is located in the Facultad de Artes de la Universidad Central del Ecuador, (School of Art of the Central University of Ecuador, Quito). This laboratory is born as a research project directed by José Manuel Ruiz (Current director of FAUCE's graduate programs), this project is also supported by the Research Department of the Central University of Ecuador. The main goals of this place, is to explore creative processes, under the possibilities that expanded graphics that use new technologies can offer. This place also has the function of educating FAUCE's students in the use of new technologies as media for artistic production, and, it also organizes exhibitions and develops publications on the outcome of its several projects. This place is creating academic foundations for a new artistic path that uses new media as a principle, and gradually becoming FAUCE's Medialab. This Medialab project was suspended due to the lack of funds. Nowadays, this project is linking students and teachers to digital media such as: digital printing, image editing software, automatic machine art theories, etc. I see the FAUCE's Extended Graphics Laboratory as a way of reconnecting with the first American art labs.

At last, I'm introducing LAB Uartes, which is actually under an opening process as part of the biggest public art education project in Ecuador, its name is Universidad de las Artes (University of the Arts, Guayaquil). This LAB has arranged several events, meetings and panel

discussions to understand and become familiar with new perspectives and models that utterly strengthen the development of LAB Uartes. In between the most prominent conferences we can mention one titled Laboratorios de Innovación Ciudadana, which addressed the issues of encouraging citizens to switch in a more inclusive social model. This follows the ideological line of Universidad de las Artes. One of the participants in this conference was Marcos García, Medialab Prado director (Madrid, España).

Ramiro Noriega president of the management commission and rector of this University, has visited several laboratories and cultural and academic institutions in order to learn from the experience of these places. Between the institutions visited I'm citing: Mind Lab (Copenhagen, Denmark), Aalto University Media Lab (Helsinki, Finland) and Amsterdam Medialab (Amsterdam Netherlands). Maite Freire, LAB Uartes general manager, searched for counseling with José Manuel Ruiz—author of this article. In these conversations we tried to find possible actions to increase the academic community participation in this project. One of the main issues addressed was, the high operating costs of LAB Uartes. As an example, LABoral (Gijón, Spain) faced the same issue, and couldn't keep up through time.

Conclusions

Data indicates that in Ecuador, there is an increasing interest in the use of new technologies for experimentation and creative purposes. Nonetheless, Ecuadorian artists and institutions are not prone to change, and, they are attached to traditional ways of production. Therefore, is important to reach and educate wider publics.

Several laboratories have been implemented in Ecuador these laboratories still work as mixture of the first American labs and current ones. Even if they have a hybrid structure, these centers are oriented to use and consume free and open source resources, they also encourage collective participation processes and questioning of traditional copyrights, aligned to new proposals such as Creative Commons.

Ecuadorian laboratories that are integrated to University Art Schools, are keeping up a strong linkage to artistic practices. LAB Uartes is a peculiar case, its relative short existence does not provide enough outcome for a more profound study.

The centers analyzed in this article are the first

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laboratories in Ecuador where art, science and technology converge. This is a strong indicator for the expansion of these practices, and also a sign that Ecuador has a promising future in this artistic field.

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Director of Postgraduate Studies - Central University of Ecuador, School of Arts - Quito, Ecuador. PhD of New Cultural and Artistic Practices – University of Castilla-La Mancha, School of Fine Arts (Cuenca, Spain, 2014) with the thesis 'Appearance, impact and effects of the automatic machine at the artist's studio: from the traditional workshop to media lab'. He has conducted research in the fields of New Media Art, Museology, Read & Write and Digital Culture. His work has focused on the new creative possibilities of Digital Graphic. As a multimedia artist, his art work has been part of prestigious exhibitions and festivals from Ecuador, Colombia, Venezuela, Belgium, Mexico and Spain, among others countries.

Julio Le Parc & the GRAV: Instability, Movement, Active Past. A Perspective Look on his Work and Ideas from the Present of Electronic Art Andrea Sosa

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Abstract

The present paper examines the work of Julio Le Parc and the Groupe de Recherche d'Art Visuel (GRAV) of the 1960's. The concepts proposed in their programmatic writings and the integration of these concepts in some of their emblematic artworks are hereby analyzed in detail. Notions that Le Parc and the Groupe introduced, such as those of the «activated spectator», «work in movement», and «instability», could be examined through the lens of technological art they created and also the evolution of that art in later times. These concepts also anticipate some of the features present in contemporary digital art. Especially, the concept of «instability» is examined in more depth with the help of existing parallels between ideas and the artworks produced by the GRAV. Additionally, we focus and reflect on the tension between technique and aesthetics, and media and artistic production, in their works which were built with new media of the kind whose starting point could be located in the notions forwarded by none other than Le Parc himself.

Keywords

Pioneers, Electronic Art Digital Art, Le Parc, GRAV, Movement, Instability, Active Spectator, Participation, LatinAmerica

Introduction

with two alternatives: either we continue working in the mythical world of painting, with our particular degrees of artistic ability, and accepting the situation of the creative artist as a unique and favored individual, whose social position is currently well-established, or, by demystifying art we reduce it to terms that are equivalent in all human activity. We've made our choice. (GRAV, 1960).

This clear and explicit choice would lead the group to follow their research in different directions—both regarding the work of art and the place of the spectator. By means of concrete propositions, they would encourage a break from the consolidated artistic practices of those times (Classical Art; Naturalist Art; Cubist Art Abstract Constructivism Art; Concrete Art;

Abstract Art Informel, Tachism, etc.), and they would base their operations on the relationships between the human eye and the work of art, and beyond any specific codes or knowledge in relation to art. At the same time, they exalted values such as «work in movement», «instability», and «activated spectator»

As Alexander Alberro (2014) describes: They intensely debated the importance of predetermined mathematical sequences and progressions in artistic compositions, seeing these as capable of eliminating the element of intuition in the construction of art, and contemplating on the possibilities opened up in artistic practice by optical effects and movement, whether actual, virtual, or incurred. (p.39)

The work of Julio Le Parc and the Groupe de Recherche d'Art Visuel (GRAV) constitutes a relevant 20th century precedent in the context of our attempts to recover the work of artists who could be seen as pioneers in the concepts and practices of what we now call Digital or Electronic Art. Born in Argentina, Julio Le Parc traveled to Paris in 1958, and in 1960 he founded—together with other artists—the GRAV. The group would dissolve in November 1968 after a period of extensive activity.

In their production, two aspects stand out. First, conceptual reflection and the adoption of a clear stand as was evident in a body of programmatic writings; second, the artistic work itself embodied the principles and values established by the group.

In the 1960 write-up called the «*Notes pour une appréciation de nos recherches*» (Notes for An Appreciation of Our Research), they clearly set out on their vision of a world of art and their position in an art historical context:

“Our main concern is to adopt a conscious stance in the current art scene on both the artistic and the social levels... We are faced

During the course of their investigations they put aside material from classical painting and incorporated

plastic, plexiglas, metal alloys, electrical equipment, projections, reflections, black light, and the like, finding in them new opportunities to study “the visual phenomenon, perception, law of information, and practical tests on probability and chance” (Alberro quoting GRAV, 2014, p.40).

This perspective encompasses various works: in «Continuel Mobil» (1960-1996) for example where movement and light become essential to a multiple form of modules that change their position in space. In «Déplacement» (1963-1987) the focus lies on the spectators and their movements in space. In «Salle de Jeux» (1963-1968) multiple experiences coexist within the same space, articulating positional changes, movements, and direct manipulation of objects. In works such as «Eléments à essayer» (1965) or «Lunettes à vision autre» (1965), the physical participation of the spectator stands out as the core element of the experience.

Movement and Instability

In the text «*Transformer la situation actuelle de l'art plastique*» (Transforming the Present Situation of Plastic Arts) written in 1961, they explored propositional arguments. The traditional plastic work is characterized as:

Unique, stable, final, subjective, obedient to aesthetics or to a strictly visual situation; establishing a more exact relationship between the work and the human eye; maintaining anonymity and homogeneity of the form and relationships between forms; emphasizing visual instability and the times of perception; searching for The non-Definitive-Work; yet one which is still exact, precise and deliberate; and shifting interest towards new and variable visual situations based on the constants rooted in the work-eye relationship; and finally acknowledging the existence of uncertain phenomena in the structure and reality of the work, and from this, design new possibilities open new areas of investigation. (GRAV, 1961).

Instability would be a core value for the group, which explicitly postulated that: “Each work should include some ‘potentialities’ and an instability that generates visual mutations after completion.” (GRAV, 1963).

The concept of the eye is of similar interest: the work - as they pointed out - is no longer meant to serve the cultivated eye, the sensitive eye, the intellectual eye, the aesthetic eye, or the dilettante eye but for a human eye in its physiological dimension, with its potential peripheral visions as points of contact with the work and ultimately creating the framework of an experience that immerses

them both in space and time.

Through lighting, reflections, movements, and changes of position, compositions would turn out to be multiple and mutable, and the spectator would be immersed in the work, no longer being an individual before a passive work but an integral part of it. The outline and dimension of the work would be subject to multiple factors established through experience, both based on environmental factors (air and light sources, for example), and on the eventual movements of spectators and the volitional manipulation of objects. Thus, an interrelationship would emerge, without which the work of art—as conceived by the GRAV— would not exist.

It Is Prohibited Not to Touch

In its text «*Assez de mystifications 2*» (Enough Mystifications 2) of 1963, the GRAV focuses on analyzing how the work may be received, and the new place they envision for the spectator. They stated:

We want to interest viewers, to lead them out of their inhibitions, to help them relax. We want them to participate. We want to place them in a situation that they could by themselves activate and transform. We want them to be aware of their participation. We want them to move towards interactions with other viewers. We want to develop in the viewer a strong capacity for perception and for action. Viewers who are aware of their ability to act, and who are tired of so much abuse and mystification can make their own real ‘revolution in art.’” The volition they highlight in participation and interaction is crowned by three axioms: “It Is Prohibited Not to Participate”, “It Is Prohibited Not to Touch”, “It Is Prohibited Not to Break”. (GRAV, 1963)

These mandates establish an eloquent contrast with the rhetoric of exhibition spaces within the traditional circuit of art, where people are urged to adopt an attitude of solemnity, silence, and restriction regarding body movement.

It is interesting to observe the taxonomic breakdown described by the group in their text «*L'instabilité - le labyrinthe*» (Instability) written in 1963. The concept of activation is analyzed in its multiple manifestations: 1) Visual Activation, Fixed Works; 2) Visual Activation, Works in Movement; 3) Visual Activation Fixed Works with Spectator Movement; 4) Active Voluntary Participation; 5) Active Spectator, Animation Element; 6) Active Spectator, Observation Subject.

Although, as Alexander Alberro (2014) states, arts

of participation, in the beginning of the 1960s, was not something completely new—and with Lygia Clark, Hélio Oiticica, Fluxus, Pierre Boulez, and Stockhausen in music we already started going down that path—the GRAV, Alberro suggests, meant to expand it to a much wider audience, avoiding its circumscription by official art museums and galleries. We may also add that the GRAV strove to conceptualize its practices and highlight qualitative differences among various manifestations of each phenomenon. The taxonomy described suggests a search for precision in order to identify the different levels of complexity in participation – identity was put forward as being the main focus in their proposal.

Reflections

Just as the works of the GRAV conceives light reflections as an essential resource of movement and spatial transformation, conceptual reflection similarly occupies a prominent position in the group's theorizations.

In relation to movement, they postulate that it may be treated under two aspects: 1) gratuitous agitation; 2) development that creates a new visual situation (GRAV, 1961).

The difference between arbitrary movement and the composition of a potential situation — where movement of both the spectator and the elements forming the work may create temporariness, durations, or precise accelerations— there are indications of the possibility of a continuous effort of analysis and observation of phenomena involved in that kind of experience.

In the same direction, they elaborated on a series of factors related to participation. Bearing in mind that participants might experience a feeling of inhibition or apathy, they proposed adopting:

Transitional solutions. For example, minimal participation by people should trigger very sizable changes; or, with the help of facilitators, a level of interaction can be maintained, above all by allowing a great deal of space for personal initiative and improvisation. If need be, the spectators' participation can be solicited by having them take part in a competition with an established prize. Although somewhat limiting, this means that they could stimulate interest in the spectator. The surprise factor should also be taken into consideration. (GRAV, 1963).

Additionally, when referring to artists, Le Parc warned about the sharp edges of becoming commonplace and of adopting certain forms without the genuine urge to

transform the cultural order:

Artists should not forget the reason why the open work was theorized in the first place, which was to close the gap between the artwork and the spectator. Much of the work produced in terms of the New Tendency uses the play of light and movement and only accentuates the 'worrying fact that a whole army of fiddlers and aficionados of electric drills are getting kitted out with electric saws and wires, and the like, simply because games with light and movement are becoming fashionable' (...) Instead of hanging up paintings in the Louvre they now hang up boxes, lights, wooden reliefs, etc. Genuine art, he concludes, strives to transform the prevailing order of culture rather than to produce ever-new versions of what is essentially the same thing. (Alberro quoting Le Parc, 2014, p. 68)

Conclusion

There is a thread that connects the past with the present. The affinity between the features of the GRAV's production and current Digital or Electronic Art may become apparent after examining the texts and works produced.

Interactivity, Participation, Instability, and Movement find their specular counterpart: in contemporary algorithms and interfaces; in the fields of hardware and software; in the growing culture of the tactile, which literally embodies the precept of "It Is Prohibited Not to Touch." Taking a retrospective look, the work of Le Parc and the GRAV constitutes a valuable predecessor to understanding the present, and recovering the hidden threads of the fabric that gave rise to the aesthetics of participation. With the proliferation of technological devices, the practice of "spectator activation" becomes more and more recurring both within and outside of Art, in different disciplinary fields, and even in inter- and transdisciplinary fields.

But there is also a thread from the active past which seems to be connecting the present day with the future, and it is here where the GRAV's proposition does not merely describe what happened in the past or explain the present in terms of an archaeology of vision; its value now also has a prospective dimension. The GRAV points out in its reflections that the uncritical use of materials could take all meaning out of a certain practice. The dozens of texts produced by the GRAV have an underlying acute and reflexive perspective that analyzes artistic practice within a historical and social context, with an intent of rupture and inquiry; far from

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perpetuating the existing order, they strive to put Art at the service of a particular world view that revises what has been established, and formulates specific strategies to introduce new situations. This proposition made by the GRAV may be read today as an intention that the current interface of Art with Technologies has not been able to resolve. At a technological phase planned obsolescence, wires, microprocessors, LEDs, algorithms are quickly interconnected, often reflecting their own original industrial uses and without necessarily having the framework of a project and the conceptual clarity to dive into the consequences of each decision, of each formal articulation.

Our proposal is to think of the GRAV's experience as an open invitation to reflect on Art without an expiry date.

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Among her artistic works in collaboration with other artists are included: 'Sentímetro' (2005), 'Heroes' (2010), 'MASA' (2014); projects selected in open calls, with the support of institutions such as Espacio Fundación Telefónica de Buenos Aires, Fundación Telefónica de Lima, Museo de Arte de Lima (MALI), Escuelab, Alta Tecnología Andina and Medialab Prado Madrid.

Her works on new media theory have been selected in festivals such as 404 International Festival of Electronic Art (Argentina), FILE10 (Brazil), ISEA2010 (Germany), FILE 2013 (Brazil), RE-NEW Festival (Denmark), ISEA 2014 (Dubai), Computer Art Congress (Brazil), SIGRADI (Uruguay), ISEA 2015 (Canada), CAC5 (France).

Brazilian Pioneers in Art and Technology: Waldemar Cordeiro, Abraham Palatnik and Otávio Donasci

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Abstract

The pioneering ideas and artworks of three major Brazilian artists – Waldemar Cordeiro, Abraham Palatnik and Otávio Donasci - are discussed in this paper. Waldemar Cordeiro started working with computers in the late 60s and produced some of the most important artworks of the initial phase of computer art. Although his career was interrupted by his premature death in 1973, Cordeiro left an incredibly vast visual *oeuvre*, and a great number of reviews and theoretical articles – including “Arteônica”, a *manifesto* on Electronic Art. Over the last 65 years Palatnik has explored the fusion of art, science and technology in creative, dynamic and kinetic ways. Now in his late 80s, Palatnik is still actively working on the conception of new art forms with different media. Otávio Donasci has artistically explored the combination of human bodies and electronic devices since the 1980s. His pioneering works explored the psychological dimensions of interpersonal relationships, encompassing a great variety of media to create innovative theatrical performances and interactive installations. In conclusion, we argue that these Brazilian pioneers brought extremely important contributions to the field of Electronic Art, and deserve greater international exposure.

Keywords

Electronic Art, Pioneers, Brazilian Art, Digital Media.

Introduction

In a paper we presented at the ISEA 1993 conference - “*Qualitative, dialectical, and experiential domains of Electronic Art*” - we argued that artistic, scientific and technological areas of knowledge should merge into one single process of cognition, since they are complementary parts of the holistic human experience. “Electronic artists are gradually discovering combinations of the expressive potential of human natural languages - which extend over aesthetic, metaphoric, artistic, affective and moral domains - and the objective, quantitative and procedural characteristics of computer technology.” (Spitz, 1993).

By that time – over 20 years ago – electronic

artists around the world were already fully exploring, criticizing, interfering in and expanding the creative potential of the fusion of art, science and computers. In fact, they were giving con- inuation to a movement which had been initiated a few decades earlier by some pioneering artists, whose theories and works - developed during the very embryonic phase of our digital era - inspired us all.

In the Brazilian scenario, pioneering artists such as Waldemar Cordeiro and Abraham Palatnik started to explore - as early as in the 60s - the unlimited number of possible combinations of art, science and computer technologies. In the early 80s, Otávio Donasci started to create new expressive languages by combining human actors with digital media, giving birth to his amazing “*videocreations*”.

Although each one of these professionals has contributed to the artistic field in a different way, their pioneering ideas and artworks – which will be discussed in the next sections of this paper – all pointed to the intersection of art, science and technology, and paved the way for the development of Electronic Art, in Brazil and abroad.

Waldemar Cordeiro: Rupture and Arteônica

In a time when Brazil was barely entering the age of electronics, Waldemar Cordeiro was already creating art with computer technologies. He worked systematically with “computer-aided art” from 1968-1973, in São Paulo, and is considered to be the precursor in the use of computer in the arts in Brazil (Cordeiro, 2014a).

Cordeiro was born in Rome in 1925, but was registered as a Brazilian citizen. In 1946 he moved from Rome to São Paulo, and settled down. The effervescence of his ideas led him to work in various different fronts – as a journalist, painter, illustrator, artist, landscape designer, urban planner, art critic and theoretician (Anagnost, 2010). “Cordeiro’s *oeuvre* was a work in

progress, a constant evolution.” (Cordeiro, 2014b). He studied figurative art, produced Cubist works, Concrete art, ‘intuitive geometric painting’ and ‘Popcrete’ art, and “turned to kinetic and *opera aperta* works, in 1967-1968, which preceded an investigation on computer art that the artist named *Arteônica*, from 1969-1973.” (Cordeiro, 2014b). In “*Arteônica*”, Cordeiro highlighted the need for new paradigms and goals for the creative use of electronic media in the Arts, raising innovative, critical social and aesthetic issues which are still of great significance today (Cordeiro, 1972).

Cordeiro’s utopian and revolutionary worldview “introduced a critical vein and participative character into the somewhat aseptic and Cartesian environment of the Concrete and electronic arts, enlarging their reach and lending them a new meaning.” (Machado, 2014). By means of their capacity “to translate reality into digital form” and their ability “to offer developmental alternatives through simulation processes”, Cordeiro believed computers had the potential for changing society (Fabris, 1997).

Although his career was interrupted by his premature death in 1973, in his short period of practice Waldemar Cordeiro left a vast *oeuvre* (Cordeiro, 2014a), a visionary legacy of writings and artworks, which testifies he was an artist much ahead of his time.

Abraham Palatnik: Forms & Dynamics

One of the precursors of kinetic art, Abraham Palatnik is well-known for his artistic sculptures in which color pieces move beautifully as parts of a complex system of motors and gears.

Born in the North of Brazil, Palatnik spent his childhood in Israel, but in 1947 - at age 20 - he returned permanently to Brazil. In Rio de Janeiro, Palatnik began visiting the Dom Pedro II Psychiatric Hospital, coordinated by Dr. Nise da Silveira, where he saw works by schizophrenic patients who had exceptional production, without prior art training. Palatnik then “abandoned his brushes and began to establish a freer relationship between form and color, since he realized that his own production was impotent in the light of the work of those artists” (Jornal do Brasil, 2017).

This research led to his first “Kinechromatic Device” - “Blue and purple in first movement” - a motorized light sculpture that created a play of light and shadow in space – which was awarded an Honorable Mention by the international jury of the First International Biennial

of São Paulo, in 1951 (MAM, 2014). Worth mentioning that his work was initially refused by the jury, because it did not fit into the traditional categories of painting or sculpture, but ended up in the show only because one of the international delegations could not participate in it (MAM, 2014).

In addition to creating kinetic objects, mobiles and drawings, Palatnik worked on many other fronts, including furniture design, cardboard and wood compositions and painting on glass (Spitz, 2005). Along different decades, he also worked with three new materials in succession: “in the 70s, polyester resin, in the 80s, strings on canvases, in the 90s, a plaster-and-glue compound.” (Morais, 1999).

Self-taught, the artist considers intuition to be his “initial impulse.” He describes it as the feeling that something artistic can be done with a non-artistic situation: “In my case, this path goes through intuition, then through thought and reasoning along with intense experimentation, and finally through a careful and careful process of construction.” (Revista Museu, 2017).

Palatnik – who is now 88 years old - still actively works on the conception and production of new art forms which involve different media. In his atelier in Rio de Janeiro, you will find him surrounded by nuts, bolts and tools built by him, always researching into new materials, forms, media and ideas.

Otávio Donasci: Video Creatures & Theatrical Performances

Otávio Donasci - also a pioneer in the field of Electronic Art in Brazil - is internationally known for his theatrical performances, or “VideoTheatre”.

Born in 1952, Donasci started mixing arts and technology in the 70’s, by experimenting with forms of video art. He has been exploring the combination of human bodies and electronic devices since the beginning of the 80s.

