Perceptual Correspondences of Abstract Animation and Synthetic Sound

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ABSTRACT

Composing with timbres involves an approach that is very different from the usual way of conceiving traditional Western music. In fact, it is problematic to attempt to organize timbres according to traditional principles. The author believes that if it is possible to establish links between audio and video events, then it is both possible to use the visual language to organize a music composition and possible to create abstract visual objects that correspond to synthetic sounds, consequently having a bi-univocal link between audio and video events. The relationships between abstract animation and synthetic sounds are investigated in light of the correspondences between sound timbres and visual shapes, between perceived audio and video spatial locations and between perceived audio and video intensities. An audiovisual work called *Dynamics* was based on these correspondences.

In order better to explain why I am interested in such a project, I would like to review the steps that in the past have led me to this current research.

I started to be interested in 'musique concrète' and electronic music in 1974. In 1975, I began to study electronic music at the Conservatory of Milan. My music compositions since then have been conceived together with images. At first, in order to have a visual counterpart, I used simple tools such as slides and lights, but soon realized that a dynamic medium would be necessary to match the time-based structure of music. Therefore, I decided to paint a Super8-mm film by hand: I exposed a blank film to light without a camera and painted the transparent result with different inks. The final film was a very fast sequence of spots changing colors and shapes. The film was then coupled with a soundtrack containing a similar sequence of events. Even though there was not a one-to-one correlation between the audio and visual events, the effect was striking and successful. However, at that time I was not aware of the abstract films that many artists produced in the 1920s and 1930s using many different techniques, such as hand painting, optical filters and colored papers, to create dynamic synthetic shapes [B2, B19, B24, B32, V9, V10, V13–V22, V26, V29–V35]. The first abstract film ever produced was probably *Diagonal Symphony* by Viking Eggeling (1921), while the first abstract film with a synthetic soundtrack (i.e. not recorded) was *Tonende Handschrift* by Rudolf Pfenninger (1929). In *Tonende Handschrift,* Pfenninger painted the area of the film normally used for the soundtrack, thereby controlling the sound with a synthetic tool. It was particularly important and encouraging for me to realize that the way I was following was not new and, on the contrary, that many artists had been on the same track in the past.

The first decades of this century were very active in terms of experimentation with mixed media. Artists such as Scriabin, Kandinsky and Klee were interested in combining music and visual arts [B17]. Even more important, the Soviet director Eisenstein was the first artist to create a movie based on a contemporary composition, *Alexander Nevsky* by Prokofiev [V11]. Eisenstein also introduced many important ideas for organizing the visual and the musical aspects of film when creating the work and when editing. He wrote several books in which he explained his montage technique in detail and stated the possibility of having an *audiovisual counterpoint,* a fundamental concept for this kind of art [B7]. However, although he introduced new ideas about audiovisual language, his movies were narrative, and in this sense traditional, while the other filmmakers I have mentioned created non-narrative films, the kind that I have always been interested in. It is interesting to note, however, that towards the end of the 1920s music visualization using abstract animation was quite popular in Europe, and it was regularly shown in public theatres. The most famous of these filmmakers, O. Fishinger, was even hired by the Disney studios to direct part of the film *Fantasia.*

I saw many of those films and other films made in the 1940s and 1950s [V23, V25–V28, V37, V38] and realized that the electronic media would be suited for me to create audiovisual works. I subsequently came across other artists' work. I found that John Whitney Sr.'s concepts were ideally connected to the works of the early filmmakers, since Whitney has always created abstract films and videos. Also, Whitney began in the 1940s using the film as physical support, but subsequently ended up with videotape and eventually computers as image generators [B40, V38–V44]. I, too, began to use computers, an Apple II Plus specifically, in order to create images and music with a digital medium. The main advantage of such a medium is the great control of each event in the audio and video domains. My ideal has always been to have a common software controlling the audio and video devices.

I started creating several works with digital media in 1981. These included *Orbital City,* which used a common structure for the music and the images. Produced with a Yamaha CX5M, a small computer with low-resolution graphics and FM capabilities, *Orbital City* took into account many interesting ideas about the meaning of sacred shapes and their correlation with ancient music [B3, B4, B18, B33, B34, V1].

In the last few years I have met with other artists involved in this particular art field, and I have seen many other videos and works related to this idea [B8, B10, B11, B13, B14, V4–V8, V12, V36, V45, V46]. Even though some of the works and ideas were not interesting to me, they all contributed to a better understanding of how to continue this fascinating research. For example, in Milan I met painter called Luigi

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Veronesi, who wrote an interesting paper *Proposta per una ricerca sui rapporti suono/colore* (Proposal for research about the relationships sound/color) [B38]. I then composed several pieces based on Veronesi's ideas and variations and displayed them at the Venice Biennale under the title *Isomorfismi Suono Luce* (Isomorphisms Sound Light) [V2].