In 1983 he created his first “*videocriatura*” - a hybrid being, resulting from the creative merging of visual arts, theater, video technology and performance. In his fantastic performances, actors use video monitors (attached to a cable video recorder or wireless transmission) covering their heads (or other parts of their bodies), which are then substituted for the parts of the bodies of off-stage actors, captured live by a video camera or pre- recorded. A *videocreature* is “half human, half machine”. The monitor screen may show a

pre-recorded video of a face singing songs, or reciting monologues, or talking live with the audience, or in some cases, talking to other “*videocriaturas*”.

With his *videocreations*, Donasci expands the expressive capabilities of actors by incorporating a myriad of resources and possibilities of the audiovisual media to their performances. The resulting effects are intriguing, surprising, and absolutely convincing and effective, in spite of being made with domestic video equipment and handcrafted resources, in most of the cases. “It is not only five the senses called for the exploration of a new field of technological art. [...] Indeed, what is at stake in electronic art is not the use of high technology techniques, but the formulation of new languages. When I explore holography to write the holopoems in space, or when Otávio Donasci uses electronics to dramatically perform his videotheatre, we are faced with “poetry” or “theater” that are inscribed in the irreducible possibilities of each interdisciplinary process, or of each “hybridism”, as Donasci prefers to call.” (Kac, 2004).

Donasci’s pioneering works explored the psychological dimensions of interpersonal relationships, encompassing a great variety of media and techniques to create performances and interactive installations. He also created and produced theatrical performances, such as “Viagem ao Centro da Terra” and “Merlin” (in partnership with Ricardo Karman) – a performance which lasted five hours, in which spectators were being physically transported (inside a truck) from São Paulo to another town. In spite of its great repercussion in the international press, the very high cost of the project “Merlin” unfortunately allowed only three performances.

During his more than 30 years of career, Donasci has developed more than 20 types of *videocreations*, and has performed all around the world, winning several awards.

Final Considerations

As foreseen by Cordeiro in his “Premises for artistic development in Brazil”, which he wrote in 1969, “Brazil is the world’s greatest experimental laboratory. Large-scale demand and an innovation-friendly mind set are key factors characterizing the general state of art in Brazil.” (Cordeiro, 1969).

In fact, electronic art has found here a fertile ground to grow and flourish: Brazil has today a significant number of artists, publications, academic conferences and exhibitions dedicated to the field of Electronic Art, as well

as a great number of internationally awarded artworks.

The great expansion of the field of Electronic Art in Brazil, over these 50 years, has much to thank to pioneers such as Waldemar Cordeiro, Abraham Palatnik and Otávio Donasci, who envisioned the enormous potential of the merging of art, science and digital technologies. We believe that their original ideas and artworks - which inspired us all along all these years – deserve greater international exposure.

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ART/SCIENCE/TECHNOLOGY. Methodological Approaches and Sensitive Experiences Based on Nature Immersions, Field Trips and Rural Residencies

Bart Vandeput (Bartaku), Karla Brunet Carlos Augusto (Guto) Nóbrega, Laura Bellof, Maria Luiza (Malu) Fragoso

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Abstract

This panel discusses practical and theoretical investigations in art and technology related to nature immersions, the construction of hybrid ecologies and transcultural connectedness. We will approach these subjects from the sand point of artists that question and propose the understanding of emerging hybrid organic structures as aesthetic organisms. Working within the immaterial, invisible, dynamical flow that intercommunicates biological (living systems) and artificial (machine/electronic/digital) organisms in the process of invention, we propose the idea of artworks as transducers, interconnecting artist, nature, and the audience into an integrated dynamical whole. Specific methodological approaches create a flow of informative and sensitive experiences based on nature immersions, field trips, rural residencies, among others. Processes in which performances, actions, meetings, and interactive platforms are not only spaces for experimentation, but also environments in which the art practice reflects the concepts applied in the artistic work. Artworks created are related to a field of experimentations where the blend between artificial systems (digital or analogue) and living organisms is explored creatively. Investigation is driven towards promoting experiences, which may propitiate sensorial and intuitive integration between species, beings, and organisms. Artistic processes are conceived in order to foster possible states of awareness that are provided by the expression of phenomenon in coherent poetic systems. Immersions in natural environments are usually stimulating our senses and perceptions, bringing about the sense of being enhanced by technology and connected to nature. Four short papers are presented by five artists/researchers from the following perspectives.

Bart Vandeput (Bartaku) proposes an artistic research practice to broaden the field of embodied cognition bringing about discussions that belong to the realm of the skill of the transversal (non-expert) artist exploring “ideas on perception and (un)reflective action in a setting of affordances.” Examples of works are given from a succession of enactions through examples of this artistic practice which implies the acceptance of a view on cognition that includes plant life.

Laura Bellof questions typical binaries western society division such as natural and artificial, biological and technological when in contemporary times “it is increasingly difficult to tell the difference

between natural- biological entities from artificially constructed ones with human cognitive abilities (...) due to the development of biotechnological methods to manipulate or construct new kinds of living organisms that are purposely designed by humans.” From the *uncanny valley* concept (Mori 1970) Bellof presents on-going artistic experiments from an intertwining of biology, nature, technology in relation to general understanding of *natural*, *artificial* and *real*.

Guto Nóbrega and Malu Fragoso, as coordinators of NANO Lab, where a team of researchers, artists and designers works intensively on the subjects of biotelematics, hybridization and transcultural experimentation propose to discuss these concepts by presenting some on-going works and methodological approaches for these art based processes. Among these methodological propositions are immersions, situations of displacements that create a flow of informative and sensitive experiences. They understand the lab’s involvement with the artistic research as an environment in which the practice reflects the concepts applied in the artistic work, therefore, the engagement in field trips, rural artistic residencies and field relocate the lab environment into a “wild”, “unexplored”, unknown natural condition.

Karla Brunet contributes to the above experiences while describing different immersive field trips in nature, more specifically related to aquatic environments, which result artworks and environmental appreciation. These experiences involve “Cartographies of everyday life on the sea” in Norway, Sweden and Lithuania and an art residency on a sailing boat in Brazil, with the theme “Experience the Sea.” These examples bring about various approaches such as the process and intentions of ‘being’ on a specific location, or the experience itself as main trigger for perception and cognition, but mainly, all experiences bring about the urge – as an artist – to be in nature and produce directly with and from nature.

Keywords

Keywords: Art, Nature, Residencies, Immersions, Technology

Environmental Aesthetics and Nature Immersion Art Practices.

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Abstract

In this paper I describe 3 different immersive field trips in nature resulting artworks and environmental appreciation. The first, it is an art residence I undergone in Norway, Sweden and Lithuania. The main subject of the call for this residency was “Cartographies of everyday life on the sea.” The second, it is an art residency I organized on a sailing boat with the theme “Experience the Sea.” The third, it is an artwork derived from different trips on nature. On the first, I focus on the process and intentions of being on that location. On the second, the focus is on the experience. And on the third, I talk about the outcome of different immersions in nature performed on recent years. They all have in common the urge— as an artist – to be in nature and produce something out of it. It can be a report, a note, a video, or a photograph, anything that connects me to nature, which can extend the feeling even when I’m not there anymore.

Keywords

Nature, Art Residency, Immersion, Environmental Aesthetics, Experience.

Introduction

Having environmental aesthetics as a methodology for nature immersions, I have been promoting and undergone different kinds of art residencies and field trips. This paper intends to present and discuss the practices and processes resulting from these nature awareness experiences. Everyday we see an increase detachment from nature and an engagement on a speedy and busy way of living. As an artist and educator I feel the urge to go back to nature from time to time. This contemporary way of living demands slowing the pace and creating some detachment from the concrete/digital world. In order to do that, I have accomplished some nature immersive field trips, most of it done by the movement (Cresswell, 2006) of my body – that is: walking (Thoreau, 2004; Jokela, 2008), cycling, sailing, and rowing... I also promoted a “day on the sea”

as an art residency on a sailing boat. The goal of this residency was to perceive the sea that surrounds our city. Afterwards, every artist created an artwork based on his/her experience. Here in this paper I intend to present a reflection on these artistic processes based on nature immersions.

Art, Experience and Nature

Allen Carlson (2000), in his book “Aesthetics and the Environment: The Appreciation of Nature, art and Architecture,” talks about ways of getting involved with nature. He (Carlson, 2000, p.194) states that

...aesthetic appreciation involves more than simply either passive contemplation of pleasing form or spontaneous delight in sensuous surface. Essential to aesthetic appreciation is active engagement, involving cognitive and emotional interaction between the appreciator and the object of appreciation.

At the same time, Carlson considers the scientific knowledge to be mandatory for nature appreciation. For the author, an art critic is capable of appreciating art while an ecologist is better equipped to appreciate nature. Science is a better tool for environmental aesthetics than art (Carlson, 2000, p.50).

Nevertheless, in Ecoarte¹ group we use art to appreciate nature. At the same time, in each project we engage on cognitive knowledge of the environment in order to better appreciate it. We mix art & science to create a deeper engagement.

Our projects are based on experiences, and these experiences lead to an environmental aesthetics. For Jorge Larrosa Bondia (2002), nowadays experience is rare. Firstly, it is because there is a great amount of information. And being experience “what happens to us,” information is not experience. Secondly, there is excess of opinion. In our society driven by social

¹URL: www.ecoarte.info

media, opinions matter more than experiences. Thirdly, experience is rare because we lack on time. Our lives got so busy, everything has to be fast and we are missing silence and memory. Fourthly, we have an excess of work, we are always active trying to finish a work and have no time to really feel “what happens to us”. Experience is based on being passive, being open, being available (Bondia, 2002, p. 19).

The three practices described below have experience as the main objective. Different from knowledge that is common to all, experience is unique, everyone has his/her own, it is impracticable to be repeated (Bondia, 2002, p. 27).

Marine Time: Perceiving Sea Changes

Traveling on the sea can distort someone’s awareness of time. Going from one place to another, a trip journey or simply enjoying the water can be a way of rethinking one’s experiences, one’s life and one’s way of dealing with time and changes. “Marine Time: Perceiving Sea Changes” is a project on time perception, environmental awareness, on location and landscape affinity.

Marine Time was created do the M.A.R.I.N. (Media Art Research Interdisciplinary Network) art and science residency organized by Tapio Mäkelä² in the North and Baltic Sea. My proposal in this residency was to create a mapping of how people perceive the sea and the temporal changes in three different places (Flørli/Stavanger, in Norway, Öland island, in Sweden and Nida, in Lithuania). By collecting stories of people who live out of the sea, such as fishers, sailors, tourism related workers, NGOs, researchers, etc, I created narratives and maps that present time chances, how it is sensed and created on a personal and spatial level.

The goal of this project was to research the spatial patterns, time changes and interactions of environmental problems, combining different sources of information to develop a mapping narratives allowing to different users to explore the details and complexities of this territory and its human and environmental problems. The main product of this was an online logbook presenting notes, maps, audio interviews, photos and videos collected on the field trips. It’s a hybrid of my subjective cartography and local people points of view, where fishers, managers, scientists, artists, tourists presented their sense of the place, time and panorama. This online travelogue can be conceived as a tool for debate, decision-making and

awareness on the sustainability on the sea.

During the weeks on the North and Baltic Sea, I went to many walks on nature, sauntering and enjoying the environment. Sometimes I took longer trips on a bicycle, or a sailing boat or a rowing boat, all in a slow pace, no motor involved. My choices of where to go were based on talks to local people or, sometimes, random. As Thoreau (2004, e-book) wrote:

What is it that makes it so hard sometimes to determine whither we will walk? I believe that there is a subtle magnetism in Nature, which, if we unconsciously yield to it, will direct us aright. It is not indifferent to us which way we walk. There is aright way; but we are very liable from heedlessness and stupidity to take the wrong one. We would fain take that walk, never yet taken by us through this actual world, which is perfectly symbolical of the path which we love to travel in the interior and ideal world; and sometimes, no doubt, we find it difficult to choose our direction, because it does not yet exist distinctly in our idea.

For me, it was a foreign land, a foreign continent; therefore, all the walks were new. It was my first time in every single field trip. On those I collected data as: photos, video, audio interview, maps, data of the fishing habits, stories of the changes and some subjective and emotional statements.

As Katharine Harmon (2004) said, “I sense that humans have an urge for maps”, maps aren’t only a tool to get from one place to another, they can be an instrument to motivate our imagination, our fantasy, a way to travel in time and space. I proposed maps that were hybrid: scientific, storytelling and subjective. It could be an instrument for community management and, at the same time, an instrument for dreaming.

The travelogue³ was a report on experiences of the way people perceive their territory and environment, reflection on the past, present, and future. It was collaboratively created using efforts from art, science and communication.

Despite of science, cartography has been extended used by artists and activists, “An Atlas of Radical Cartography” (2008) presents some examples of that: maps of places, routs, protests, actions, feelings, intentions. The map here pretends to use many of these themes, but different from the ones in a book, they are not static, not printed versions. Accordingly, I created a collaborative narrative mapping produced

² <http://tapio.translocal.net/cv/>

³ Marine Time URL: <http://marine.ecoarte.info/>

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by a combination of my field trips; Open Street Maps, scientific data, community stories, subjective places and emotional perception.

Velejar Art Residency

On the end of October 2016, a group of artists and art students went on a sailing trip with the aim to sense the sea of the bay around their town. This project was called "Sailing: Art and Experience of the sea." The city was Salvador, in Bahia, the first capital city of Brazil. The boat was a 17-ton 44-foot sailboat, a Bruce Roberts 434 model, with a ketch (two masts) and a pilothouse. And the group was interdisciplinary, students and artists from different backgrounds and age range. Together with Roberto Fabiano, the captain of the boat, I led this art residency on the sea. Our main goal was to sense the sea – to feel it, to observe it, to notice it in a different way, to recognize it, to be aware of it, to comprehend it, to appreciate it, and to realize it. And after that, to create art pieces based on this experience.

Place for me is the locus of desire. Places have influenced my life as much as, perhaps more than, people. I fall for (or into) places faster and less conditionally than I do for people. (Lippard, 1997, p4)

Having this citation from Lippard as mote to the day on the sea, our objective was to fall for the Baía de Todos os Santos (bay where we have sailed). I have a great passion for the seas and the bay that surrounds my city.

We were a group of 12 artists and the great majority had never been on a sailing boat. The experience started before boarding, when we planned the trip. Beto Fabiano showed us the possible routes, the wind forecast, currents, weather forecast, nautical chart and topography of the bay. The two days planning were a form of start to understand the environment we were going to face. This scientific data helped us to better appreciate nature (Carlson, 2000).

During the experience on the sea, we could feel the wind on the sail, how the boat moves and how to anchor. We stopped in different island and went for a swim on the sea. On board, I realized that four of the artists didn't know how to swim. I took each of them with me to the water. Their experience of the sea was original. They said it was a strange sensation not to have anything beneath their feet. It was an incredible statement. For a diver as myself, it was amazing to hear that someone that lives in a coastal city had never been floating on the sea. It was a perfect example of an experience described

by Bondia (2002).

The result was an online exhibition⁴ of 12 pieces resulting from this practice. There was video, photography, text, drawing, performance, glitch, dance, land art, audiovisual performance and animated code. Everyone had a different experience on that day, and those are translated on their resulting pieces.

Wanderscapes

WanderingScapes is an audiovisual performance about journeys on nature. It is wandering on different -scapes such as landscape, cityscape, townscape, roofscape; riverscape, seascape, waterscape, snowscape... It is going into field trips as nature immersions and bringing back a miscellaneous of videos and sounds. This audiovisual performance is the outcome of the lived experience in different environments. It is glitched, rusted, noised as the experience cannot be (re)lived. It is just performed with simple body movements, instruments, sensors and objects created by us.

As an artist, I went to a variety of immersions in nature in order to record videos for this performance. The way to experience nature had no selected weather, some days were sunny and colorful, and others were rainy and gray. The mud, the wind, the sand, the extreme heat, the freezing cold was felt on my skin.

WanderingScapes was created together with Enrique Franco Lizarazo, I work with the visual and Enrique works with the sound. In the performance, we mix the movements of the body on going into immersion in nature with the movements of the actual audiovisual performance. The videos and sounds collected during immersive field trips walking, cycling and sailing in different landscapes – deserted beaches, open ocean, forests, parks – bring us back to nature. In this AV Performance, we use simple movements of the arms and upper body as an allusion to the movements of the body, which took us to the contact with nature. It forms a simple dance of the arms on air, using sensors and mixing images and sounds to recreate a revised version of the nature experience.

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⁴ URL: <http://velejar.ecoarte.info/>

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Aronia m.BaBe: Berry-artist(ic) Research Bart Vandeput (Bartaku)

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Abstract

In an artist-berry alliance an artistic research practice is developing that arguably provides a case as part of a wider attempt by practitioners to broaden the field of embodied cognition. This implies the acceptance of a view on cognition that includes plant life. Examples of the artistic practice describe how it drives -and thrives- in a time spatial matrix of 'merely happenings', unreflective and reflective normative actions and embraced failure. A dynamic coupling, interspecies interaction system that is enactively named a 'Leaky Loop System'.

Keywords

Embodied cognition; Plant cognition, Enactivism, Artistic re-search, Ontology, Philosophy of Science, Technology.

Introduction

One of the most effective vegetal dyes that convert light into electricity is produced in the berry of the 'Aronia melanocarpa' bush. Due to this property Bartaku was introduced in 2009 to a former Russian state owned plantation just outside the Midwestern town of Aizpute, Latvia. Ever since he annually returns to reconnect with the 1Ha Aronia m. Plantation (1HAMp). These repetitive residencies are a key prerequisite for the ever-deepening relationship that fuses Aronia m. and Bartaku's artistic research practice.

In this paper, I propose that this artistic work can be seen as a case that can contribute to the widening of the scope of -or at least contribute to discussions in- the theory of embodied cognition. It is a case that belongs to the realm of the skill of the transversal (non-expert) artist, who is also a naming, wording agent, in the context of his entanglement with a berry. Central here are ideas on perception and (un)reflective action in a setting of affordances. The latter being defined by Rietveld as relations between aspects of a material environment and abilities available in a form of life. (Rietveld, 2014). When an individual engages adequately with an

affordance this is often an exercise of skill. In acquiring a skill, the individual becomes increasingly expert at responding adequately and appropriately to the actions a particular situation invites. Skilled persons - typically craftsmen, or more generic, experts- often respond in a non-reflective, still normative (discontent/wish to improve) way to various possible actions that the situation, environment provides.

The key notion enaction is inspiringly described by Varela, based on a poem by A. Machado, as the laying down of a path in walking: "Wanderer, the road is your footsteps, nothing else; you lay down a path in walking". (Thompson, 2007).

Rietveld has been focusing on humans, later adding non-human animals so as for plants I follow here Gagliano who extends the above-mentioned concepts into the realm of the living (Gagliano, 2014). Her thinking and experiments are embedded in Maturana's view on cognition as a natural biological phenomenon contributing to the persistence of organisms in a dynamic 'process' of interactions in the organism-environment system. Cognition is not a fixed 'property' of an organism.

In the examples of works given below, some past, some ongoing, some becoming, it is shown how they are the result of a succession of enactions that interact dynamically: unreflective ones, especially whilst wandering in the familiar 1HAMp; reflective, in the context of a lab, talk, study... Reflective as well, in terms of embracing failure, be it planned or unplanned. As for Aronia m., the unreflective self-beneficial action (signaling, biochemical action) to its environment happens most in its familiar environment, 1HAMp. Reflective action becomes more dominant when the biotope changes, augmenting the stress levels in Aronia m. and other parts of the biotope. But what then with the enactive moment in which merely something happens,

enigmatically, as in the case of the awareness of the discontent of Aronia m. with its formal name, followed by the immediate appearance of the right new name in a setting of rich affordances? For now, there is no explanation other than the enigma.

In the writing -and perceiving of this paper, in the coupling of embodied cognition with plant cognition via the pathways of the human/berry artistic practice, I will enact conclusively by naming this constellation a 'Leaky Loop System'.

Aronia m. Baroa b.

September 3rd 2014. At the edge of a shrinking town not far from the Baltic Sea, Bartaku wanders as usual at that time of year at the 1 Ha Aronia melanocarpa Plantation (1HAMp). Amidst thousands of Aronia m. bushes he senses their discontent with their formal science given name 'Aronia melanocarpa (Michaux) Elliot'. At an instance, without any reflection a new name is spoken out: 'Baroa belaobara'. The bush tension drops drastically, Bartaku bodily understands it is the right name that came.

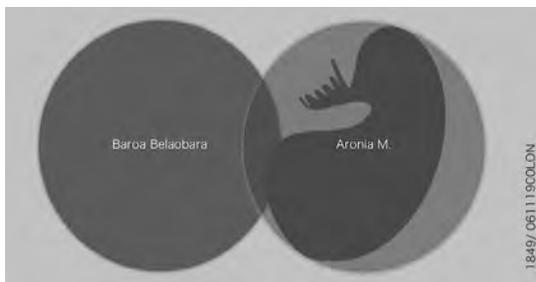


Figure 1. Nomenclatural and shape morphing. Sketch by Bartaku

Few seconds later, that fresh sudden void that arose due to Aronia m. no longer referring to a flesh fruity *something*, was filled: a graphic sketch of a possible future new Aronia m. materialized whilst observing a single onyx black berry on a bush. A day later, using the just learned quick clay shaping method, a clay figurine made whilst gazing at the sketch, came to be. With powder sugar, Aronia Baroa belaobara juice and some brushes ready at hand then, a traditional simple paint was made and applied on the piece. After two days in open air and nocturnal indoor shelter the piece was hard. Most probably due to the high amount of tannins it seemed as if it had been baked in the kiln. Not entirely surprising having investigated the metabolite properties

in the Aronia Overture: a collaborative piece consisting of 11 movements, with Babe juice dripping on a custom-made hardware Babe-audiodevice modulating its sounds. And juxtaposed with an *unchoir* that produces Babehuman sounds, emulating the sensation of choking that one perceives with drinking Babe juice.

Back in Aizpute, soon after the future Aronia dried, a photo shoot took place at Serde Arts Center (Lat) with annually returning photographer Daniel Allen. In the process, vibrations of the wooden -300-year-old-floor led to the fall and mutation of future Aronia m. It was said that the birds did it. At the time of writing the number of mutations due to various causes has risen to four.

These transducing moments of Babe bushes' signals into unreflective, immediate creations of a new name and shape are fusing a whole chain of artistic processes that influence the contexts in which they emerge.

Nomenclatural Morph

The well thought of act of 'Nomenclatural morphing' is foreseen. A name change request to modify Aronia m. (Michx.) Elliott into Baroa belaobara will be delivered according to the protocol of "The International Code of Nomenclature for algae, fungi, and plants" by *The International Association for Plant Taxonomy (IAPT)*. For the physical formal wordings of the procedure, Babe-ink will be used, applied on a medium, possibly living flesh. Observing the Code, it is most certain that the request will be rejected. Nevertheless, Baroa belaobara, Baroa b. or Babe, will be enacted further outside the realm of the formal.

Synaptic Morphing

'Synaptic morphing' was initially conceived as an intend to allow Babe to commend on the field of neuroaesthetics by applying Babe-light based electricity to the brain such that the human would start perceiving Babe as the most important work of art in cosmic history. Due to the grounding advice of a neuroscientist pointing to the complexity of invasive brain electrotherapy, the idea transformed. During a bio-signaling workshop a physical and conceptual discontent towards a brain reading device resulted in the unmasking of a face-like-feature with the device pushed flat on a paper. At 1HAMp this feature became the model for 5 masks, one in plaster, made in a highly unreflective way by a fine artist on wine and wodka. One antidotal masks was

sculpted and three times reproduced in a conceptual, conscious stance. The Sun dried masks were brought together in the form of an interventionist happening at an arts festival. They were stained by human performative hands that squeezed out the juice of berry after berry for two days. Shiny, onyx black the masks became.

Morphing Aronia m.

‘Morphing Aronia m.’ features the exploration of a new physical identity for the initial Aronia m. as name. It will have the clay figurine based shape and enhanced metabolite properties. The latter are informed by Babe’s relation with light and the aim is to both honor this berrycosmic relation as to enact a facilitated adaptation of future changing light conditions. Developing the highest concentrations of anthocyanin pigments will lead to an even darker new berry. Various techniques will be tried out, from in vitro cell culture to more complex endeavors. Plants are selected on their high presence of anthocyanins.

Distributed Plantation



With labs nearby but Babe absent, it is worthwhile mentioning that this situation changed due to the highly non-reflective immediate intervention by the grandson of a grandfather who used to have a leading position at the plantation in sovkhos (Soviet) times. Also, the young man had been assisting Bartaku and the local winemaker/chemist in various harvesting moments and other interventions. Aware of other than financial values of the berry land, he prevented the fifteen lot owners from selling to agro-industrial, pension fund controlled entities. He found himself renting for the next years. Bartaku was informed about the ongoing change, immediately found himself daytraveling to IHAmP, photo-shooting the young man amongst the bushes,

and digging out young shoots and driving back together with the Babes to Helsinki. Eleven young shoots are now constituting the Otaronian Distributed Plantation at the science Aalto University Campus. Through a highly unreflective finger-on-digital-glass act, followed by a skillful mapping and digging operation, the Finnish extension of IHAmP has bird view wise the shape of future Aronia m. Parts of the plants have been used for growth in sterile condition in glass and sterile labs. Until the moment of writing they did not enact in the planned way. The protocols fail. Or the humans, protocolling. Or the protocol matter.

Conclusion

A selection of past, evolving and evaporated parts of the Aronia m. Babe berry artist(ic) research practice has been described in terms of contents, process, and method. It is an ever-evolving hybrid entity through mutual, non-hierarchical influencing of the alive and non-alive components in the constellation. A process in which the human and berry are morphing separately, but also in a more entangled way, giving shape to a hybrid humanberry entity.

I propose that the Aronia m. Babe Bartaku based constellation can be seen as a case that contributes to the broadening of the understanding of the field of embodied cognition. This by offering a context in which plant cognition is acknowledged and in an embodied way enacted. A context with variable cognitive and skill-based stances by both artistic researcher and Aronia m. Babe, laying down a path in walking.

The case is particular in that the unreflective can reflectively clash –being fused by berry discontent– with the highly reflective, like the plant Nomenclature. Notwith-standing being conscious of the guaranteed failure, with contentment there is a bouncing back into a context with affordances that could be relevant for non-reflective artistic action. In this seemingly rational methodic realm, the artistic practice and the involved agents evolve through bidirectional coupling, recharging themselves, changing constraints, eco-systems and understanding.

In the process of writing this paper it was understood that the above system can be named in a wordy enactment as a “Leaky Loop System”.

A remaining void is the notion of “it merely happened”, as mentioned above, Bartaku’s sudden awareness of Babe’s discontent with its official name. For now, it has to suffice to encode it as an enigmatic

artistic-empathetic interspecies awareness.

“And the Aronia berry, is an apple”

Anete Boroduške, molecular biologist. Faculty of Biology, University of Latvia. Sept. 11, 2015. Serde, Aizpute (Lat)

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Author Biography

Bartaku practices the art of enquiry with main interest in cognitive ecology, consciousness studies, neurobiology, energy and the philosophy of knowing and becoming. His work is often process-based, collaborative, transversal and situated in the folds and cracks of formal classifications. Since March 2016 he develops the deepening of the entanglement with the Aronia m. BaBe appleberry as a Doctoral candidate at the Department of Arts, Design and Architecture of Aalto University (Fin). He is participating artist in arts ecology project frontiersinretreat.org and member of both cultural lab FoAM (Bru) and the Finnish Bioart Society.

Immersion in a field phenomenon. Going with the flow Carlos Augusto (Guto) Nóbrega, Maria Luiza (Malu) Fragoso

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Abstract

NANO-Nucleus of Art and New Organisms has developed practical and theoretical investigations in the field of art and technology related to biotelematics, hybridization and transcultural experimentation in the last 6 years. A methodological approach has been applied in order to create a flow of informative and sensitive experiences based on collaborative strategies such as events, meetings, immersions and interactive platforms. NANO lab is not regarded only as a physical space for experimentation, but also as an environment in which the practice reflects the concepts applied in the artistic work. In this sense, we engage in field trips, artistic residencies and field projects that relocate the lab environment into a “wild”, “unexplored”, unknown natural condition which we call immersions, situations in which the lab is re-located or dis-located according to specific work plans, work groups, project objectives. On the following paragraphs the organic model behind these ideas and strategies will be briefly discussed and some examples presented.

Keywords

Art & Technology, Aesthetic Organism, Hiperorgânicos, Immersion, NANO Lab

Introduction

As already discussed in previous articles (Nóbrega & Fragoso, 2015), the concept of field has been a consistent and productive working model for the methodologies applied at NANO Lab. In the first place we believe that art should be addressed as a organic system of and integrative dimension whose essential qualities such as coherence, connectedness, emergence, transductivity are part of a complex web of forces that can only be fully grasped if one allows for him/herself to go deep in the playfulness with the system (artwork milieu) as a whole. Going with the flow is a state of awareness which implies to be present but not in a fixed manner, not anymore from a standing privileged point of view towards the artwork, but to exert an state of presence in movement, oscillatory, encompassing multiple

perspectives and scenarios, here and there, all at once. This is why the environment in such a context is critical, as it has the power to reverberate to ones presence. The environment should be considered not the “white cube” for the artwork, but effectively and affectively integrated to the artwork’s nature as part of its genesis. The environment must be taken into account, not

only on the process of reception of the artwork, but also for the process of its invention. However, we cannot to go further in that discussion without defining the artwork’s nature, without specifying what we conceive as the nature of a work of art and the multiple forms it can assume.

Aesthetic Organism

In his paper “Towards a Field Theory for Post-Modernist Art”, Roy Ascott (1980) draws our attention to the transactional character of works of art, in which a field of “psychic interplay” between the artist and the observer takes place, and proposes the artwork as a system. Thus, the artwork may be seen as a matrix around which the art game is set. The art object is in fact a fraction of a general system that encompasses several actants - human and non-humans, natural and artificial organisms, multidimensional perspectives - with several entrances. Playing, would be “...the way the artist, the observer and the artwork become a whole interlinked mind, and that art is a game of which the rules are to be discovered through playing, and that in playing ludic patterns that interconnect are revealed” (Nóbrega, 2009). The work of art is what results of such live experience with the system – the playfulness of getting immersed in acts of invention, transductions, emergence involving its several parts. That is why we call works of art “Aesthetic Organisms” (Nóbrega, 2009).

Activating Flow

This framework gives us the possibility to approach

artworks not as a process byproduct, but, indeed, as a process component of a larger structure, a trigger, of its one nature, able to activate along with the system, an artistic experience. We may consider such an experience as a fourth-dimensional window, which brings visibility for the system and allows for its fruition. In this case the concept of field shall be applied “as a working model for the systemic role of information within the immaterial, invisible, dynamical flow that intercommunicates natural (humans and other living systems) and artificial (machine) organisms in the process of invention as well as fruition of the artwork” (Nóbrega & Fragoso, 2015). This brings us back to our initial point regarding NANO Lab methodologies which includes field trips, artistic residencies and projects immersed in nature. These are actions that relocate the lab environment into a “wild”, “unexplored”, unknown natural condition which we call immersions, situations in which the lab is re-located or dis-located according to specific demands, network needs and project goals. What is important for us in such an strategy is the window opened for the process and the awareness for the emergence, crucial for nurturing the genesis of aesthetic organisms.

Hyper-organic Immersions

As a practical example, we may focus on “Hiperorgânicos”, an open lab event created and organized by NANO Lab which provides for the participant a network of actions during three days of sharing experiences, processes and invention in a collaborative manner. There is not an expectation of a single artwork to be created along the process, but rather an open space for exploring and connecting. The core of the “Hiperorgânicos” event is a server that interconnects all processes created along the three lab days. Each participant is invited to share data and connect, using local and telematics data to generate, transform their own processes and the whole emerging picture from these exchanges. The public is invited to engage in an active form, bringing their own resources, sharing knowledge with the artists, scientist, researchers in a collaborative way. Video, sound and behavioral systems are generated along with the event. At some point, performances are shown to the public, inviting them to interact. However, what draws our attention is the systemic, complex behavior of the whole system (environment, processes, network) which at some point show us some aesthetic values we could qualify as art. This is an important observation, as it calls our attention

for the multidimensional, trans-sensorial nature of art. As a temporal phenomenon, timing is crucial for the absorption of what we call an aesthetic organism. Instead of the classical fruition mode artwork-observer relation, we notice that context such as these of open labs and immersive residencies brings awareness to the continuous sampling of multiple unfolding of the system, a flow of events which can be grasped by intention, intuition and immersion. The concept of this proposed work could be thought of as that of emerging organisms whose duration is conditioned to time, space, the environment in which it develops a play full experience with the public. Ephemeral work, updating itself to each encounter, metabolizing itself in time.

Nature Immersions

A practice that functions as a preparatory for the “Hiperorgânicos” event, as well as for several processes developed at the NANO Lab. These are moments in which all members travel to a place outside the city and engage in a program specially created for that specific time and space. These programs are a set of propositions brought through by any member of the lab when there is a need for group focus, concentration and co-creation. Usually happens two or three times a year and requires specific planning for each detail of propositions. Immersions in natural environments are usually stimulating for our senses and perceptions. These specific immersions are conceived to construct sensitive coupling between natural/organic and artificial systems. When one returns to nature, after a tremendous technological immersion, normally stimulated by the lab’s research practice, carries with and on the body these technical apparatus. These syncretic interactions and hybrid intersections are extremely relevant to the artistic processes developed in NANO Lab. It is not only the natural environment that we are interested in, but, specially the sense of being enhanced by technology and connected to nature. This is made possible only when our bodies (flesh and machine) are provoked and demanded by the environment.

Immersions last for three days, when documentations are made through photos, videos, drawings and texts. Collaborators are invited to participate and the groups are usually around twenty people directly or indirectly related to the lab’s team. Most activities are experimental and some are proposed after arriving at the chosen location, stimulated by the environment itself. There is little time to sleep and interactions

between all are intense and challenging. After each immersion, results and processes are organized and re-located at the lab space and became object of reflection and further research. The intense group activities during the immersions contribute to the laboratory's integrative system, to promote academic dialogs and favors the need to bring into form the experimentations in order to show the processes in artistic or scientific events and consequently creating a coherent flow of creative initiatives within the collaborative works at NANO. Immersions allow us to return to the essence of the the nucleus of new organisms, stimulating what "conversations" and "autopoiesis" as explained below.

Other than Roy Ascott's work, we point out here two, from a few, theoretical references, that influence this methodological approach to the art-lab environment: Humberto R. Maturana and Francisco J. Varela's idea of "autopoiesis"(1980) as a systematic medium (space) where all recursive dynamics of reciprocal interactions occur to sustain the survival of life, of processes, and of systems; and, Jorge de Albuquerque Vieira's approach to art as a type of knowledge essential to the umwelt (and it's possible poiesis) and to any process that guarantees the permanence or the survival of any living system. Very briefly, Maturana and Varela envisioned self-referring systems by which life is centered in maintaining and reinforcing the vital parts (organs) that the system needs to survive. Environmental influences are absorbed and processed but the essence is maintained and this is advocated from the understanding of "biology of cognition". This essence would be what defines or differs one organism from another. Interaction with the environment is referred as "conversation", a consensual braiding of emotions, behavior and language, which reinforce the construction of networks. According to the author, technology is seen as a powerful instrument/medium to expand our knowledge about structural and sensitive coherences within living and nonliving systems.

In this sense, Jorge A. Vieira (2009) quotes three major characteristics for the survival of an open system: sensitivity, to operate information flows; memory, to transfer and retain information; and capability to elaborate, or prepare, information according to its needs. Vieira applies the term umwelt, first introduced by Estonian ethologist Jacob von Uexküll, to propose the idea of understanding art as a type of knowledge, so to speak an open system related to the survival of any living organism. According to the author, before philosophy or

even science, art served as an "evolutionary adaptive strategy" of survival. This is possible if we consider the idea that survival is directly related to deliberate conditional couplings of each organism's with it's umwelt. Vieira also tells us that our umwelt has long been technologically constructed and art, understood as a type of knowledge, incorporates all necessary technology to favor processes of consciousness, and consequently of survival. Creativity and innovation are aspects in artistic processes, which reinvent our relations with our umwelt and construct possible realities. Other than a scientific approach to understanding the truth of biological systems, artists may be more interested in understand the possible relations between humans and nature; other living organisms, humans and nature; technology, organisms, humans and natures, and so on.

Conclusion

Practical and theoretical investigations held at NANO Lab in Rio de Janeiro intend to explore in the field of art and technology notions of biotelematics, hybridization and transcultural experimentation. From Field Theory, to the concept of Coherence, in processes of autopoiesis and environmental consciousness, there is this constant need to understand an emerging hybrid organic structure, thought as an aesthetic organism, that becomes more and more product of our own bodies and lives. From experimental processes applied to strategic methodologies, dynamical flow is necessary to intercommunicate natural (humans and other living systems) and artificial (machine) organisms in the process of invention as well as fruition of the artwork. Methodological approaches are in process of experimentation. Informative and sensitive experiences are based on collaborative strategies.

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Uncanny Realm – The Extension of the Natural

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Abstract

One of the typical binaries existing in western society is the division between natural and artificial. But similarly biological and technological are often seen as oppositions. In today's world, it is increasingly difficult to tell the difference between natural-biological entities from artificially constructed ones with human cognitive abilities. This is due to the development of biotechnological methods to manipulate or construct new kinds of living organisms that are purposely designed by humans. Likewise, artificial intelligence-systems are being developed to become more autonomous and life-like with their sensing and learning abilities. These developments point out that our perceptions of the concepts of *natural* and *artificial* are radically changing. Traditionally *natural* is understood as something coming from nature and not made or caused by humans; and *artificial* is understood as the opposite – not natural, but produced, created or caused by humans.

Taking the *uncanny valley* concept by M. Mori (Mori 1970) as a starting point, the paper will investigate how this concept fits into experiments that are intertwining biological and technological matter. The *uncanny valley* idea was developed by Mori in relation to robots and their resemblance to humans. It is a concept that is strongly connected to our perception of truth and to the moment when we are confronted with a question to judge if something is 'real'. In the paper the *uncanny valley* concept is extended to experiments in the arts and the sciences that address intertwining of biology, nature, technology, and which disarrange our traditional understanding of *natural*, *artificial* and *real*. The talk will additionally present examples of the recent and on-going research by the author that is interlinked between biology and technology.

Keywords

Art & Science, Natural and Artificial, Biology and Technology, Uncanny Valley.

Introduction

The most of us are familiar with the concept of *uncanny*, which has been analyzed and described in length by Sigmund Freud in 1919. He writes that "an uncanny effect often arises when the boundary between fantasy

and reality is blurred, when we are faced with the reality of something that we have until now considered imaginary, when a symbol takes on the full function and significance of what it symbolizes [...]" (Freud 2003). Freud's examples are mainly literary novels and fictional texts, but he also mentions in his text wax figures, dolls and automata as sources of the *uncanny*.

One of the long-term dreams and fears of humans has been the ability to construct *life* from scratch. The figure of Frankenstein, which we know best from many movies that are based on the well-known story from 1818 by Mary Shelley, is one of the most prominent examples where these dreams and fears culminate. Shelley's text produces an *uncanny* effect in us as it blurs the boundaries between fantasy and reality and the figure of Frankenstein brings forth a range of feelings in us – from amazement to revulsion.

Revulsion is also considered to be one of the feelings affiliated with the concept of the *uncanny valley*, a concept that is less widely known than the *uncanny*. The *uncanny valley* concept obviously refers to the Freudian *uncanny*, but it originates in the research field of robotics and their cultural aspects. The concept is based on a hypothesis by Masahiro Mori, who in 1970 envisioned people's reactions to robots that look and act almost like a human. In particular, Mori claimed that a person's response to a humanlike



robot would abruptly shift from empathy to revulsion as it approached, but failed to attain, a lifelike

appearance. This descent into eeriness is known as the *uncanny valley*. In other words if one follows a

chart that represents people's reactions to human likeness in robots, in the first instance people seem to like robots that remind of themselves. The more likeness to human figure the higher the curve rises. But, suddenly, when the human likeness starts to be very close to 'real' human the curve abruptly drops down and rises again afterwards to its highest point that represents a real human. This sudden drop in the curve draws a kind of a valley in its shape; this dropping point Mori named as the *uncanny valley*. One of the examples by Mori is a prosthetic hand that resembles a real hand. Mori writes, "once we realize that the hand that looked real at first sight is actually artificial, we experience an eerie sensation. For example, we could be startled during a handshake by its limp boneless grip together with its texture and coldness. When this happens, we lose our sense of affinity, and the hand becomes uncanny." (Mori 2012)

There has been a fair amount of speculation concerning the *uncanny valley* concept; if Mori's claims are true, and why do we react in this way? Several scholars have aimed at explaining this kind of behavior present in the *uncanny valley* concept. One of the explanations, which seems plausible, stems from an evolutionary tendency to be repulsed by anyone who looks sick, unhealthy, or *wrong*. In other words, it is humans' innate instincts for pathogen avoidance that causes the revulsion (Rhodes & Zebrowitz 2002). Another explanation is closer to Freud's description of uncanny and particularly in regards to humanoid robots, which have been claimed to trigger an innate fear of death as they typically move like lifeless puppets, reminding us of our own mortality (MacDorman & Ishiguro, 2006)

Uncanny Nature

Author Yuval Noah Harari writes in his book *Sapiens* about bionic life and gives an example of research (at Duke University, North Carolina) where scientists were planting an electrode to a brain of a rhesus monkey. The electrode received signals from the monkey's brain and transmitted them further to external devices. One of the monkeys, Aurora, learned to thought-control a detached bionic arm at the same time as she was using her two biological arms to other tasks. Aurora now has

three arms, two biological ones attached to her body and one that is wirelessly connected to her and which can be located anywhere in the world (Harari 2015). This example concerns non-human species, while both Freud and Mori connected the *uncanny* and *uncanny valley* concepts mainly to a human figure, shape and experience.

The world has changed since the time of Freud, which becomes obvious from examples of advanced developments in biotechnology, technology, artificial life (AL), and artificial intelligence (AI). However, I argue that the Freud's concept of *uncanny* and Mori's *uncanny valley* are still relevant today even if coined many decades ago. Nevertheless these concepts no longer concern only human figure and experience, but find resonance in our relation to nature. As already pointed out in the previous example, certain kind of *uncanny*-ness can be found in the human manipulation of nature and other organisms.

The paper proposes that an *uncanny* sense of nature is currently emerging around us, which is caused by the fact that today, increasing amounts of biological organisms are based on man-made design. These developments change our relation and perception of nature and lead to a construction of *uncanny nature*; a concept grounded on Mori's idea of *uncanny valley*. Where Mori was investigating robots and their human-likeness in relation to human sensations, the author points towards comparable sensations and experience when concerning biological organisms that are either manipulated or designed by humans.

Natural and Artificial

The *uncanny* by Freud and the *uncanny valley* concept by Mori have a direct relation to the concept of *real* - or what we perceive as *real* and what we understand as artificial. During the last decades we have witnessed an increasing blurring of categories between biologically evolved and artificially created or manipulated organisms. For example, until now humans' cognitive abilities have been apt for quick judgments in dividing things into ones that are artificially made by humans and those that have evolved with minimal human impact. Today, this is no longer obvious due to the development of e.g. biotechnology and methods to construct new kinds of living organisms that are designed by humans. These types of developments that concern of manipulation of life, radically impact our understanding of the term *natural* and what has been considered its counterpart

Panels

- the *artificial*. Traditionally *natural* is understood as something coming from nature and not made or caused by humans; and artificial is understood as the opposite – not natural, but produced, created or manipulated by humans.

The possibilities for manipulation of biological matter via technological methods, and also extension of technological by biological, will increase in the near future. What kind of division between biological and technological will form in the future, and to what degree will our concepts of *real*, *non-real* and *artificial* blur with the development of various kinds of hybrid entities? Artists are already addressing these questions and opening up the field for experimentation, as well as pointing to many ethical and moral questions these science- and technology-based practices bring.