DYNAMICS

Dynamics, which has received support from the Council for the Arts at M.I.T., is based on correspondences between aural and visual objects. The correspondences are extended across several perceived parameters of the audio and video objects. In *Dynamics* there are three fundamental correspondences between the audio and video events: timbre-shape, perceived location and perceived intensity.

Timbre-Shape

I have decided to establish this correspondence because I think that timbre and shape are the features that best define what we hear and see, respectively. Arnold Schoenberg more precisely states in his *Harmonielehre,* "I think that sound reveals itself by means of the timbre and that pitch is a dimension of the timbre. The timbre is therefore the whole, the pitch is part of this whole, or better, pitch is nothing more than timbre measured in just one dimension" [B35]. However, one of the original goals of this project was to create a composition using complex timbres. My musical interest is in fact highly concentrated on timbres. I think that timbre has become one of the areas of major interest in contemporary music [B35, B37]. One of the great innovations that computers have brought to music has been the possibility of synthesizing new sounds, immensely increasing the number of instruments a composer can deal with. Jean-Claude Risset and David Wessel also stated, "With the control of timbre now made possible through analysis and synthesis, composers . . . can articulate musical compositions on the basis of timbral rather than pitch variations. . . . It is conceivable that proper timbral control might lead to quite new musical architectures" [B28]. In the visual domain, I believe that shape is the element that defines an object. However, I think that the actual physical phenomena of sound and light have very different properties and behavior than hearing and vision. Nevertheless, I think that in our minds there are similar 'categories' (qualities) common to vision, hearing and other senses [B12]. This is why I believe it makes sense to speak, in everyday language, about 'cold color' or 'harsh sound' and so forth [B6, B16, B20, B21, B26–B28, B34, B39].

Perceived Spatial Location

This correspondence is established between the positions of the audio and video sources in a space. For instance, a visual object located in a certain position in space emits its sound from the same location. One way to achieve this result is to use a video projector, a big screen and four speakers located at corners of the screen. The speakers then create not only the usual stereo image (right-left), but also the top-bottom image, filling the area of the screen. However, the perception of the localization of sounds is not as precise as that of visual elements and is a function of the spectral content of the sound [B15, B36]. This fact influences the way I imagine the size of the shapes to be matched with the sounds. In other words, the original size of a certain shape is a function of the spatial extension of the corresponding sound, which is in turn a function of the spectral content of the sound itself.

Perceived Intensity

Another precise correspondence is between the perceived intensities of the audio and video events (loudness and brightness). As loudness changes, following an envelope, so does the brightness of the corresponding shape change. Eventually, the visual object can fade out while the loudness becomes zero [B15]. This correspondence has a side effect: since the attack of sounds influences the perception of timbres, the envelope of sounds can modify not only the brightness of the visual object, but also its shape.

When creating the correspondence, my approach is:

- I create a sound I am interested in. It is usually easier to model shapes on sounds than vice versa.
- I sketch an outline of the temporal behavior of the main components of the timbre.
- I imagine a shape that changes over time and matches the behavior of sound and I write down a description of the shape.
- When creating the 3-D model I listen again to the sound and if necessary modify the model so that it matches the sound. Since often the timbre changes over time, so does the shape. In order to produce this effect, I use three different methods:
  1. I create two 3-D models (initial and final) that are then interpolated when animated (in some cases I use more than two models).
  2. I rotate the object along one (or more) axes. Since the shape is irregular, it reveals other aspects that have not been seen yet.
  3. I use two (or more) different objects. At the beginning, object one is hidden by object two. Then object two arises, creating a more complex shape. This process can be reversed (two objects initially) and is particularly useful when I am dealing with processes of spectral fusion [B22, B23].

The way I decide how much to match timbres with shapes is clearly very important. I associate low-energy spectra with smooth shapes and high-energy spectra with edged shapes. I use textures and colors to enhance the idea already provided by the shape. Harmonic sounds become non-reflectant objects, while inharmonic sounds are associated with shiny and metallic objects. For example, white noise is represented with a highly irregular, bumpy and shiny object. Or, I have described an inharmonic sound with high energy content as rotary blades. Also, a sound that is present (i.e with components around 2000 Hz) is represented as close to the viewer.

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