Art and Uncanny

In the recent years there has been a large increase in artistic works and interests that are affiliated with science and technology and which use living matter - such as microorganisms, bacteria, yeast cells, plants, mushrooms and animals - as an integral part of the art work. In some of the artistic experiments, the organisms are being technologically manipulated whereas in others the living organisms are cultured and mainly observed. At the same time technological development concerning robots and especially artificial intelligence-systems is directed towards creation of life-like autonomous entities with learning capabilities through imitation of biological organisms. There is a growing body of artistic works that are exploring the intelligent systems – applying machine learning and artificial intelligence algorithms to create autonomous and semi-autonomous entities capable of evolution through their learning abilities. These both approaches in biology and technology experiment with matter and ideas concerning life.

Education of artists in the field of art & science involves learning laboratory techniques for maintenance and manipulation of living organisms. One of the typical educational experiments is to grow a green fluorescent glowing *e.coli*-strain on a petri dish. In the experiment a GFP gene from bioluminescent jellyfish *Aequorea victoria* is introduced into the *e.coli*-strain. This results in *e.coli* colonies in a petri dish that glow bright green under a UV light.

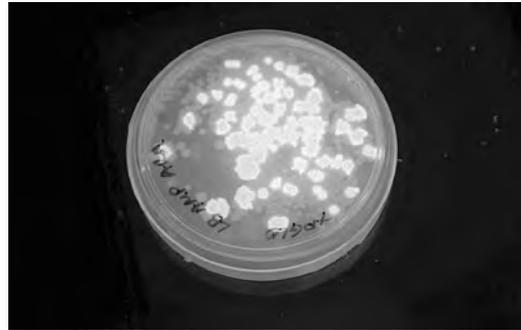


Figure 1: GFP e.coli created in a workshop by Finnish Bioart Society

Artist and biologist Brandon Ballengee has been investigating for years the declines and potential causes of deformities among amphibian populations. His image series *Malamp: Reliquaries* consists of images of deformed frogs found in nature, in which one can see the inner structures of the frogs and their bones. Many of them have several pairs of back-legs that are deformed in different degrees.

Here, we have two examples of biological art: One is a bacteria that has been gene manipulated to glow green and the other is an image of a deformed frog that is found in its natural habitat. One would easily expect that the manipulated bacteria glowing in green fluorescent color would feel more *uncanny* than the deformed frogs that are simply collected from natural environment. However, the bacteria seems to mainly fascinate us in its harmless beauty and existence that is strictly confined to a petri dish, whereas looking at the deformed frogs immediately creates an eerie or *uncanny* feeling in us.

However in the case of artist Guy Ben Ary's experiment with in vitro grown nerve cells that are connected in real-time to a robotic drawing arm in another location - this work without doubt produces an immediate and strong feeling of *uncanny* in us. The work is a hybrid entity made of hardware, software, and wetware that are connected via the Internet. In a similar sense as Harari's previously mentioned example of the technological third hand controlled by a monkey through brainwaves, also this work creates a novel idea for the constellation of a body, in which the brain and the body are distributed to different locations. They seem exemplary cases for Freud's claim that severed limbs,

or a hand that is detached from the arm, or feet that dance by themselves, have something highly *uncanny* about them, especially when they are credited with independent activity (Freud 2003).

My own recent artistic experiments: with cloned Christmas trees that are existing under non-terrestrial microgravity conditions, with fruit flies that are observed by AI agency, and attempts to understand interspecies communication made as clicking sounds by the plant roots – they all are constellations of hybrid ecologies consisting of biological and technological agencies. This kind of hybridity of components also blurs the line of aliveness, as a hybrid entity may be alive in certain aspects even when it seems lifeless to us and vice versa.

Conclusion

These above described exemplary artistic works no longer simulate nor create representations of the world. They deal with the actual *real*. They use living organisms, technology, and earthly conditions as the base for the works, which are presented, investigated, and manipulated in order to create experiences and pose questions to the audience. This kind of art both observes and explores the possibilities of the *uncanny nature* – a nature or reality that used to be familiar but which has been modified in a laboratory, extended with newly designed features, or located in a new context with various agencies and components, which all together form a hybrid ecology.

I would like to propose that, what makes these above-mentioned works *uncanny*, is not solely their potential manipulation by humans but their inherent affiliation with the *real*. They tamper with our expectations of how things used to be. These kinds of experimental artworks present us moments when the boundary between fantasy and reality is broken and we are faced with the reality of something that we have until now considered imaginary.

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Author Biography

Laura Beloff (PhD) is an internationally acclaimed artist and a researcher. Research includes practice-based investigations into a combination of information, technology and organic matter, which is located in the cross section of art, technology and science. Additionally to articles and book-chapters, the outcomes of her artistic research are artworks and projects that deal with the merger of the technological and biological matter and intelligence. The research engages with the field of art–science– technology including areas such as human enhancement, biosemiotics, biological matter, artificial life (AL) and artificial intelligence (AI), robotics, and information technology in connection to art, humans and society. Currently, she is Associate Professor and the Head of PhD-school at IT University in Copenhagen.

Posters

Revealing Network Infrastructure at Geographic Scale Using Location Based Audio

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Abstract

Data centers are a necessary element of contemporary global network infrastructure, but are generally overlooked due to obscurity or more often indifference by the general public. This project aims to elevate the importance of data centers within urban landscapes by providing them with unique sound signatures. To achieve such a goal, a web based application has been developed that takes a user's location and orientation and creates a synthesized three-dimensional audio space based on that user's spatial relation to nearby data centers. This enables a user to passively listen to an audio representation of the combined virtual activity within a given region. Additionally, users can actively seek out individual data centers using their emanations as a navigation tool.

Keywords

Geolocation, Augmented Reality, Infrastructures, Data Center, Sonic Environment, 3D Audio, Mobile Phone, Web Application

Introduction

Network protocols, which enable computer-to-computer communication and thus mediate everything that travels over a digital network, perform silently and are often highly abstracted and simplified when a user receives a notification. Unless an application is specifically for network traffic analysis, it would be inappropriate for a developer or designer to include such traffic as part of its graphical interface. Yet to achieve a solid awareness of digital space and to develop abilities for traversing and modifying hybrid spaces, one cannot remain oblivious to the underlying structures and semaphore of digital communication.

There exist tools for uncovering the particulars of networking traffic, yet are, for the most part, for system administrators and require some preexisting understanding of network jargon to make much sense of a stream of data (e.g. Wireshark, Carnivore Client, Little Snitch). These types of software are indispensable for monitoring and packet analysis. They can provide indirect reminders that routers and data centers are

functioning properly, and can even describe the pathways taken by individual packets via commands like *traceroute*. However, these tools only function when a user explicitly wants to discover network traffic and consequently fail to represent the continuous existence of the infrastructural elements that facilitate such data transfer whether the user considers them or not.

In the domain of auditory displays, most of the previously mentioned tools only provide a minimal amount of sonified information. These types of output are used to assist in monitoring a network and highlight important events such as a network aberration or a remote access request. As such, the sounds are discrete and meant to alert the user of an action that needs to be taken (Walker & Nees, 2011). While successful at conveying that a network event has occurred, the audible components in isolation fail to provide any added understanding or insight regarding the overall networked system or its relationship to outside systems.

Even when successful at depicting the constant flow of data, monitoring software remains primarily within the physical boundaries of screen space. Ignoring the physical nodes and edges supporting our networks presents a detached and incomplete perspective for the user. It is not sufficient to simply provide the positions, addresses, or satellite views of the buildings (data centers) housing this equipment, as it fails to elicit an embodied relationship with infrastructure based on the physical constellation of the collected human and nonhuman actors. In the same way that the stepping points of a network are inert until activated (performed), the experience of the surrounding data centers should also be revealed through the active participation in space with those sites (Thrift, 1997).

By using a portable device, such as a smart phone, to add perceivable characteristics to a data center *entity*, one can sense the presence of data centers and gain a more concrete understanding of their infrastructural

surroundings. Venturing into physical space to encounter data centers lets users achieve experiential and embodied understanding of their relationship to infrastructure. Because sound can so readily fade into and out of our focus, yet remain ever present, it provides the most effective characteristic for a data center to virtually emit.

Implementation

Adding audio characteristics to the data centers is achieved through the use of stereo headphones attached to a smart phone capable of running a web-based application. The web application is the primary method for connecting a user's position (location and heading) to an existing data-base of actual data centers.



Figure 1. The PannerNode object takes multiple parameters. This project specifies a position while leaving the sound cone omnidirectional. Image by Mozilla Contributors is licensed under CC-BY-SA 2.5

Location

When a user connects to the application, the server queries an up-to-date repository of publicly listed data centers throughout the world, checking against a database stored on the web app's server for any changes in data center locations. To reduce latency for the end user, the server returns a JSON object with a subset of centers filtered based on the user's location. In order to provide a user's position, the user must grant the application permission to access her device's GPS and orientation sensors. Once the locations of both the user and the data centers have been retrieved, the client side of the application can initialize the audio.

Audio

All audio is generated and controlled using the JavaScript Web Audio API which allows web-based applications to take advantage of much more sophisticated control over audio without the use of plugins.

Following the location data retrieval, an audio context is initialized and the position of the user, a vector containing latitude and longitude coordinates, is assigned to the main *AudioListener* object. Additionally, data collected from device orientation sensors is processed

to produce a compass heading ranging from 0 to 360 degrees and assigned to the *AudioListener* orientation. Both of these values are updated whenever new sensor data is made available.

For each data center, a *PannerNode* is created based on its respective global coordinates. The directionality of sound moving away from the node is controlled by the shape of a sound cone (Figure 2), however in this project all nodes are set to be omnidirectional. The node on its own does not emit any audio, therefore once a node is created it will immediately be assigned a unique sound.

With both an *AudioListener* and at least one *PannerNode* created, any audio produced by a node will be filtered and attenuated based on the orientation of the listener and the distance model of the respective node. The *PannerNodes* will remain fixed, while all changes in audio are determined by the listener's change of position and orientation. As the user moves through a region, whether by train, car, or on foot, the levels and positions of the audio will shift and change, creating unique mixes of the various centers within that region.

The head-related transfer function (HRTF) used by the Web Audio API to provide accurate spatial discrimination for the user, using impulse responses from human subjects (Adenot & Toy, 2016), did not create a significant enough difference between sounds located directly in front of a user and sounds located directly behind a user. In systems where small changes in position provide clear indications regarding the distance of a user to a sound object, the problem of inverted direction can be detected and corrected quickly by the user (Carlile, 2011, p. 54). However, when the amplitude falloff of a sound may only become noticeable after hundreds of meters of movement, as in this system, clarity of a sound object's spatial position will be the primary source of information used in navigation. Because of this, further processing of the sound based on the orientation is necessary to prevent misunderstandings and frustration for the system's users.

The decision to have such parameter mapping, to represent extremely slow and gradual auditory feedback for users of the system, is reflective of the geographic size of the region exposed by the auditory display. Given such a slow feedback loop, and provided that the collective data center soundscape maintains an amount of interest, the full sonic capacity of an individual data center can slowly emerge. A visual

analog to this experience might be driving toward a benign looking mountain, far along the horizon, and gradually realizing its imposing stature as you move ever closer. Rather than downplay the importance and presence which data centers hold in our lives by using a more immediate audio perception action-loop, their importance is magnified through the energy we must expend in order to significantly modify the sonification model. This highlights the affective nature of spatialized sound by combining the auditory qualities of the sound sources (see below) and the performative nature of such a labor-intensive perception-action loop. However, it is also possible that because the interaction design of this system goes against the transparency between action and effect which characterize most successful sonic interaction designs, that participants may become frustrated or disinterested by lack of immediate feedback (Serafin et al., 2011).

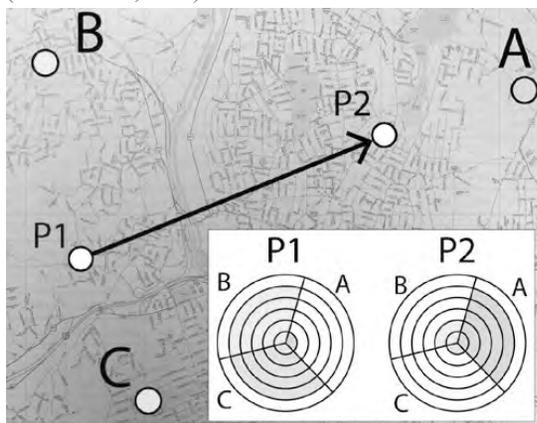


Figure 2. A representation of the change in sound influence of data centers A, B, and C as a listener moves from point P1 to P2. Each center's color gradient shows the size of its sound influence based on a user's distance from that center. The diagrams show approximate loudness of each center for each point

Sound

The sounds attached to each *PannerNode* are created from modified audio samples with adjustments to the buffer speeds of the samples based on the relationship of the listener to the data center and other listeners. Historically, there have been many examples of communication devices being used as tools for extracting sounds, either incidental to the device or indicative of the network's medium. From Thomas

Watson listening to natural radio through a telephone wire to works by Paul DeMarinis, e.g. *Rome to Tripoli* (2006), these examples both channel and examine the natural energy of electromagnetism that saturates our atmosphere (Kahn, 2013). With the current dominance of digital communication protocols adding a layer of separation from the analog, it becomes necessary to also explore the underlying components that drive digital communication. Therefore, the methods for generating sounds which intend to explore the energetic activity of contemporary networks, in the same vein as the above examples, should similarly embrace the systems, protocols, and physical components which underpin them. Because the focus of this project is to consider the spatial relationships of physical bodies and structures, the sounds draw from the hard-ware and mechanical qualities of the network rather than exploring the higher-level messaging protocols or soft-ware.

Several years ago, I was given the opportunity to visit two separate data centers on the campus of a university. I was fascinated at the contradicting nature of the space. The visual stillness of the racks of servers, the neatly strung cables, and the uniform fluorescent lighting was immediately overshadowed by the filtered noise of the arrays of fans simultaneously pumping air through the machines. It brought to mind the dichotomy of the static and solid external appearance of the computer against the inner chaos of the CPU, GPU, and hard drive produce billions of operations per second. This relationship of an unremarkable exterior belying chaotic internal activity informed the process of creation for the sounds in this project.

Each sound begins as a simple audible waveform, with a relatively low frequency, recorded into a buffer. The speed of the sample is then multiplied by a factor to bring the frequency of the waveform far above the range of human hearing (20-20,000Hz) and into the same frequency spectrum of computer hardware operation speeds (MHz, GHz). These goal frequencies are determined by various mile-stones within the history of computing systems, for example the original IBM PC had a clock speed of 4.77MHz. The radical shift in frequency, coupled with the degradation of the sample inherent in the process of modifying the sound, results in a drone of subharmonics both chaotic and stable.

Rather than sonifying the user's position and orientation information solely from the perspective of communication efficiency, using beacon chimes

or spoken descriptions of the occurrences at each location, the sonic nature of the overall soundscape depicts the continuous activity of a large network ecosystem. This presents problems regarding audio stream segregation when many different data centers are emitting audio in close range to one another. Though spatialization is usually aids in the process of separating sounds (Neuhoff, 2013), the complex and continuous nature of the sounds require further assistance with differentiation of each audio stream. A solution is found in the bioacoustics of rainforests, where the large numbers of vocalizing animals create a highly-crowded frequency spectrum. Rainforest species have adapted to occupy “niche” frequency bands within the overall audio spectrum, which allows them to communicate with others of the same species within their own audio territories (Krause, 2011). Just as different species of animals within a rainforest differentiate their sounds using their own species-specific frequency bands, the different datacenters of a metropolitan region can each inhabit their own bands within the frequency spectrum. Combining virtual sound spatialization with bioacoustics inspired frequency differentiation will aid users in pinpointing each unique sound source while not detracting from the overall auditory scene.

Conclusion

By creating a system that enables data centers to emit virtual sounds across large distances, I hope to allow users to consider the constant presence that these complex entities maintain on all aspects of global networked communication. Additionally, this system provides a very specific implementation of a more generalized system for creating audio based augmented realities. More possibilities exist for local, regional, continental, and worldwide installations using this system. I intend to further explore these variations in scale as well as new contexts that, with the help of this technique, can gain additional meaning.

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Media Art in the Ibero-American Context ISEA2017

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Abstract

Any historiographic effort on Media Art shows the complexity of its own conceptualization regarding those artistic practices that it involves, since there is not unanimity between experts and researchers about this topic as it is shown in the media art history meetings (<http://www.mediaarthistory.org/>). Neither a consensual taxonomy in these artistic practices. However, one of the most relevant is the taxonomy completed by Professor José Ramón Alcalá, MIDE's director and a ground-breaking in the subject of electrographic art in Spain. Taking his taxonomy as a reference, we can resolve that Video art and Electrographic Art, both started in the 60's but developed in the 70's and 80's, were some of the artistic practices that brought the first ideas of Media Art in Spain and Latin America. Regarding to Video art, some of the pioneer artists and researchers were Eugeni Bonet, Joaquín Dols, Antoni Mercader and Antoni Muntadas, as can be seen in the historic book *En torno al video*. With respect to Electrographic Art, some of the pioneers were Paulo Bruscky, Clemente Padín, Humberto Jardón and José Ramón Alcalá with the International Museum of Electrographic Artworks (MIDE) in Cuenca, the most important example adding the collection of this unique museum.

Keywords

Media Art, Media Art Histories, Video Art, Electrographic Art, Ibero-American, MIDE.

Introduction

The *Media Art History* construction, is an essential work of our present time, which is defined to a great extent for the creative processes in which new media is nuclear.

To deal with this research, we should establish a taxonomy that restricts it and, at the same time, limits the research field. In this way, we are starting from the taxonomy carried out by José Ramón Alcalá Mellado, https://www.academia.edu/15188485/New_Media_Art_taxonomy- as a result of 25 years of experience as researcher, artist and MIDE (International Museum of Electrography) director. This taxonomy became a reality through the course of the National Research

Project: "Creation and Studies of the CAAC (Collection and Archives of Contemporary Art) of Cuenca as a methodological model aimed to an excellence research in Fine Arts (HAR2013-48604-C2-1-P), a project in which this poster's authors have been an active part. So what it is going to be explain in this poster is the result of some of those investigations which were develop by both authors.

The research carried out in the stated project has allowed to deepen in this taxonomy to narrate the beginnings of the Media Art in the Ibero-American context. Starting from this reference, two were the main experiences that marked the beginning of the Media Art besides to the computer: the Video art and the artistic practices with the photocopier

Video Art in Spain & Latinamerica

The beginnings of Video art in Spain were established by the artistic and research efforts made by those who are considered the parents in this country: Eugeni Bonet, Joaquim Dols, Antoni Mercader and Antoni Muntadas. The experimentation, research and discussions maintained between these four artists and researchers, were collected in the emblematic book titled *Around the video*, published in 1980. Thirty-five years later, a group of young Spanish video artists of reference met to interview them and develop their own history of video creation in Spain, whose result was the text *About Around the video*.

Both texts make up the history of video art from its beginnings to our contemporary times. The history of Spanish video was collected as a visual narration in the documentary titled *Course Video [Devenir video (Adiós a todo esto)]*. 2004-2005 (<http://www.hamacaonline.net/obra.php?mode=29>) by Gabriel Villota, one of the leading artists of the second mentioned text.

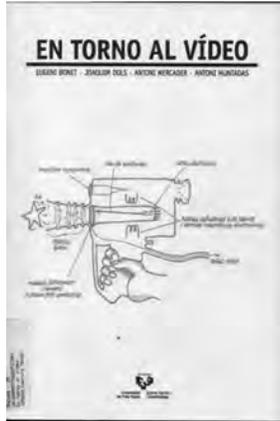


Figure 1. Around to the video, the book that marks the beginning of video art in Spain



Figure 2. About around the video, book edited 30 years after the first book considered starter of video art in Spain by the new generation of Spanish video artists

But if we focus in the main texts on Video art in Latin America, the main book is titled *Videoarte en Latinoamérica. Una historia crítica*, by Laura Baigorri. And as a reference video artist contemporaneous with the Spanish video artists previously mentioned, we must underline the name of the Mexican artist Pola Weiss.

The Photocopy Machine's Role in the Media Art

Although digital technologies settled in the 80s, the adoption of the automatic machine of graphic multi-reproduction –photocopy machine- as an artistic tool, meant some needs which reflected the artistic, social,

political and economic changes that were taking place. However, those resultant artistic practices have remained in a discredited place, developing their own access modes into the culture, through the management of spaces, exhibitions, workshops, and even collections such as the MIDE of Cuenca, by professor and artist José Ramón Alcalá. He was a definite driving force, along with his artistic partner Fernando Ñ.Canales, for the artistic development of the electrography in Spain, with the contributions by Marisa González, Jesús Pastor, Paco Rangel or Rubén Tortosa, among others; and for the compilation of international artworks.

Latin America Media Archaeology

One of the most significant geographical contexts with respect to these artistic practices was the Latin American ones, of which MIDE treasures artworks as a witness to it. Although having a tremendously activist character due to the political position of some countries, the Latin American Copy Art emerged having this technology as a muse, a medium and a creative objective. With a significant propagandist root, it sought to experiment through a creative process turned into an artistic artwork in its procedural sense and to break with traditional concepts, such as original, copy, unique and multiple.

One of the most productive centers was Brazil, with artists such as Paulo Bruscky, who was associated with performance practices on the machine and with the experimentation with video technology creating the *xerofilmes*, with humorous tone to survive political repression. And Luis Guimarães with his monochromatic tendency artworks that explore the degeneration technique and reflect on the temporality. Guimarães was a great cultural promoter because he organized the “1º *Studio Internacional de Electrografía de São Paulo*” within the “XX *Bienal Internacional de Arte*” (1989), inviting international artists.

Also Mexican artists, such as Félix Beltran and Humberto Jardón, investigated the alternative use of photocopiers, faxes, video and computers. Jardón organized “*Encuentro Otras Gráficas*” (1993) and coordinated the electrography section with Victor Lerma. As a result, they produced the *Arquetipo* artistic folder, as a continuation of the *Mimesis* proposal (1991), to legitimize artistic production with this technology. Other relevant artists were Santiago Rebolledo, Mónica P. Mayer, Fernando García, Magali Lara, and Marcos Gabriel.

Artworks by other artists who used the photocopy machine but remained more related to Mail Art were relevant too, as Uruguayan Clemente Padín and Argentines León Ferrari and Silvio de Gracia in reaction to authoritarian regimes. Some as a means of reproduction and others with an experimental approach linked to the development of different techniques and procedures.



Figure 3. Clemente Padín. *Autorretrato I*. 1987. Monochromatic xerography. MIDE Collection



Figure 4. Humberto Jardón. *Sin Título*. 1982. Chromatic xerography. MIDE Collection

Conclusions

This poster is a theoretical and visual approach to some historical artistic practices of the Media Art and those who marked its beginning in Latin America. Likewise, it pretends to witness the role played by MIDE in the development of Media Art.

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Beatriz Escribano Belmar. Bachelor of Fine Arts (2011) with a Research Master in Visual and Multimedia Arts (2012), she is FPI Research fellowship at the UCLM by the JCCM. She collaborated in the *Archive of Digital Art, ADA* (Danube University, Austria) and worked in the Musei Civici in Venice. Her last publication is *Processes: The Artist and The Machine. Reflections on the historical Media Art* (2016)

Data HarVest: Physical and Digital Data Collection for Citizen Science

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Abstract

“Field Computing”, is an ongoing interdisciplinary research project to design and build wearable devices for use in citizen science applications. The works from this project is derived from the fields of wearable electronics, citizen science and environmental biomonitoring through a critical design perspective. *Data Har-Vest*, one of the works in this series, is a wearable tool that collects physical artifacts and contextual data about fungi for scientific surveys. An early prototype for this tool is discussed along with design considerations.

Keywords

Wearable Electronics, Citizen Science, Critical Design, Environmental Biomonitoring, Outdoor, Human-Computer Interaction, Textiles

Introduction

This research focuses on an interdisciplinary investigation across the fields of wearable electronics, citizen science and environmental biomonitoring. By utilizing a critical design approach, the tools and technology that come out of this project will provoke dialogue surrounding how we currently engage with the environment and what potentials interactions we could have, especially as non-scientists working in data collection for citizen science. This idea of citizen science is especially provoking in the context of critical design because it allows us to speculate how non-scientists and “non-experts” can contribute to scientific study (Kuznetsov, 2013).

In utilizing wearable electronics, this work builds upon previous research in how computing technology can be embedded into fabrics and garments by utilizing traditional textile techniques (Hartman, 2016; Kobakant, 2009; Orth, 2007). Technologies and designs that have been previously developed for environmental biomonitoring and citizen science work are also incorporated into these projects (Kuznetsov, 2010; Paxton, 2009; Pierce, 2012; Tse, 2016).

One of these projects, *Data HarVest*, a wearable device

designed for data collection for mushroom specimen, will be detailed in this poster. This work researches and creates digital interactions and technologies that can be used to explore, facilitate and intervene in relationships between human users, non-human users (which include plants, animals and other organisms) and their environments.

With “Field Computing”, a critical design practice is leveraged to build wearable devices that draw attention outside of the user’s body and actions to connect them to how they interact with the environment around them. As environmental concerns are growing every day, these devices can play a critical role in sensing the changes around us to solve these problems.

Data HarVest

The current project in development for “Field Computing” is *Data HarVest*, a wearable device that can be used to collect physical artifacts and digital data from the environment. Specifically in this iteration, this device is focused on collecting information regarding fungi samples during a foray (See Figure 1). A foray is an informal scientific survey which can be conducted by amateurs or scientists in which a species, in this case mushrooms, are collected and catalogued (Lincoff, 1981).

Mushrooms, the fruiting bodies of fungi, are the targeted specimen for this iteration of this device due to their sensitivities to the environment. Depending on varying temperature and moisture conditions, mycelium, the vegetative part of a fungus that resides underground will grow and develop to produce the spore-releasing mushrooms above ground (Lincoff, 1981). Mycelia also absorb nutrients through their environments, in such that they can be used as a marker to track and reflect upon the overall health of the local climate (Money, 2011).

Figure 1. Fungi samples collected from a mushroom foray with the



Western Pennsylvania Mushroom Club

Through measuring and recording the conditions that various mushrooms are found in during a particular foray, the information can be used to help understand not just the various conditions for particular fungal growth, but also how an environment may change over time. Although this project is currently focused on mycology, there is potential for this device to be used in various other fields of research for data collection.

Using design research methods, conversations and interviews with members of the Western Pennsylvania Mushroom Club, were conducted to gain insights to the necessary design and technology functions this device would require. Since the device is designed to support the foray through a wearable intervention modeled after vests used in fly-fishing, a garment that can hold multiple tools and gears for this sport. *Data HarVest* is a wearable device that needs to be able to store specimen, along with hardware components for data collection and function outdoor environments, design references from fly-fishing vests serve as a useful and informative guideline (See Figure 2).



Figure 2. Sample of fly fishing vests used in consideration for design of *Data HarVest*. From top-left clockwise: Char Bloom Vest, Allen Gallatin Ultra Light Fishing vest, Filson Fly Fishing Guide Vest, Filson Foul Weather Fly Fishing Vest



Figure 3. Soil sensor glove prototype that is used to detect moisture levels of the ground

In addition to helping citizen scientists collect specimens, *Data HarVest* supports logging of contextual information during the foray. Wearable sensor inputs includes GPS, temperature, soil moisture and voice recordings. Considerations are being made into the placements of these sensors on the user's body from a design and technical perspective (See Figure 3). By collecting a combination of physical artifacts and contextual digital data, this device allows its users to create a synoptic view of their environment.

Data HarVest will be refined and deployed within the context of local forays for mushroom exploration. The concept will be used to engender and study conversations with experts and non-experts on the role of wearability and technology in field work. Iterations will be made according to the usability and needs of these users out in the field. In addition, this device could potentially be used to collect, study and survey a large range of specimen in various contexts.

Conclusion

“Field Computing” is an ongoing series of interdisciplinary work that speculates upon the tools and devices necessary to compute and sense to aid citizen scientists in the wild. *Data HarVest* is one of the projects in the series based on this concept that explores the relationship between the body and the surroundings using wearable devices. Along with researching new methods of physical and wearable computing possibilities, future iterations and work will continue to take on a critical perspective of how technology and tools can be used in field research by citizen scientists to monitor the natural environment.

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Author Biography

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La Última Alúa. Exploration of the Constituent Elements of *MOTION COMIC* in the Development of an Audiovisual Product

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Abstract

In this work an audiovisual product was generated through the exploration of a new narrative tendency called motion comic, which combines codes of two consolidated languages: comic and cartoon.

Keywords

Motion comic, animation, comic, languages, adaptation, narrative.

Introduction

Narrative as a fundamental element of our lives proposes new expressive ways to tell different stories while presenting a technological provision that allows better media betting from the new media (Scolari, 2004). Within these possibilities, we should highlight the facilities and the economy that the *motion comic*¹ offers.

Through this theoretical-practical work was developed the first chapter of an audiovisual piece of entertainment with the characteristics of *motion comic*, adapting the story “Las últimas alúas de la noche”

The above mentioned conceptually supported, in the characterization of motion comic from the analysis of examples by means of a matrix that arises from the differences in the representation of the cartoon and the comic: 1) movement representation, analog in the cartoon and digital in the comic, with kinetic signs; 2) sound representation, analog in the cartoon with the presence of soundtrack (Sáenz, 2008) and digital in the comic, with text balloons and onomatopoeias (Gubern, 1992); and 3) the montage minimum unit, which in the cartoon is the shot, constructing scenes and sequences (Deleuze, 1994), while in the comic is the panel (Barbieri, 1993).

¹ It is not easy to define motion comic. To date and with the exception of this document, there are no academic papers that attempt to elucidate their codes of representation. Julio César Rodríguez (2012) says that it is a kind of audiovisual story in which the images produced by a particular comic book are animated in a simple way. Definition ends up being too short because many motion comics are not based on pre-existing comics.

The result of this analysis is a spectrum of possibilities (table 1) under the three axes mentioned, where the motion comic can approach or move away from any of its two referents or take a balanced position as to the resources that each from them.

Motion Comic Development

According to the conclusions of the analysis, it was decided to make the motion comic titled: “La última alúa”, achieving a balance between the language of the comic and the cartoon, in the three axes proposed in the spectrum of the motion comic, and evidenced below.

Movement representation a) Cutout animation was used at very specific times and enough so that the action can be understood. There is no complete animation (Figure 1).

b) Kinetic signs are included as graphic forms of reference to the comic.

c) The camera movements are present without much complexity, because what is sought is the composition of space in comic’s panels.

The movement in this production is performed by overlapping layers 2d, animated independently.

Sound representation a) Voices were not included, therefore the presence of speech balloons (for the locations of the personages) and captions (voices off) is necessary and practical. The above rescues that aspect of personal reading of the printed comic.

b) Noises were included (steps, blows) to contextualize. However, the onomatopoeia present as part of the visual repertoire of the comic present as a visual resource (Figure 2).

d) Incidental music is included as an expressive resource

Montage minimum unit “La última alúa”, as audiovisual product, must contain all the conventions of the shot, the

scenes, transitions, etc. Nevertheless the panel appears like a unit of assembly in each plane granting a reference to the comic and an interesting dynamic from the point of view of the visual thing (Figure 3). Thus, an approach or zoom,mwill be replaced, for example, by the inclusion of a detail panel.

codes	Lan-guag-es01	Spectrum of motion comic			lan-guag-es02	codes
Movement		They represent the movement with kinetic signs. No character animation.	There is little animation of the characters. Features cameramovements.	There is complex animation. They present camera movements.		Movement
Sound	comic	It lacks voices and noises. It presents balloons with parliaments and onomatopoeias. It features music.	It includes music, noises and voices, but also balloons with the locutions.	It includes music, noises and voices. The onomatopoeia and the balloons disappear.	Cartoon	Sound
Montage Unit		It presents panels that are configured in the field.	The plane has divisions in the form of vignettes, overlapping and configuring between them.	The vignette disappears completely in favor of the conventional plane without segmentation.		Montage Unit

Table 1. Proposal for the characterization of motion comic in relation to the inclusion of codes of two established languages: comic and cartoon. Source: prepared by the author.



Figure 1. One character drags another from one end to the other. The picture is the same © La última alúa



Figure 2. In this photograph there is an expressive onomatopoeia and a text balloon with the speech of a character. © La última alúa.



Figure 3. In this photograph there is a central panel in which two overlapping panels referring to the comic's language. © La última alúa.

Conclusions

This project involved detecting the characteristics of motion comic from the differences between the two languages it feeds: comic and cartoon, and its use in adapting a literary narrative to the audiovisual language.

The analysis of motion comic referents, based on differences between comic and cartoon, proves that due to the heterogeneity of these pieces, a spectrum is created

within each of the axes (representation of movement, representation of the sound, Minimum assembly unit), where each specimen that was analyzed approaches or distances from each of its references (Comic / cartoon).

On the other hand, the new technologies open a range of technical and narrative possibilities that invite the user to produce. Within this phenomenon there are possibilities such as motion comics, many of which are created by a

motivation or personal concern for free distribution on the web.

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Author Biography

He was born on October 21, 1987 in Palmira, Valle del Cauca. From a young age he was lover of comics, animation and illustration. He studied at the Universidad del Valle obtaining the title of graphic designer.

He is currently Professor of Graphic Production of the Autonomous University Corporation of Nariño (Aunar), member of the *Visualize* research group, and of the organizing committee of the annual event *Contrapunto, festival de la producción gráfica* and *La semana del diseño* of this university. Its main objective is the formation of research seedlings in the fields of Enlightenment and graphic storytelling.

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http://scienti.colciencias.gov.co:8081/cvlac/visualizador/generarCurriculoCv.do?cod_rh=0001619736#datos_generales

ALGORICENE Genealogy, Ontology, Aesthetics and Politics of Algorithmic Life, from the Ancient World to Big Data

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Abstract

Algoricene is a concept and subproject of the Metabody project. This project proposes to explore, both through theoretical research and through artistic creation, the impact, history, ontology, aesthetics and politics of algorithmic modes of organization that may be traced already in old cultural formations such as grided urban plans in Mesopotamia and ancient Greece, or perspectival vision in the Renaissance, and which currently undergo an explosion in the context of Big Data systems.

Keywords

Big Data, Anthropocene, Capitalocene, Chthulucene, Singularity.

From the Anthropocene to the Algoricene

Though algorithms are usually considered a recent offspring of computation culture they may be in fact a very ancient form of distributed intelligence that both exceeds and conforms the very human cultures from which it seems to stem. Algorithm traces may be found in modes of organization as varied as grid like urban plans in ancient Greece, and the birth of rationalized vision in the Renaissance.

However, we are currently assisting a process in which algorithmic autonomous decisions shape more and more the world we live in. At same time the very nature of algorithms may be changing. Hyperalgorithms is a term proposed to name the new threshold of algorithmic life in the big data era: hyperconnected, emergent, all-encompassing algorithms.

If ever since the emergence of gridlike algorithmic environments the human has been evolving along such algorithmic organizations in a technogenetic spiral, now more than ever humans are becoming the entangled in algorithmically shaped worlds of increasing complexity. Arguably we are assisting the birth new algorithmic life form, as well as the further evolution of an older one.

This project will elaborate on different aspects of the genealogy, ontology, aesthetics and politics of this not so recent but changing life form that has such a crucial

significance for our planet, in trying to grasp some its longstanding challenges to our understanding of the world, some of its present evolutions, while venturing and speculating about its unforeseeable futures.

Last but not least, are we assisting a new geological area, an Algoricene? The notion of anthropocene has already been questioned by theorists like Andreas Malm, Jason Moore and Donna Haraway, who propose that the current processes affecting the planet are not caused strictly by humans but by capital, by the processes related to the accumulation of wealth. Haraway goes further by proposing that neither Capitalocene nor Anthropocene offer a complex enough narrative and offers the term Chthulucene that seeks recourse to old and present narratives of earthly powers of creation and destruction that are both smaller and larger than the totalizing tragic narratives of the Anthropos and of Capital.

We propose yet another trope for understanding the current processes of earthly creation and destruction, looking at some ontological aspects of the processes at stake, where underlying capital there may be a deeply rooted processes of pattern-making that allows quantification, this would point to the historical emergence of pattern or form, algorithm being a movement pattern historically linked to the quantification of sensibility. The Morphocene or Algoricene would point to this ontological substrate of the process of alignment and capture going on in the planet over millenia, while placing form in a historically contingent crossroads within a much larger Amorphocene, of processes not aligned with algorithmic patternmaking, rationalisation and quantification (for instance bacterial perceptions and ecosystems).

Algoricene points to a crucial aspect of contemporary Big Data Culture in which old descriptions of algorithms as “a finite set of unambiguous instructions performed in a prescribed sequence to achieve a goal.” become obsolete as algorithms become hyperconnected,

emergent, all-encompassing, while automated algorithmic decisions affect more and more the planet. Algoricene speaks of this tendency to an algorithmically driven world, that eventually points beyond Capital.

Algoricene is thus a term proposed to define the current geological era in which not a priori humans but algorithmic automated systems are shaping more and more life and inorganic matter on the planet, an era whose genealogy may be traced across several millennia. The project thus proposes to explore the past, present and future impact of such systems at a planetary scale and their projection beyond the planet.

The project will put an emphasis on critical investigation, both in the field of theory and of artistic production, foregrounding proposals that facilitate a critical engagement and empowerment, thus inviting a plural and participative engagement with the numerous challenges raised by algorithmic systems. Are algorithmic modes of organization reductive vs. the more complex modalities of movement that constitute the world? If so what are the consequences of this reduction and how is it possible to counteract it?

The project proposes a highly transdisciplinary field in which philosophy, cultural studies and other theoretical disciplines meet all the arts, technosciences and society at large, with particular attention to social minorities, in a critical engagement bridging continuously across theoretical production and crossdisciplinary artistic creation of projects that respond in experimental ways to the challenges that algorithmic and Big Data systems pose to humans, other species and the environment.

The project proposes a novel and unconventional approach to algorithmic systems by attempting to understand the material and embodied nature of the infrastructures and processes that sustain them, thereby also inviting artistic creations that deal with the body, temporality and public space in relation to digital systems in novel ways, foregrounding approaches that allow an empowerment of all kinds of citizens in dealing with algorithmic and Big Data systems.

The project will involve artists working across dance, visual arts, music, architecture, performance and new media, technoscientists, philosophers, cultural theorists and citizens and people of all kinds, with particular attention to social minorities including people with disabilities and people living in nomadic and precarious situations such as refugees, amongst others as well as indigenous people. The project will address

the impact of algorithmic systems in society at large and for all kinds of people as well as for the environment, while giving special attention to social minorities so as to afford a plural framework.

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DIY Awareness of Ozone in Urban Desert Climates

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Abstract

The purpose of this work was to explore a potential low-tech DIY means of members of a community to track and mitigate the impact of pollution in their daily lives. For this project, we chose to focus on the presence of ozone in an industrial area located within a desert climate. We then describe a preliminary test in which volunteer participants from the community place pieces of ozone reactive material (copper) outside their residences in order to determine if the pieces would successfully oxidize over a relatively short period of time. We conclude with a discussion of where this technique may be helpful, as well as possibilities for future concerns and interests.

Keywords

Pollution, Air-quality, DIY, Analog-Recording, Air-Filtration, Ozone, Oxidation, Copper

Introduction

Industrialization and urbanization have increasingly brought large groups of people into close contact with the potentially dangerous byproducts of manufacturing and metropolitan pollution. Because of this, we feel it is important to empower individuals to detect pollutants in ways that don't require access to specialized or costly technology, such as electronic pollution detectors or air readers. By focusing on the use of low-cost, DIY methods of detecting and mitigating pollution, we hope to find more accessible means for larger amounts of people to gain evidence of and possibly mitigate the existence of pollutants.

Background and Related Work

We specifically focused our research on the Phoenix Metropolitan Area, a dry desert climate that is currently ranked 12th in worst quality in the United States [1]. Like many large population centers, Phoenix is set in a flat valley surrounded by more rugged geography. Because of this, air and air pollution can become trapped over the metro area.

Ozone

Ozone, the most widespread air pollutant, is created when sunlight interacts with car exhaust and other emissions [1]. Ground level ozone is largely formed from photochemical reactions between volatile organic compounds and nitrogen oxides, both of which are largely formed by industrial activity. Because ozone is not water-soluble, the respiratory tract has a hard time filtering it out of inhaled air. Once deep inside the lungs, ozone starts to oxidize organic tissue, causing damage to the lung tissue and blood vessels [5].

Designing for Community Involvement

A common theme when trying to encourage community involvement is the need to present information in ways that the user finds easily accessible [2]. Often, this takes the form of using physical or analog objects, which the user can interact with in a way that they cannot with a completely digital item [2, 3].

In hopes of creating a detector that could accurately record the presence of ozone, we wanted to find accessible materials that could visually show its presence.

For our experiment, we chose to use copper foil as the oxidized agent [6]. When copper is oxidized, it absorbs a single oxygen atom, turning the ozone (O₃) molecule into an oxygen (O₂) molecule. Pure copper, which is a shining orange-bronze color, will darken to black-brown, and then turn a pale green when completely oxidized [4].



Other particles, such as water, which has some mix of unattached oxygen and hydrogen atoms in it, can also act as oxidizing agents. However, given the low amount of humidity and precipitation in Phoenix, the vast majority of oxidation that will occur will be the result of the city's oversupply of ozone [6, 7].

Study

In order to ascertain the effectiveness of copper as an oxidizing material, we gave sample pieces to 6 individuals living within the southeastern part of Phoenix with instructions for them to leave the pieces outside during a period of several months. Ideally, the copper would show the result of oxidation within the period of a few months without suffering any structural damage.

Design

In order to have the pieces of copper have as much surface area as possible (and as such have a greater area exposed for oxidation), we used copper foil, which was then cut to increase its surface area even more cord (fig. 1). The cut foil was then lightly folded and attached to a piece of cord so that it could be easily hung outside during the study.

We gave the pieces out to five people living within south-west Phoenix and instructed the participants to leave the pieces outside in a shaded area from mid-May to mid-August, when ozone levels would be at their highest due to the elevated temperature of the surrounding area [5]. Although rain is uncommon in this climate during the summer months, we requested that the users hang the pieces under an awning or porch roof in order to insure that there would be no direct contact with any precipitation.



Figure 1. left: An example of the cut and folded copper foil before being placed outdoors; center: example location of where the pieces were located outside; right: The copper pieces after being placed outside for several months.

Results

All of the pieces left outside show clearly show the results of oxidation. After the three months, the bright, shiny orange of the copper foil has turned to variations of dull dark brown, without causing any notable damage to the structural integrity of the copper foil (fig. 1). Due to the rate of oxidation over this three-month trial period, it is possible to assume that the copper foil would be able to absorb and display the presence of ozone for 1-3 years before it is completely oxidized [4].

After the three months outside, the copper pieces were not drastically different from each other in terms of how much they oxidized. This is likely due to the fact that all the participants hung their test pieces in residential areas within the southeastern section of the Phoenix-metropolitan area. While the similarity in oxidation could be a result of air pollutants dispersing relatively evenly over several neighborhoods, we would be interested to do further tests to compare the results from areas near highways, industrial centers, and residential areas in different parts of the city. It would also be interesting to see how these results compare to the speed of oxidation in other similarly polluted cities with differing climates.

Conclusion

In order to help insure health and longevity, we need to remain aware of the pollution around us. In this research, we chose to specifically target ozone by using copper foil, since it can be used to create lightweight models that offer plenty of surface area for ozone to oxidize while still maintaining a physical structure. These pieces provide a visual example of the presence of ozone while simultaneously helping to neutralize the potential health threat. Our initial experiments have shown that the resulting oxidation is visible after only a few months and can show distinctions in the amount of ozone present in an urban, desert environment.

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Using Animated Vectors to Generate 3D Models from 2D Shapes

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Abstract

The focus of this research is to explore an alternative means of computer animation by allowing two dimensional vector models to be viewed with directional variations. By doing this, the animated model is composed of 2D shapes but can be viewed from multiple angles like a 3D object without having the structural limitations and complex rendering of a 3D mesh.

Keywords

Animation, Vector Graphics, 3D Modeling, Processing

Introduction

Computers have created options for vastly different types of animation by allowing for control and complexity that is virtually impossible to create using only hand drawing. However, despite the diversity of animation that is being created, most of this can be traced back to using series of 2D images or animating 3D models. This project is centered on creating models based on 2D vectors that, despite being composed of flat shapes, can be viewed and animated in three dimensions. To do this, algorithms are used to manipulate the shape of the 2D vectors based on what direction they are viewed from.

3D Animation and Rigging Systems

3D animation is composed by creating a character model with a poseable rigging system. The 3D model is most often constructed from several 2D source images, and have a rigging system to allow the model to be move [5]. For example, a human model would have tools to move or rotate all major joints, so that the model could be animated in a way that mimics how humans actually move [1]. After the rig is created, the actual animation is done by moving the joints of the rig to different positions within the timeline of the animation [4].

2D Computer Animation

While 2D animation still largely focuses on drawing individual frames to depict continuous movement, there is currently an additional focus on using computers to combine and manipulate raster images into smooth animation [2, 3]. In some cases, 2D animation movement is accomplished by deforming raster images in order to make them appear that they are moving [7]. In contrast, it is also possible to create 2D animation based on manipulating vector shapes, which can change shape without distorting or loosing details the way a raster image will [6].

Development

This demo was created using Processing, a programming platform that is focused on having visual output and includes many tools to allow for user interaction. During development, several different versions of the program were created to test different parts of the system, including the means of animating the models using pins, the mechanics of 3D rotation and viewing, creating models that are flexible while still holding a recognizable shape, and a version that combines all of these features into a functional prototype (fig. 1).

Animating with Vector Shapes

In this demo, each part of the model is based on simplistic vector shapes. Each point in the vector has a corresponding xy coordinate that can be algorithmically changed based on the angle the model is being viewed from (fig. 1, fig. 2). Because the models are composed of these individually animateable points, they can have flexibility based on the direction they are viewed that is not present in 3D meshes (fig. 2). In addition to being able to rotate the model, I developed a rig structure composed

of pins that could be used to separately animate specific points on the model in a similar matter to current 3D animation techniques (fig. 3). When these capabilities are combined, they result in a complete model of the figure that can be posed using the rigging system and be viewed from multiple angles (fig. 1).



Figure 1. Example of posed 2D rig when rotated to be viewed from different angles

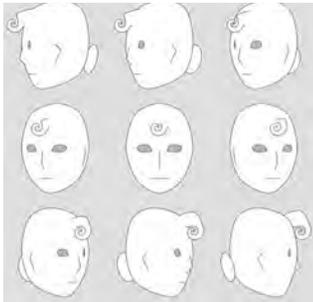


Figure 2. Example of head model being rotated to different angles. Because the model is not based on 3D geometry, it is possible to have parts of it (in this case, the hair) deform depending on the direction it is viewed from

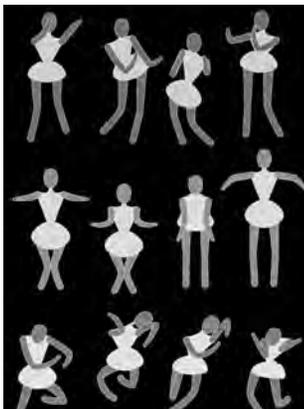


Figure 3. Example frames from some of the earlier animation tests. In order to test the robustness of the character rigs, we attempted a variety of animations, including randomized movements in order to insure that the model would still maintain a recognizable shape

Rigging with Two Dimensional Models

Using two dimensional perspectives to animate the model does limit how much the animator can do without rotating the model. For example, if the figure is facing the animator, the animator would be able to move points on the model along the x axis (side to side) or the y axis (up and down) but not the z axis (depth). Similarly, if the animator were to rotate the model to its side, they could move points on the z axis but not the x axis. This is because the current system's user interface is moving the pins based on how they appear to the user, and not their actual position in space. To combat this, it may be preferable to add distinct controls that move the pins along the x, y, and z axis without regard to what perspective the viewer is observing the model from.

Conclusion

This project was able to develop a simplified way of animating models using the rigging approach common for 3D animation, but without requiring the data storage and structural meshes required for 3D models. While this model is still an early prototype, the results of this research have proven that this is an avenue in animation that is worth exploring. In the future, I am interested in exploring the possibility of testing this approach with animators as well as developing more complex animations using this technique.

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Roundtables

Proyectos Rurales ANT (Art Nature Technology) in Latin America

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Abstract

“Proyectos rurales ANT: Art, Nature & Technology in Latin America” brings together creators, teachers and researchers involved in art, digital culture and the development of rural spaces, in the shared conviction that, to face the environmental and social challenges that confront us all, it is necessary to engage with rural areas and other forms of “post-extractivist” relationships, technologies and sensibilities.

The challenge lies in how to apply our knowledge of the arts, our experience in collaborative networking skills and digital culture to the healing of ecosystems and their respective communities, with indigenous people and local farmers as guides and companions. Together we are organizing spaces, gardens and houses that nourish experimental practices, new autonomies and investigations in common. We hope that many more will join us in this act of love and survival.

The projects represented are Upayakuwasi and Pujinostró (Ecuador), Manga Libre and Selvatorium (Colombia), Nuvem and Ruralscapes (Brasil), Rao Caya (Chile) and Goctalab (Peru). Valentina Montero (PAM - Plataforma de Artes Mediales) and Lucía Egaña have made theoretical and cartographic contributions.

Keywords

Art, Nature, Technology and Society. Rural Areas, Education, Network. Environment, Peace. Residences, Interculturality, Community.

Proyectos Rurales ANT (Art Nature Technology) in Latin America.

Human beings have become a danger for our planet. Their destructive and ignorant attitude in manipulating natural resources has resulted in a tiny percentage of the

population accumulating immense riches while laying waste to the ecosystems of the world.

In the beginning humans sought simply to prosper, organized in small groups with face to face interspecies relationships. But then certain sectors and peoples began to dominate and conquer, constructing immense machines (understood as dispositives or articulations of bodies, technologies, plants, animals and so on) for resource extraction and the accumulation of capital, the ultimate goal of all human effort.

The contemporary relationship of humans with nature is dominated by this patriarchal perspective, where machines have served as the symbol of their assumed dominance over nature. This relationship converts everything, including nature, into objects under the control of the rational will, separated and outside from humans, orientated towards economic gain and acting as if the mere fact of existing gives them the right to consume the resources of an ecosystem which goes far beyond the human.

The technological progress of capitalist culture has also been ruled by these principles. An example is “planned obsolescence” where technology is purposefully dysfunctional and ends up as waste, often toxic or contaminating. Another well-known example is the creation of imaginaries that produce artificial needs and unending consumption, ending up with immense quantities of waste and the overproduction of products. This endless cycle of production and consumption completely ignores the impacts on ecosystems and the environment, treating them simply as a limitless source of resources.

This hegemonic ideology, based on financial speculation and an extractivist economic model, has diversified its forms of control, instrumentalizing scientific and technical knowledge and imposing a single model of production, adopting and distorting concepts like “progress” and “innovation”. Natural disasters and environmental imbalances are just considered as collateral damage, without great importance, justified by the greater goal of economic progress and minimizing the importance of the extinction of animal and vegetable forms of life and the impact on the quality of life for humans.

However, there are other ways of working with technology and taking back the imaginaries and the narratives. A network of artists, creators, activists, technologists and cultural managers are seeing from a different perspective, opening the possibility of other forms of relationships with nature and with technology. Internet and its collaborative forms of working have opened up access to information and communication, enabling organization and knowledge sharing between local and remote realities, blurring to some extent the separation between rural and urban. Art understood as a space for experimentation and the reworking of imaginaries and generating new narratives without which there is no possibility of social and environmental change.

The majority of artists, teachers and investigators specialised in New Media and Digital Culture have worked in these collaborative contexts, intensely connected, creating knowledge together and confronting social and environmental issues, generally from urban spaces. The increasing knowledge and implication in these issues has deeply influenced the direction of the work of the members of *Proyectos Rurales ANT* leading them to start to apply their knowledge and carry out their investigations in rural environments, difficult as they often are, considering that it is our urgent duty to work towards the preservation and recuperation of our planet, to undermine the immense divisions of wealth, to fight against colonial systems and to seek sustainability with nature.



Figure 1

Nature in all its expressions of abundance, beauty, complementarity, cruelty, synchronicity, nodality, chaos, multiverse, love, danger, serendipity, synergy, autopoiesis, amongst other infinity of concepts, has given us the precious gift of personal and collective expression: our bodies and an endless variety of materials, energy and beings which can be transformed and formed to express our most profound desires. In exchange for all this she only asks for responsibility and the recognition of this gift that life itself gives us.

The artists united around this table are working on awareness, starting from the personal (is political), then the home and out to the communities around us, learning from them and, at the same time, teaching our specialties. We are all interested in working in collaboration with similar projects because the problems that we are facing are impossible to resolve alone, they require us to act together, with the adequate tools for communication and community development.

This *comunalidad* – as theorised by Jaime Martinez Luna in Oaxaca - is one of the thematic threads that unite the different projects, all of them thinking about technology, art and nature from the optic of relationships, understanding themselves not as outside the rest of the world but as part of it and interdependent with it. Living in a continual experiment or exercise, an attitude of respect and in tune with our habitat, attentive and perceiving the multiple times and responsibilities. Relearning the relationship with the earth and, at the same time, integrating contemporary tools that help us to sustain us all, expanding the knowledge of our respective fields so that the earth, nature and communities may prosper.



Figure 2

We have special interest in integrating concepts like permaculture, bio-construction, organic farming, medicinal plants, do it yourself DIY, do it with others DIWO, minka (or minga – a traditional form of collective work organization), home education, wikis, digital platforms, networks, interculturality, the commons and so on. We develop free and open source technologies in relation with the models that nature shows us – decentralized, horizontal and powered by solar energy. We recognize the necessity of interculturality, of building a common construction between different peoples and nations, indigenous and migrants, through the appreciation of difference and the overcoming of colonial social structures. Generations who have lived on the land have valuable lessons for those who arrive from the city, who, in turn, bring new views, art and knowledge to often closed rural spaces. This exchange, circulation and common construction is vital. All these relations need to become increasingly like organic choreographies.

The creation of these new (neo?) rural spaces requires an immense physical, mental and economic effort. One has to step right outside of one's "comfort zone", change one's way of life. Be ready to learn every day about this new habitat. Coordinate our tasks with the climate, the time, the animal and vegetable life that starts to become our responsibility. It is an exciting challenge but also very complicated, because we often find ourselves in situations typical of the current global state: contamination, depredation, mistreating of animals, bad food, lack of water, threats and industrial or economic projects that don't respect the interests of the community. It is surprising to see how these problems are repeated in almost all rural areas.

The countryside is a warzone not a bucolic paradise. Poverty, ignorance and the lack of resources impulse a continual migration to the city and the impoverishment

of those who remain. Resistance to change and suspicion of the stranger mark the characters of many while the profound colonial imprint of centuries of domination make interculturality so difficult and yet so necessary. Multiple battles in overlapping wars, brutal and ferocious. Our struggle is confrontation, creation and healing instead of destruction; learning, teaching and communicating instead of division.

Participants in Proyectos Rurales ANT: Goctalab (Peru) <https://goctalab.lamula.pe>

Goctalab is a community platform for exchange and creation, through programs of interdisciplinary rural residences we share, debate and spread techniques and knowledge that support the implementation of concrete actions towards a new definition of development. In the context of a planet with limited resources, we are searching for balance instead of infinite growth.

Founded in 2012 in Cocachimba the space has developed a close relationship with the local community, a key element in the project. These relations develop reciprocal exchange which feed the transmission of knowledge to and from the community. The building, built with adobe and integrated into the slope of the mountain, is a practical example of the philosophy of Goctalab and provides accommodation as well as a big well equipped studio/workshop for making projects. Our next step is to construct a freely accessible center for multimedia resources which will function as a seed bank, a library and a community cinema.



Figure 3

Manga Libre (Colombia) www.platohedro.org

Manga libre is a project aimed at rehabilitating a wasteland in the Buenos Aires neighborhood of Medellín left by the demolition of a building that was there before. From 2011 Platohedro started carrying out actions to recuperate the area such as cleaning, planting

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a community vegetable garden and the collaborative construction of a public structure where the local community gathers. Through various “Mingas”, artistic interventions and the participation of the community this wasteland has been transformed into a garden and natural space in an area that doesn’t have parks close by.

The Platohedro Corporation is a non-profit organization that functions as a collaborative creative platform in the city of Medellín, Colombia.

Since 2004 it has been dedicated to the permanent investigation of free culture, self-education, artistic creation and experimentation. These processes are guided by the search for collective well-being based on the philosophy of Buen Vivir (Good Living) and Buen Conocer (Good Knowing).



Figure 4

Minkalab (Colombia) www.minkalab.org

Minkalab is a rural lab that encourages the horizontal exchange of traditional and technical knowledge, the development of a stable social network, the strengthening of local skills, innovative projects and cultural diversity in order to tackle issues of local priority. The lack of autonomy and the lack of access to decent living in the countryside, the loss of biodiversity, the cultural and social isolation in rural areas in Colombia, have encouraged us to create this platform for the exchange of knowledge.

Since 2014 Minkalab has organised various meetings, mingas and collaborative projects in the space.



Figure 5

Nuvem (Brasil) <http://nuvem.tk>

Nuvm emerged in October 2011 as an initiative where desires, people, actions and thoughts converge, intended to welcome artistic and non-artistic creation and research, located in the mountains 200km from Rio de Janeiro and 300km from São Paulo.

We seek autonomy that aims for sustainability. This autonomy is not only technical - electricity generation, communication networks, etc. - but covers all of life: food, health, body, territory. In a context where cities are becoming increasingly unsustainable, we believe that a rural space is the most appropriate environment for these experiences. The project had a house for ten people, laboratory, teams; now it is based in an experimental farm. Since its founding, more than 300 people have participated in 31 activities that took place in Nuvm.



Figure 6

Pujinostro (Ecuador)

residenciadeartistaspujinostro.wordpress.com

Pujinostro is a farm for creators and artists located in Pujilí, in the province of Cotopaxi in the Sierra of Northern Ecuador, 2800 metres above sea level. It is a strategic site for its central location, close to the Cotopaxi volcano, the Quilotoa lake and the road to the coast (La Maná). Pujilí keeps Andes culture alive and has a strong tradition of pottery making.

It is an ideal space for creators and artists where people with common interests in the areas of visual arts, digital arts, new and old technologies, can meet, get to know each other, exchange and collaborate in an open way. The space was created out of the necessity for encouraging meetings for creative development, a rural headquarters for critical thinking and experimentation. It is also a place for recovery, sharing bread and thought, meditating, and to be inspired for creation, learning from the rural context and its traditional knowledge.

Pujilí in the indigenous kichwa language means “House of Games” and it is precisely this element of play which permeates the space where dialogue flows naturally and generates an open thinking, propulsing an organic educative project which affirms that “education can happen anywhere. At any time.” (Educación Expandida, ZEMOS98).



Figure 7

Rao Caya (Chile) www.yto.cl/raocaya

Rao Caya is a art, nature and technology project that was started in 2015 by Yto Aranda, Omar Gatica and Ytyo Díaz. Its main objective is to conserve the sclerophyll forest (unique to Chile), its flora and fauna in an area of thirty six hectares. The first year we have dedicated to the construction of a cabin, future residences for artists

and researchers in areas related to the project. We have also dedicated to build roads, implementing gardens (vegetables, medicinal herbs, fruit trees) and enabling irrigation systems.

The challenges and goals to be developed are: to organize art, nature and technology meetings in the place. Generate a residential program, make a registry of the local wildflowers, implement projects of bio-construction and permaculture, integrate the community, and in the medium term, begin with the recovery of the waters that flow from the mountain slopes. The process will be documented and periodically published on the Internet.

rural.scapes (Brasil) <http://www.ruralscapes.net>

rural.scapes – lab in residence is a rural residence program that focuses on research, articulation, reflection and transdisciplinary artistic practices and critical production in the rural environment. rural.scapes – lab in residence works as an interface between regional, state, national and international networks and focuses on the revaluation of the rural environment through a revision of our notions of individual and collective identity in terms of territory. These actions stimulate the development of projects that promote new productive networks and alternative micro-economies, making the region more self-sustaining and fostering new creative dialogues between city and countryside.

Rural culture, traditionally based on the construction of tools and technologies in order to guarantee a self-sustainable survival, could now be recognized or misread as the culture of DIY (Do It Yourself). However, differently from the DIY, the transmission and exchange of this knowledge represent a value of negotiation, which conforms the local socio-environmental dynamics.



Figure 8. Selvatorium - Anti Vamp circuit by Constanza Piña ©Selvatorium

Selvatorium(Colombia) www.selvatorium.co

Selvatorium is a living laboratory that grows out of the experience of an urban family that has decided to abandon the city and build their life in the Sierra Nevada de Santa Marta in Colombia; a sacred mountain range where nature still vibrates with magic thanks to the spiritual practice of its inhabitants; the Kogui, Arahuaço and Wiwa indigenous people.

There, since 2008 this (our) family and other families and individuals, who have joined the process, form a community with permanent and transient members. Between ourselves and our habitat and neighbors, we have constructed a space in which to live, create, learn, educate our children and share with temporary guests, this experience of existing within nature.

Our objective is for all the members of our community to attain a full and comfortable life as well as to contribute positively to our local and global community and natural environment. We are interested in minimizing our dependency on the monetary system and we aim for autonomy. We wish to learn to utilize modern technology when it is truly worthwhile and recognize and abandon what is superfluous. We have many challenges; health; security; agriculture; home construction; home-schooling of the children; as well as resolving community and spiritual conflicts. We are learning enormously at all levels and are convinced that this way of life is the best we can offer ourselves and our children.

The experience that we (the permanent and transient inhabitants) have; the processes that we invent; the experiments that we try, the reflections we share; the works of art that we create are all a part of the living laboratory Selvatorium.

Our space is open and throughout most of the year to receive volunteers and residents, which come to develop personal projects or carry out activities that benefit our community. We have made happen a few events; mainly the Mango Jam during the years 2014 / 15/ 16; a festival that takes advantage of the mango harvest to inspire creative projects related to food sovereignty, art and music.



Figure 9

Upayakuwasi (Ecuador)

<http://upayakuwasi.hotglue.me>

Upayakuwasi is a rural space near the town of Cayambe that began in 2016 inspired by the necessity to activate experimental dialogues with the rural context and to generate meetings between artists of different origins, the local communities and the natural environment while questioning our relation to memory, the past and its archives, aesthetic practises, imaginaries and relations, resituating the concept of the rural in contemporary narratives.

Cayambe has an important place in the history of the indigenous movement, home to leaders such as Dolores Cacuango, Transito Amaguaña and Jesus Gualasivi and now, for the first time, has an indigenous mayor, Guillermo Churuchumbi. It was also here where the capitalist transformation of the traditional system of the hacienda began, beginning with milk production and, more recently, the intensive cultivation of flowers under plastic that dominate the region and its economy.

The first project carried out there, in 2016, was the Transmestizx residence where 17 artists met to invent and develop a collective performance exploring interculturality and diverse identities, the trans as possibility, the memory of indigenous resistance and art as the creation of new imaginaries. This work was exhibited in the Centre for Contemporary Art in Quito.

Upayakuwasi has a house, gardens, library and studio as well as a food treatment workshop called La Divina Papaya. This is a project that is concentrated on the deshydration of organic fruits, flowers and other foods, result of a search for sustainability and ecological management. The workshop is also a laboratory for the exploration of the properties of plants, fruits and flowers, of the local soil and water, nourishing the diverse artistic investigations (such as film scripts, documentaries, or interactive installations) of the residents and users.

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- Figure 2. Internet meme. Anonymus.
- Figure 3. View of the Manga Libre. The structure was created in collaboration with the collectives Todo Por la Praxis (España) and Proyecto NN (Medellín). In the distance is the community vegetable garden and beyond, colorfully painted, the Platohedro house. Source:: Platohedro.org | licencia CC BY-NC-SA 3.0
- Figure 4. Minkalab ©Minkalab.
- Figure 5. Agroforestral systems in Nuvem 2016 CC BY-NC-SA 3.0
- Figure 6. Pujinostro ©Pujinostro.
- Figure 7. Rao Caya, Alhué, Chile. Fotos: Omar Gatica - CC BY-NC-SA 3.0
- Figure 8. Selvatorium - Anti Vamp circuit by Constanza Piña ©Selvatorium.
- Figure 9. Transmestizx residency. Still from VR video. Upayakuwasi 2016.

Authors Biographies

Yto Aranda Moving between artistic disciplines, particularly painting, electronics and sound, she has researched and developed a diverse body of work. Since 1997 she has used the Internet as a platform for action, developing a strong interest in issues related to communication, collaboration and community development. Painting mention Bachelor of Arts, University of Chile. In 1999 she founded the "Escáner Cultural" magazine, the reference for digital art in Chile. She continually participates in international electronic arts events, such as the Bienal Artes Mediales Santiago (2005 and 2009), FILE (2005, 2006, 2008 y 2009, Brazil), Festival Montréal en Lumière (2008, Canadá), LabSurLab (Ecuador 2012), Isea2012 (Estados Unidos), Isea2013 (Australia), Asimtria/Once (Perú 2015), Kiebre (Bolivia, 2015) or BunB, Festival de la Imagen, (Colombia 2016). In 2015 she co-founded the rural project "Rao Caya" for Art, Nature and Technology and in 2016 was awarded the Fondart 2016 prize for the project (((KO))), a visual & acoustic electronic mural in the Subway of Santiago (Metro), Chile.<http://yto.cl>.

Pedro Soler: Trained in digital arts in Barcelona, Spain (UPF 1997-1998), Pedro Soler was co-founder of the fiftyfifty collective in Barcelona (1999), curator in Sónar festival (2000 - 2006), artist-programmer for theater in

Paris (2003 - 2006) and director of Hangar, production center for visual arts in Barcelona (2006 - 2009). After leaving Hangar he curated exhibitions in Barcelona and Cairo and initiated Plataforma Cero, a space for production and investigation in LABoral art centre, Gijón, Spain. From 2012 he travelled widely, arriving in Medellín in 2014 where he worked with Platohedro, Casa Tres Patios and Parque Explora. In 2015 he co-curated the exhibition "Art in Orbit" in the CAC, Quito, and collaborated in the process of Jardineria Cultural in Ambato. Currently he is involved in the Upayakuwasi project in Ecuador and is the artistic director of the Transitio_MX 07 bienal to be held in 2017 in Mexico City.<http://word.root.ps>

Gabriel Vanegas (Colombia 1982) His research in the areas of American history, media sociology and relational aesthetics have influenced his creative production, working mostly with video installations, sound sculptures and written theoretical publications. In 2004 he co-founded the magazine El Niuton, one of the first publications in Latin America exploring the relations between art, science and technology. In 2011 he founded Botaniq, a platform for conservation and archive of contemporary art, and in 2013 joined a collective developing a rural lab in Colombia. He is currently finishing a fellowship at the Institute of Time-based Media at the Berlin University of the Arts with Professor Siegfried Zielinski, working in the area of Media Archeology in pre-Columbian America.

Katharina Klemm (Germany 1981) Studied painting and arts in Alfter, Alanus Hochschule 2007. In 2015 she graduated as a Media artist from the KHM (Medien Hochschule Koeln). One aspect of her artistic work deals with various characteristics of the sun as a source of energy, star, symbol, myth as well as mathematical parameters. Another aspect is the visualization of time structures, working with video installations, video animations and printed illustrations.

Valentina Montero Ph.D in Advanced Studies on Digital Art from University of Barcelona; Masters Degree in Curatorial and Cultural Practices in Art and New Media (Mecad), Journalist, graduated in Aesthetics. She has worked as an art curator both independently and in institutions in Chile and internationally. Her writings have been published in indexed magazines and sections of books such "Red Art: New Utopias in Data Capitalism" (Leonardo Electronic Almanac, London, 2014); Cinemas Experimentais (Luminarias, Sao Paulo, 2016); Technochamanism (Goethe Institut, Sao Paulo,

2016), among others; in 2012 she published the book “By Reason or By Force, The Chilean Neoliberal Model and its Implications for Education and Culture” (Errant Bodies, Berlin/London, 2013). Currently she teaches in several institutions and carries out research on matters related to photography and media arts, from gender and decolonial approaches.

Yuliana Rodríguez Student of Psychology and facilitator of solution focused brief therapy with children and young people (Terre des Hommes Schweiz). She is coordinator of the educational program at Corporation Platohedro in Medellín, Colombia. She researches and produces experimental activities in alternative pedagogical spaces. She is one of the leaders in the urban intervention Manga Libre, a free garden in the city of Medellín, and is member of the Jaquer Noise a collective for audio experimentation with free software tools and DIY electronic instruments.

Luciana Fleischman holds a B.A. in Social Communication from the Universidad Nacional de Rosario (Argentina) and a Master in Communication, image and Information from the UFF (Universidade Federal Fluminense, Brasil). She researches and produces experimental activities in art and free technology such as Tropixel Festival - Art, Science, Technology and Society (Ubatuba, Brazil); Rede//Labs network, where she researches experimental digital culture in Brazil and Latin America. She currently lives in Medellín (Colombia), where she coordinates the residency program of Platohedro Community Lab.

Bruno Vianna studied cinema and has a master from the ITP program in New York University. He directed 4 prize winning short films between 1994 and 2003 and in 2006 released his first feature. In 2008 he launched “Resaca”, an interactive fiction feature film edited live in each viewing, which was shown more than 70 times internationally and received 4 prizes. He has created works for digital platforms such as PoemApp, interactive poetry for mobile phones, and Devorondina, an apparatus which makes images from electromagnetic fields. In 2010 he made the documental film “Satélite Bolinha” about Brazilian satellite hackers. He won a Vida 11.0 prize for his “Fountain for Satellite Fishing” shown in ISEA, Residencia Rio Occupation London, Olympic Games of London 2012 and Chambre Blanche, Canada 2013. Since 2011 he has co-organized Nuvem, a rural space for art and technology. He is currently preparing a feature about MST (Movement of the Landless), teaching in Oi Kabum!, a free school for art and technology in Rio de

Janeiro and programming video filters.

Lucía Egaña Rojas has worked as an independent artist and freelance feminist activist. She studied Fine Arts in PUC (Chile), a Master in Creative Documentary in UAB (Barcelona), and has a PhD in Media Studies from the same institution. Most of her work is based on collaborative productions that interrogate the construction of social imaginary in popular culture, technology, free software, feminism, gender and body representation. Since 2000 she has been working in independent media projects, as a creator, producer, doing workshops and promoting the creation of new alternative platforms in Chile and Spain. She has developed many of her projects working on independent platforms of alternative, independent and popular modes of media communication as well as with collectives such as prisoners, women and immigrants. Since 2008, she is a member of minipimer.tv, a collective and laboratory of real time video, streaming, research and free technologies based in Barcelona. Since 2014 is part of cooptecnicas.net, a feminist media cooperative. Her work has been presented in Chile, Uruguay, Colombia, México, Ecuador, Argentina, Spain, Italy, France, Switzerland, Finland and Germany.

Omar Gatica Rivera, is a graduate in Fine Arts from the University of Chile and an emblematic national painter, known for his abstract neo-expressionism. He is part of the “Group of the 80’s”, a movement which advocated the reappraisal of painting in art. Irreverent in his drawing and strongly expressive with his materials, his work marries expressionism and abstraction, using powerful colors, a limited chromatic range, intense gestuality, strong lines and dense layers of paint. His principal themes are humanity, daily life and the meaning of existence. Winner of the 2010 Altazor prize for “Yo Pintor” 2009 (Museo Nacional de Bellas Artes). Winner of the competition MOP2014 which commissioned him to create the mural “Ciudadanos del Medio Día” in the Moneda Bicentenario Building. In 2015 he founded, with Yto Aranda, the Art Nature and Technology (ANT) project “Rao Cayo”. Since 2002 he has taught in the Visual Arts Faculty of the Finis Terrae University. www.omargatica.cl

Vanessa Gocksch (aka: Pata de Perro) originally from Belgium, is a woman of many trades residing in the tropical jungle of the Sierra Nevada de Santa Marta in Colombia where she runs the Selvatorium, a community based cultural and ecological project. In 2000 she co-founded Intermundos, a grass roots entity

dedicated to culture and communication that, amongst other achievements, co-founded Systema Solar in 2006, currently one of the most important musical groups in Colombia. In 2005 and 2006 she was involved in the organization of Bogotrax in Bogotá and, in 2007, two Pixelazo (Pixelache Network) events in Medellín as well as kickstarting the Colombian vj scene with a series of workshops in Colombia's major cities. In 2006 Intermundos released "Frecuencia Kolombiana", an audiovisual testimony of Colombian hiphop from that decade; Vanessa is also a pioneer in documenting ecological construction in Spanish through her blog about Casa Biyuka. <http://intermundos.org/en/>

Daniela Moreno Wray (Ecuador) studied cinema at the Centro de Investigación Cinematográfica (Buenos Aires, Argentina) and was awarded an Ibermedia grant to study creative documentary at the Univalle (Cali, Colombia). She has participated in various documentary projects such as "Ojos bien abiertos" by Gonzalo Arijón, "The Challenge" by Leticia Moreau and organized workshops in the afro area of Esmeraldas, Ecuador, with the team of Fátima Toledo, for the film "Los Ángeles no tienen alas". Since 2014 she has been creating collective actions like "El Árbol en Movimiento", interactive installations like "Transmestizx" y documentaries like "Aquí estoy otra vez" or "El Elefante Dormido", currently in development. She has developed her interest in food and artesanal practises in the grant winning "Las Cocinas de los Pueblos", an investigation of Ecuatorian culinary traditions, and currently in her family workshop "La Divina Papaya", located in Upayakuwasi, a rural cultural and productive laboratory near Cayambe, Ecuador. <http://dmw.hotglue.me>

Rachel Rosalen's works focus on the construction of spaces using multimedia and concepts drawn from architecture. The artist mixes electronic media like videos, programmings and performances to make interactive video installations and live cinema performances. Rosalen has had exhibitions and projects in renowned cultural centers such as Centre Pompidou (Paris), Yokohama Museum of Art (Japan), Museum für Gegenwartskunst (Basel), Image Forum (Tokyo), Videoformes (Clermont-Ferrand), Kunstraum Walcheturm (Zurich), Palazzio Nuovo (Naples), Paço das Artes (São Paulo), VIDEOZONE IV – 4th International Video Art Biennial (Israel), among others. She has won awards like PAC New Media Prize (São Paulo, Secretaria da Cultura 2014 and 2015) or the

Sergio Motta Art and Technology Prize, São Paulo (2007) and was selected for artist in residence programs by The Japan Foundation/ Nanjo and Associates, Werkraum Warteck PP/ Warteck Fonds – Basel and Bain::Connective, Brussels. In collaboration with Rafael Marchetti, with whom she has collaborated since 2007 in developing interactive installations and hybrid spaces, she co-created and co-coordinated rural.scapes - lab in residence from 2013 until 2016.

Proyectos Rurales ANT: Rural.scapes – Laboratory in Residence

The future of the city is the farm.

Rachel Rosalen – reflection upon the project rural.scapes – Lab in Residency (2014-2016)

Altered Fields

rural.scapes – Lab in residency was created by the artists Rachel Rosalen and Rafael Marchetti in 2013, beginning its activities in 2014, and launching four editions in three years. Since its first edition in 2014, the **rural.scapes – Lab in Residency** program has offered the local rural environment as a key element for research and creation, fostering dialogues and stimulating the creation of approaches, interventions and spaces for shared practices and possible transits, connections, ruptures and integrations within this specific territory. The program recognises Lab in Residency itself as an intervention with local implications. (2014, Rosalen & Marchetti).

"New perspectives arise from these non-traditional methods, in order to deal with these other ruralities which emerge as a network, while acting systemically, through a group of practices committed to the local. The creation of interfaces for connectivity, places these environments on the map, not merely as residual territories of two big urban centers, but as relevant actors for resilience and resistance. Those territories, or those actors, teach us that huge plantation areas are not necessary, while small areas can become sustainable platforms. This does not imply longing for some lost, bucolic romanticism linked to an idealized, lost nature, but rather to the desire for reinserting these territories into the networked context, while considering its own organization and horizontality. Quantum physics suggests that mere observation affects the studied environment, transforming both the observer and her ways of showing. **rural.scapes'** raw material

seems like a network, considering the environment as a natural, ethnological and prosthetic whole, within the restructuration of local relations” (...)

“Works, devices, images-devices, interface-works, pre-cinematic vision machines created in **rural.scapes** –**Altered Fields** start from *processuality* as a procedure, within a non-controlled immersive environment –a sort of expanded green cube- and from *experientiation* as the base for these processes, in a non stop exchange between action and development, and of listening and sensitive frequency generation that alter our perceptive environment (...) **rural.scapes** – **Lab in residency** is based on “situations generated by the encounter between rural traditional technologies and electronics, of retro-technologies, of transposition, translation, transcription and transplantation exercises of affective and geopolitical topographies, which break with the black box of industrialized “consume and discard”, “plug and play” technologies.” (Fragment of the curatorial text for the exhibition Altered Fields MAC-SP

– Rosalen & Marchetti – 2015).

micro-politics. “**rural.scapes** is a platform open to thinkers and creators, both Brazilians from different regions and foreigners who are locally related to the construction of a transdisciplinary, multi-cultural, inter-regional and international exchange, who build the project’s network. **rural.scapes** acts as an interface between regional, state, national and international networks, seeking for the collective revalorization of the rural world, by examining our notions of individual and collective identity in relation to the territory. **rural.scapes** supports works that are the result of transdisciplinary creative processes, fostering and dynamizing new productive networks, while promoting new local micro-economies and valorizing new relations between communities and territory.”

“Considering nature as a group of intelligences and networked biosystems, Altered Fields points at small emergencies within infinite experiences of micro and macro scale re-cartography, creating new representations of old constellations, in processes that point to the capacity of resilience of this system. This system’s sustainability is fundamentally dependent on the way in which energy is both generated and used.” (Fragment of the curatorial text for the exhibition Altered Fields MAC-SP – Rosalen & Marchetti – 2015). **Inventory** During its four editions, **rural.scapes** brought 42 artists to São José do Barreiro (21

Brazilian and 21 foreigners), 12 international guests – including curators, managers, directors of art and technology centers, such as LAA-Laboratorio Arte Alameda and Hangar, and art critics (6 Brazilian and 6 foreigners) - in order to integrate 4 in-residence juries (together with the project’s organizers Rachel Rosalen and Rafael Marchetti), who produced a text about the processes and works developed by resident artists, and 2 researchers (sometimes, in more than one trip) who also produced texts and reflection. **rural.scapes** has organized more than 35 workshops, 9 exhibitions between the project’s headquarters at Fazenda Santa Teresa and São Paulo (Paço das Artes, Espaço Augusta and MAC – Museu de Arte Contemporânea de São Paulo), 10 performances between São José do Barreiro, Paço das Artes de São Paulo and MAC-SP, and more than 40 works and round tables at São José do Barreiro and MIS - São Paulo, Paço das Artes de São Paulo, Espaço Augusta and MAC-SP.

The future of the city is the farm –or how stepping back means going forth. The illusion of big megalopolis, industrialization, digitization, virtualization of life and easy consuming make life’s basic values to be forgotten, which includes a healthy relationship with nature, the preservation of our environment and the production of our own food. Life is a systemic construction, not an individual matter. At a time in which we are discussing liquid futures, post-humans, and hybrid bodies, **rural.scapes** brings about a different perspective on the future and another way of living. Neo-liberal capitalism is destroying the environment and generating an economical apartheid. This is the time to step back and to reconsider the relationship with the things we consume.

Resignification That said, thinking about the future of **rural.scapes’** platform becomes essential. In times of a new raising of neo-liberal far-right movements; in times of post-truths, of political scenarios built by the media without any type of filters; in times of ostensive police control and human, working, gender and migration rights annihilation; in times in which walls and social abyss are being built; in times of sea-cemeteries- and unspeakable exodus; in times of extermination policies towards black, Muslim and indigenous communities from all over the world and from all minorities; in times in which fear and helplessness prevail over the capacity of thinking; in times in which the pharmaceutical industry sedates mourning and our capacity to be sad and to revolt; in

times in which women are treated as a minority while they are the majority of the world's population; in times of ultra-sexism; in these dark times, it becomes urgent to find new strategies for survival in various layers – humanly, keeping the capacity of loving and regaining the possibility of acting within micro-politics that turn our existence in the world meaningful, micro-politics that break the cultural, social and –above all, economical apartheid.

Healing proposals, such as the creation of hybrid systems and micro systems based on the concepts of agricultural forest and permaculture, act systemically in micro-scales, renewing a non-romantic viewpoint about nature - though acting by contamination. Within the context of hybrid systems, reflecting upon the way in which these projects point at “rural in-between/offline networks”, at a rural gambiology (a concept created by the gambiologists collective), and at interventionist micro-politics on these territories, becomes vital. Such actions create artistic processes in themselves. DIY culture has grown strong at the farm, resorting to the logics of improvisation and reutilization, of using whatever is at hand and, in this sense, becoming less dependent on the black box, and more on the reinvention of rudimentary technologies. Taking into account the scale in which they can exist, in what ways can these altered fields contribute to the decrease of our social abyss and of systemic natural unbalances? This might be a relevant issue when pointing at “Other” strategies –of alterity. Immersions, temporal labs of exchange of something that can be called *immaterial patrimony*, involving local and foreign agents, create a wave frequency that disseminates surreptitiously, while it also act in terms of reverberation, permanence and re-occupation/transformation of the territory.

These collaborative networks are spread among the institutional links of the project, but also among the links with the “rural.scapers” community. All of them carry seeds for exchange, as in the Creole seed banks –small cores that resist industrialization processes of food, diseases and medication. These seeds are distributed among small-scale actions, even though they act in geometrical progression, resorting to conceptual and pragmatic contamination logics. It is worth remembering that the communities which often visit the Fazendas Abertas (Open Farm), have kept seeds, exchanged recipes, collected fruit trees, and re-encountered their origins –very much lost during the rural-urban exodus.

We defend an idea of re-encounter, not of romanticism. It is political, not nostalgic. In relation to the rural, romanticism is an European concept, stemming from German romanticism, which installed a viewpoint on the countryside that never corresponded to the reality of living and producing in the farm –a viewpoint built from a bourgeois or aristocratic perspective. Everyday life is denser, much rawer and includes some degree of intrinsic violence, which is hardly conceivable when the countryside is imagined from the city as the “country house”, and not as a way of life or as a means of production on an artisanal scale. The industrial scale of the countryside is not considered by us, since that is **rural.scapes**' anti-proposal.

dystopian territories Dystopias are a fundamental part of the *experientiation* process of these utopian micro-politics which, without promoting any kind of absolutism or revolution, rebuild these conflictive territories – whether because of the class struggle, of the dominant loss between the rural culture as a result of colonial/post-colonial and industrialization processes, and of the virtualization of their reality by the bureaucratic public institutions that never go to the countryside to see what it demands or produces. These are logistic, strategic, priority, lifestyle, and ethical conflicts, based on experiences so radically different, that reaching the point in which the sum of the parts generates an exchange to expand the individual notion of cartography and of the use of this territory, becomes a daily exercise. **atemporalities – or nothing like writing while watching the cows grazing under the yellowish autumn light.** In these territories, different temporalities coexist. If, on the one hand, the above mentioned conflicts question the colonial heritage that penetrates the way of living, the circularity of nature creates, on the other hand, a suspension in which interventions can be considered as “acupuncture” (Cristian Espinoza, *Esquizoterritorios - fabulasmecanicas.wordpress.com*). To intervene in this time flow means to act within this complexity, in an impermanent manner. Duration and impermanence seem to be opposite concepts, though they might not be when dealing with new ruralities. The impermanence of the actions of men is supported by duration (that of nature).

Having reached three years/four editions, **rural.scapes** begins a new cycle of projects, which conceptually maintain the principles that originated it, though reconsidering them from a different impermanence: that of public cultural policies in relation to the continuity of those projects that

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act both vertically and in networks. In this context, this new cycle is launched by focusing on specific projects with a counterpart for the community, by workshops to be distributed throughout the whole year, by the strengthening of international partnerships, and by searching for sustainability within Fazenda Santa Teresa. Therefore, 2017 becomes a year for balance and restart, and our participation in ISEA is considered as an opportunity to reencounter partners in this politically conflictive world moment, with the intention of redrawing new strategies of networking actions – a network made of micro-resistances and affection, which potential can be transformative.rural.scapes received the prize Programa Rede Nacional FUNARTE de Artes Visuais 10ª edição (Ministério da Cultura – MINC Brasil, 2014), EDITAL PROAC Nº 17/2015 “CONCURSO DE APOIO A PROJETOS DE DE ESPAÇOS INDEPENDENTES VINCULADOS ÀS ARTES VISUAIS NO ESTADO DE SÃO PAULO” (2014/2015) and “CONCURSO DE APOIO A PROJETOS DE TERRITÓRIO DAS ARTES (ESPAÇOS INDEPENDENTES) NO ESTADO DE SÃO PAULO” (2014/2015).

The Online Counter-collector, the Open Source Heritage and the Museums of the Unfinished

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Abstract

For this roundtable, we propose a debate about public policies of memory preservation based on the specificities of digital media culture. The ephemerality of these kinds of technologies and the intensification of personal and non-professional process of digital documentation bring unprecedented ways of understanding the collections and cultural heritage of our times. We are experiencing not only an overproduction of data, which proliferates in new formats of storage in the networks but also a documentary overdose. Nevertheless, this not performs a cumulative system. Due to the speed with which technologies are discarded in shorter and shorter periods of time, loss, change, and even replacement will be more and more part of our conservation practice. For all these reasons, it seems particularly important to discuss how to deal with the cultural ambivalence of this very moment. In our debate, we will concentrate in three main axes: the online counter-collector, the open-source heritage and the digital museum as the museum of the unfinished.

Keywords

Memory, Digital Museums, Digital Heritage, Open Source, Digital Art, digital preservation.

Introduction

The ephemerality of digital images and the intensification of personal and non-professional process of documentation bring unprecedented ways of understanding the collections and cultural heritage in contemporary times. Traditionally conceived as an immaterial heritage, it becomes, increasingly, mediated by collective creations of online collections that indicate another perspective of memory, resulting from the culture of sharing.

We are nowadays experiencing not only an overproduction of data, which proliferates in new formats of storage in the networks, but also a documentary overdose. The total of photos captured in 2015, for example, exceeds the number of all photos ever made on film in history

(about 2.5 trillion to 3.5 trillion). It is certainly important to avoid loss, but it is impossible to store everything that is produced. The process of building this collections has also changed in the last years, because the users became active creators and the creation became collective most of the time. A concept of open source heritage can emerge if we realize what kind of content will be considered collection in the next years that come. Otherwise, this new concept of open heritage could be manipulated by different powers to direct behavior and ideologies, which bring this discussion of control to the surface.

The notions of patrimonial preservation of the physical space have been radically changing in this context. While the city and the urban spaces become also museological and digital interface, visual narratives proliferate on the networks. These experiences indicate an emerging institutional review. Although more connected to networks, their power of action seems to be more diluted, transferring it to the visitors and users the autonomy to interfere and construct new images and collections.

The musealization of everyday life, a contemporary phenomenon which is related with our culture's fascination with the past, is also putting the museum as a source of big interest on contemporary times, acting as "repositories of temporality", as Manuel Castells has called. But what happens when museum themselves are "musealized" by the visitors, shattering its established temporality by putting their collection on the noisy realm of Instagram, for instance?

Since art institutions are more and more engaged with social media, it seems necessary to understand which paths could be follow in this new scenario. It is fundamental to evaluate how we live such images that awaken a desire to immerse ourselves in collaborative narratives, where many contribute under the same creative cycle. Different levels of space appropriation arise as these ephemeral heritages reach the physical places around us, as the constant association between

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image making and checkin locations demonstrate.

The function of space is changing front of this landscape where the institution is shared by users and visitors, which use the places as triggers for their collections. Then, these collections seem to be opened in their creation process, but also in their existence in the place, where the artworks are linked and exist connected to different narratives and routes. The city and the museum start to establish different relationships, not only on the social media, but on the urban territory, as long as the city become an interface for different artistic projects or digital services (evidencing the disputes between resistance and control), like Google Local Guides, which turn the users routes some kind of curatorial experience of places and public opinions.

In this sense, the establishment of new informational layers on the cartography of the city and the living spaces transforms the way in which we see the images and their meaning as patrimony. It happens especially because these collections do not belong to traditional museums but parallel ones, outside its constitutional power, composing its own scene with open, often mixed dynamics.

The On-line Counter-collector and the Musealization of the Museum



Figures 1 and 2 Images of the highly-photographed exhibition of Ron Mueck, at Pinacoteca do Estado de São Paulo: an example of the musealization of the museum

Two different situations emerge from this new scenario. On the one hand, there is the promotion of an unequivocal adherence to practices of open source culture, experiences with open data and collective actions. Personal and informal initiatives proliferate, such as Ubu Web, by the American poet Kenneth Goldsmith, which documents and archives experimental film and contemporary poetry; and Netzspannung, by the artists Monika Fleischmann and Wolfgang Strauss. On the other, the possibilities of appropriation by marketing campaigns - benefited by hashtags often associated with sponsoring brands - grow. Not to mention the recurring scenes of selfies with the works, often with their backs to the objects but “facing the Instagram”. Besides that, companies such as Google and Facebook dominate more and more storage spaces on the networks.

As an attempt to avoid this process, a whole counterculture of archival and musealization has been created outside the institutional tradition of memorization practices and policies. Jurgen Vermaire, a Dutch art historian-teacher has been exhibiting images

of artworks taken by him in museums around the world on the Instagram account @lets_talk_about_art, which has already more than 26k followers. The photos are post daily and come along with a descriptive text and a standard identification following museological criteria: artist's name, title of the work, year, technique, dimensions, name of the museum and place of origin. Although the pieces exist in the physical/material sense, this group of images is already a collection by themselves – an archive without museum, as Hal Foster predicted (Foster, 1997).

Edward Sandling, a British art historian and author of the profile @london_mudlark, began to collect historical objects randomly found on the banks of the River Thames in London about a decade ago. By displaying them on Instagram, he takes on the role of a curator of his own collection, transforming a private collection into a gallery of objects that, to his followers, seem to exist only as an image on the digital realm.

Such examples can certainly be classified as practices of ‘counter-collecting’, a neologism created by Beiguelman and Magalhães (2014) to describe an emergent archive and musealization counterculture, beyond the academic world and outside of the institutional tradition of memorization policies and practices, and often crossed by corporations demands. Cicero Inacio da Silva uses this term to discuss the disappearance of archives on the digital age and how personal records can often be mixed with the official ones in the future. As he describes, “the counter-collecting would be a response to a long and historical process of formalization. It would be a kind of counter-methodology, now guided by the massification of digitization and its complete dismissal of hierarchical methods” (Da Silva, 2014, p. 198).

In the midst of images combined by the hashtag #van-gogh or #selfportraitwithabandagedear, as an example, we can hardly notice which one was officially photographed and post by the Courtauld Gallery or by a visitor. Both of them will be displayed one aside the other, with no hierarchical separation. Following a prominent idea developed by Victoria Vesna, the hashtag configuration can be read as a database aesthetic example of social media, a visual configuration often generated randomly in a emergent way or by the logic of the algorithm. As a consequence, the hashtag offers a possibility to favor a “peer to peer” relationship, as Christiane Paul points out, and the political and philosophical impact of this configuration is immense

(Paul, 2007). Besides being a possibility of “server liberation”, it is also an opening for other discourses in the field of art beyond those already established by institutions.



Figure 3 Images found among the 397,455 available on the hashtag research #atamodern

To better understand these practices of the online counter-collector, it seems valid to look to them in parallel with a contemporary phenomenon called the musealization of everyday life. As Andreas Huyssen analyses by following the ideas of two German authors (Hermann Lübke and Odo Marquard), our current fascination with the past was partly originated by the breaking down of the traditions and stable experiences brought by modernity and technological transformations. As such, musealization – and the museums themselves – plays a restorative role in this context of loss of stability, bringing “traditional forms of cultural identity to the destabilized modern subject” (Huyssen, 1994, p. 15).

Similarly, the relation between musealization and new temporal dynamics has also been discussed by the Spanish sociologist Manuel Castells, for whom the museums function nowadays as “repositories of temporality”, acting as a kind of organizational system of a chronological time that has been lost in the information era. In his own words: “Museums are repositories of temporality. They constitute an accumulated historical tradition or a projection into the future. They are thus an archive of human time lived or to be lived, an archive of the future. Re-establishing temporalities in a long-term perspective is fundamental to a society in which communication, technological systems and social structures converge to destroy time by suppressing or compressing it, or arbitrarily altering time sequences” (Castells 2001, p. 6).

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If the musealization of daily life is pointed as one of the phenomena of the culture of memory, it is interesting to reflect about what happens when the museum also becomes an object of such practice. In other words, by registering the works of art and arranged them in their personal virtual galleries, visitors assume the role of musealization of the museum itself. This process seems to contradict Castells and Lübke's ideas about these spaces as repositories of traditions and temporalities. In fact, they may even have this function at an earlier stage. But as soon as visitors take over the images of the works to reallocate them in particular galleries of the Instagram, any stability which was previously supposedly present disappears.

In this new virtual configuration, museums seem to assume an aspect of the information age that, according to Castells, they were meant to avoid. With artworks of styles and periods so distinct juxtaposed randomly and visualised without any categorial separation on the Instagram feed, for instance, they also carry a sign of a time and spatiality compressed.



Figure 4 Edward Sandling's London Mudlark profile: a private collection transformed into a public gallery on Instagram.

This radical transformation brings a lot of questions and issues to be considered in an upcoming future. Will the image of the original artwork be overshadowed one day by these less reliable reproductions until completely transforming the imagery we have of it? Or private collections such as the one by Edward Sandling could be more and more inserted into the public sphere through this image sharing process on Instagram and other social medias? Or, even more drastically, could these counter collections be lost forever if Instagram suddenly comes to an end? Although it is too early to consider all the challenges brought by these counter-instrumental practices, these issues will certainly be more often and changing the way museums and institutions deal with this scenario.



Figure 5 Different images of “Self-Portrait with a Bandaged Ear” by Van Gogh seen along with a different work by another artist

Open Source Heritage and the City as Museums Interface

The collective production of images changes the way we build our memories. In the last twenty years the world saw a big change in communicate and live. All places around us become more than a physical space, especially because they represent our relationships in the post-virtual condition, in which our virtual check-ins also become physical connections. Front of the huge amount of images produced in the last years, this digital culture of collective creation brings to us the discussion about how open the heritage of the future is to be build in community and to be changed.

Laurajane Smith (2006) point that the heritage is about negotiation – about using the past, and collective or individual memories, to negotiate new ways of being and expressing identity. By this way, we can consider all the memories we have been collection and exhibition online based in the places we went, like or collect in our journeys around the world. She says this process heritage objects, sites, places or institutions like museums become cultural tools or props to facilitate this process – but do not themselves stand in for this process or act. And day after day the function to collect and curate the heritage is more related to digital companies than to cultural institutions. Smith also affirms that the heritage is also a discourse, which not only organizes the way concepts like heritage are understood, but the way we act, the social and technical practices we act out, and the way knowledge is constructed and reproduced.

The present is based in different trend topics of interest on internet, and this access mean what is considered essential to stay online. This behavior of

digital society makes important analyze what is the limit of the conservation of memories that build the collection of the future, how these unfolding of what is produced collectively and what is considered a cultural heritage. Emerge a dispute among (1) the collective production of resistance, open source and hacker culture, and (2) an average collective production induced by indirect control of data and surveillance, overall connected to the city area (Google Maps, FourSquare, Facebook check-in, Instagram locations, etc). The innumerous services, which are created to stimulate the rebuild process of the contemporary city, make us think about the manipulated repair of the urban area as cultural recognition of the cartography from the interests and patterns of society. This is the case of Google Local Guides, which is a service to upload photographs, reviews and favorite routes of the users, based on Google Maps and Streetview, gamifying the city through rewards and points. There are 5 levels to be achieved and many awards for the achievements, related to the amount of content uploaded every day. From this service is possible to visualize how deep is this behavior to build an open collection of our lives and routes, based in preferences and routines, where resides the importance of the data we produce everyday and the images collection we curate all the time, creating patterns of behavior of the society. But this new maps in the city can have different shapes beyond the simples service proposed by Google, reaching levels of resistance.

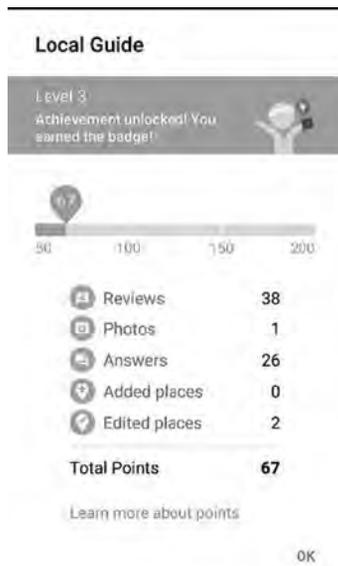


Figure 6 Google Local Guide - www.google.com/local/guides

Many artistic projects discuss this new direction for collections, and here is clear the resistance process, where users share authorship in another level, where they are not just a data resource or the final product of a service cycle. The challenge is how to preview what kind of heritage we are building with our present collective way of creation, and how track the differences between a real appropriation of the city as museum/artistic interface, or the result of a manipulation cycle.

All of these process to create collections in the city through digital experiences, bring the topic of tangible and intangible, and about the materiality of the heritage. Smith (2006) points all heritage is ultimately intangible and it is fruitful as it challenges the materialist idea of heritage and the ideological baggage that goes with that, and yet also challenges the critiques of heritage that warn against its stultifying backward reactionary glances. She says the heritage is a cultural and social process; it is the experiences that may happen at sites or during the acting out of certain events; it is a process of remembering and memory making – of mediating cultural and social change, of negotiating and creating and recreating values, meanings, understandings and identity. Above all, heritage is an active.

More than social media networks, we are dealing with

dynamics in which open source is more important than the object. The idea of open source firstly appeared when Linus Torvalds started a free computer operating system called Linux (1991). This project represented a new way to create interactive systems, which code are available to be edited for everyone and Torvalds (2007) says that open source is the only right way to do software. But when analysed in the context of art and museums, we can see how closed has been this system in the last centuries, which limits were established by the main institutions, controlling the power of exhibit, communicate and distribute the “noble” artistic experience. Even after the first modern public museums started to appear, their history has always been attached to private collections developed by a minor group of a bourgeoisie society. But now, many tools give the power to small groups manifest their own opinions and artworks (in a high level of viralization and accessibility) in a place, technically, absolutely open to intervention in the digital landscape: the urban place. The city is completely vulnerable to be changed, tagged, reviewed. So the urban system in some way can dialog with the idea of open source heritage, and, as such, the open source can often be seen as a revolution on the way we access artworks and objects of memories in the next decades. The open source heritage has just started to be built by all of us, and probably the museums of future will exhibit the memes of our culture, our tours in the city, the fragments of our routines, because the city is a rhizomatic and malleable interface, with any judgements, which make it open to different types of interventions and appropriations.



Figure 7 Mapas Afetivos - www.mapasafetivos.com.br

The ambivalence perceived between resistance and manipulation, can be discussed from projects which bring the local identity of the city, the affects and

cultural cartography, or expose the gaps in the system using the data to explore the political discussions. *Mapas Afetivos* is a collaborative projects created by Andre Deak e Felipe Lavignatti, to built a new map of Sao Paulo, based in affection and emotions of its citizens. The site brings testimonials of ordinary citizens, famous or not, and their favorite places in São Paulo and other cities in Brazil and the world. The launch of the site's collaborative area will be in January 2015, during the commemorations of the anniversary of the city of São Paulo.

Created by the same group, the website *Arte Fora do Museu* it's an award winning project, based on the mapping of works of art that are in the public space of the city. This initiative for the valorization of public art has becoming a transmissible narrative as mobile application, a traveling exhibition, multimedia production and mapping workshops.

The open source heritage we talk about is based in initiatives like the artistic projects we showed and so many other, which review the city as interface of real connections and interests, as tool for artistic deep productions. We are talking about a heritage based in real desires of the citizens and users, and not unconscious wishes implanted somehow. Maybe the next generations won't understand why to create private and closed collections of images, especially front this universe of shared data and information, but the main aspect is built the critic sense about why we are creating this amount of data and what we are going to do with this.



Figure 8 Arte fora do Museu - www.arteforadomuseu.com.br

The surveillance need to be discussed front of so many services to control our steps, routes, behavior and potential choices, because the city need to be the interface of cultural and free expression, and not an interface to map potential consumers and their favorite products. If we share and co-create all content together, is it possible to curate what we will keep for the future? Through this path, the new heritage conditions are created based in a new image, part of many lives, which belong to everyone and to anyone at the same time.

Museums of the Unfinished

Obsolescence, loss, devices and files not found. This seems to be the more perfect picture of the digital culture and the aesthetics of abandonment that prevail in its realm. Maybe the imminent disappearance that is constantly to be found everywhere all the time justifies the apocalyptic tone that is suggested in the most basic commands for handling digital editing programs, which invite us to 'save' files all the time, and not simply store them.

Networks have no time. A system of permanent urgency prevails over them. The most recent publication is supposedly more relevant than the previous one. Now is what counts. And this 'now' has an increasing intensity. Try to find that very important comment posted by your friend thirty days ago on Facebook, that photo you 'liked' in some remote day of 2012, or that remarkable event in which you shared a video back in 2008. Don't even try it. You won't find them.

It is true that all data can be tracked. Scandals related to electronic surveillance, such as Prism, involving the US government and companies such as Google and Facebook, can confirm this. But this is far from meaning that we have the right to remember whatever we want about ourselves whenever we want. Not that the models existing for the traditional cataloguing and retrieval of data are better, or even that they are the only possible ones. They are historically engendered and are related to forms of power and to the political, social and cultural authorities that define the criteria for conservation, the ways to institutionalize memory locations and to decide what is or what is not left to be told as history. It is not a coincidence that the protagonist of one of the most brilliant short stories by Jorge Luis Borges – *The Book of Sand* [*El Libro de Arena*] – chooses precisely the National Library as the place for losing the book that tormented him. Putting it on a random shelf was like hiding a leaf in a forest. It could never be found

again. But this human scale restrained by institutions is now shaken by an overdose of documentary production that is unprecedented in history. If there is any question about this statement, let us make a comparison between the volumes of data stored in the world's largest library collection – The Library of Congress of the United States – and the Internet Archive Wayback Machine, an independent service that archives web pages daily. The Wayback Machine contains 3 petabytes of data (equivalent to approximately 700 thousand fully loaded DVDs and this is only part of the 9 peta-bytes of the Internet Archive as a whole) (Drinehart 2012). If the Library of Congress had its entire collection of books scanned (32 million volumes), there would be 32 terabytes archived, considering 1 megabyte per scanned book (Lesk 2005). The Wayback Machine was created in 1996. The collection of books from the Library of Congress dates from 1815. The Wayback Machine grows at the rate of 100 terabytes per month, which is almost three times the size of the whole book collection of the Library of Congress in bytes accumulated over almost two centuries.

In an anthropological essay – “The Historiographical Operation” – Michel de Certeau wrote a concise History of Historiography and summarised what this operation consists of in a few lines: “In history, everything begins with the act of separating, gathering and turning certain objects that were otherwise distributed into ‘documents’. However, this separation is always done after the work of the archivist, who is responsible for the selection and organisation of documents that will be kept at the expense of those that will be discarded” (de Certeau 1982).

But, given the media avalanche we produce every day on Facebook, Instagram, Twitter and other similar social networks, how do we choose what will be stored? And what if they were simply deleted by a system error or a discontinuation of the product? How to deal with so much unstable and fragmented information produced by us and about us? Is all this information really relevant? And what can we do when it suddenly becomes unavailable? Could museums be a solution in a context like this or should we remember Adorno, who wrote a long time ago: “Museum and mausoleum are connected by more than phonetic association. [...] They testify to the neutralization of culture” (Adorno, 1988: 173).

Nevertheless, all that we cannot keep is on the probable horizon of permanent loss. And this includes personal

memories, private and professional information, relevant data, a lot of futility for sure, and culture, art, and uncountable (perhaps fundamental?) unfinished works. Of course it is important to prevent loss, but it is impossible to store everything that is produced nowadays.

Until practically the end of the last century, according to Michel Melot, one of the world's leading authorities on archival and library science, budget constraints “in their wisdom” prevented institutions from literally overflowing. In an article suggestively entitled “Des archives considérées comme une substance hallucinogène” (Melot 1986), he pondered what would happen if every citizen became a collector and a curator and we could keep absolutely everything in the name of future historians. We would arrive at a paradox, he concludes: “History finally produced solely for historians and also blocked by them, like the surgeon who immobilises his patient in order to operate on him” (Melot 1986: 16). After all, as we learned in another short story by Borges (“Funes the Memoriosus” [Funes El Memorioso]) thinking is generalising, not only archive (“Funes the Memoriosus” [Funes El Memorioso]) thinking is generalising, not only archiving and adding yet more and more data.

Just as important as paying attention to the instability of the cultural system we are living in, and understanding how it demands new preservation methods, is realizing that these are only provisional and palliative solutions. Due to the continuous speed with which technologies are discarded in shorter and shorter periods of time, the solutions provided for the time being are bound to create the same problems we seek to resolve. The transposition and adaptation of works to new equipment or their reprogramming does not result in definitive solutions. On the contrary, these procedures indicate the need for continuous updating, which, at some point, may also produce a quite distinct result from the work created by the artist in a given historical context. From now on, loss, change and even replacement will be more and more part of our conservation practice.

Following a similar term coined by Arjun Appadurai's about the five scapes of the global exchange of information, we can say that we are facing nowadays a noisy ‘data-escape’, which goes far beyond our screens. Its signals and inputs/outputs are everywhere, and they amount too much more than just some reading or coding mistakes. In this sense, we could say that, instead of celebrating

a progressively more stable future, by preserving fragments of the past, museums of digital art should be the museums of the unfinished, the unrepaired, and the unretrieved. By doing this, they will allow us to deal with the social and emotional perception of loss without counting on an imminent process of disappearance.

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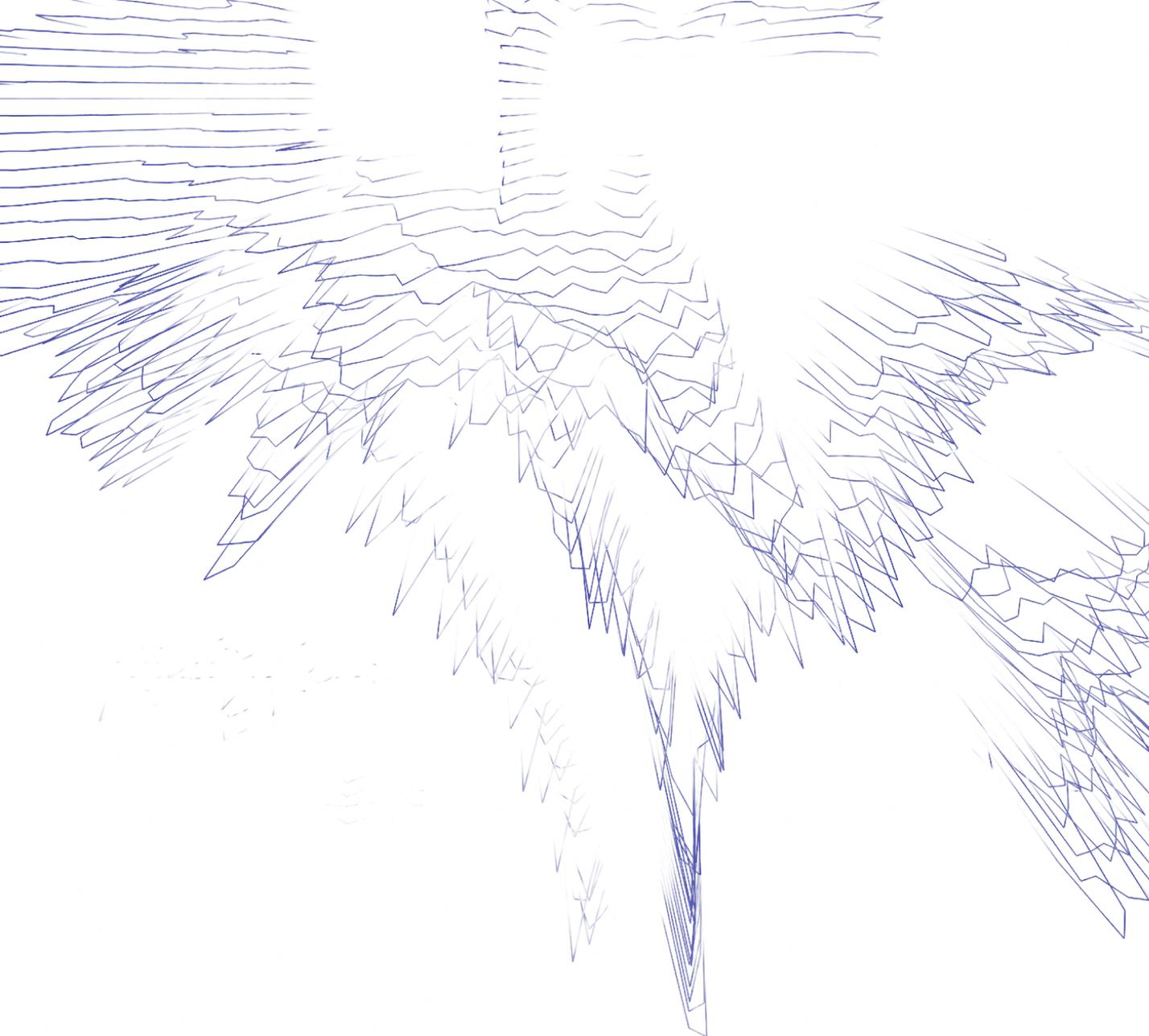
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