

## **The Composer and the Orchestra - Closing the Gap**

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**NeXT Computer**

When composers began using computers to make music, the relevant computing conditions were in a state much as they are today for computer graphics. In order to achieve the level of realism, expressive control, and timbral nuance necessary for a satisfying and successful musical art, real-time control was out of the question. Compute ratios of 100 or 200 to 1 were not uncommon, especially when compute-intensive qualities such as digital reverberation were included. But back around 1976 when I began my doctoral work at Stanford, the excitement and satisfaction at working in a pioneering and futuristic medium was great enough to make us abandon good sense and spend the small hours of the morning computing a few tens of seconds of music.

As most of those early works were sans performers and presented on tape, we often questioned the need or appropriateness of the traditional concert presentation. However, there were some good reasons for retaining it at the time. The extreme dynamic range and frequency bandwidth of computer-generated sound required an uncommonly high degree of power and accuracy in audio reproduction. Sound systems also needed to be carefully equalised to minimise the acoustic non-linearities of the listening spaces. Many compositions used four or more discrete channels of audio in order to be able to simulate moving sound sources in space. This technique required the careful control and balancing of the sound system and positioning of the loudspeakers. Even today the precise effects accomplished then cannot be reproduced on home sound systems, even with the increasingly popular film-type surround systems.

It is undeniable though, that the live performance tradition in music is very ingrained and powerful. Pressures soon developed within the computer music community to find techniques for real-time performance of computer music. This led first to the development of large, centralised, expensive, and usually therefore one-of-a-kind digital synthesisers. Notable examples of this class of machine are the Systems Concepts Digital Synthesiser at Stanford University (recently retired in favour of a network of NeXT computers), and the 4X synthesiser at IRCAM in Paris. Eventually, commercial activity produced frequency modulation, wave table, and sampling synthesisers, along with the ubiquitous Musical Instrument Digital Interface (MIDI). The commercial technology made available at an affordable price certain discreet subsets of the possibilities allowed by the earlier monolithic synthesisers.

Both developments were seen as a mixed blessing by those accustomed to the total computational flexibility of the general-purpose computers we had been using for synthesis and signal processing. Live performance was fun, and contained the exciting element of the unpredictable. However, because of the newness of the technology, it was also more risky, and many wonderful and expressive computer music techniques were still not available in real-time, or available only at a lower level of quality or expression. I sometimes feel jealous of artists who work in media which have little or no tradition of live performance. For example, I have yet to see anyone coming out of the International Tournée of Animation saying, "Well, it was ok, but it would have been much better as a play". In other words, they are allowed the luxury to refine works until they are completely satisfied with all details, whereas in performed music, even when you think your score is perfect, any one performance always falls short of perfection.

There exists something of a double standard even within the music audience. The same traditionalists who complain about the lack of a performer on stage at a concert of taped works spend hours happily listening to recorded performances at home, without demanding that the orchestra be in their living room. In fact, when works are presented as recordings, there is no inherent difference between synthesised music and music whose sounds came originally from acoustic instruments. In this context, one listens to whatever "performance" is there, whether programmed by the composer or played by humans. There is no reason why the same cannot be true at a concert presentation of taped works, if the audio quality is of sufficient calibre. If taped works fail, it is usually the fault of the composer who, used to having a performer transform his scores into music, neglects to take responsibility for that level of expression himself.

Today though the live-performance of computer music is in the process of making another advance via new generations of computer technology. The latest general-purpose desktop computers and accessories are extremely fast and powerful. They support a great deal of real-time control, and also allow a return to the more general approaches to computer music of the past, wherever commercial synthesisers and signal processors fail to provide needed capabilities. Real-time possibilities now include not only sound synthesis, but also algorithmic composition, the processing and manipulation of live and recorded sound, and the simulated movement of sound in space. The quality of the latest sound synthesis techniques and hardware is also very high. The dynamic range and timbral pallets of the best computer music systems are measurably comparable to that of a symphony orchestra.

Computer music systems can perform sophisticated interpretations and mappings of a performer's gestures in order to control much more music than can be performed on any one conventional instrument. To accomplish this, a repertoire of knowledge of the details of a composition's musical style, harmonies, textures, and other structures can be taught to the computer in advance, so that during the performance the performer may direct events at a higher level of expression. One may envision a musician in such a context as having a role in between that of conductor, composer, and performer. The role can be continuously varying -- as musical complexity increases, the computer assumes an increasing amount of responsibility for the musical details and the performer's gestures are applied at a higher level.

In experienced musical hands, this kind of system has the potential of expanding the performance capabilities of the individual musician from that of a single instrument into the realm of complex orchestral expression. Such a system represents a step in the effort to narrow the gap between the symphonic composer's imagination, and the direct experiencing of his work by others, perhaps even as it is created. This is a liberating concept, in an era where most orchestras are de facto early music ensembles, under the control of conservative benefactors or government agencies, and have no money to pay for rehearsal of new music.

As computers continue to increase in speed and flexibility, these concepts will no doubt be extended into the visual domain as well. It has even been proposed that since computers allow music and graphics to be composed and synthesised using a common set of principles, that this combined medium is inherently superior to music or graphics alone and is destined to supplant both. I believe that this attitude arises from a naive understanding of how art interacts with the listener or viewer. In our renewed enthusiasm for the synaesthetic experience, we must not lose sight of the fact the much of the power of music, or any art form, lies in its mysterious interaction with the listener's own imagination, personal experience, and unique emotional psychology, whatever the creator's intent. If we add a strong visual element to music merely for the sake of expanding the artist's range of expression, we may easily wind up weakening the experience of the listener and viewer, as we have effectively co-opted an element that was previously left to the audience's imagination. The artistic message may become more specific, and the experience more universal, but at the expense of depth of personal experience which the music or graphics alone formerly allowed.

Obviously there is potential in a new art of sound and light under the control of high technology. It is not, though, a successor to or enhancement of either purely musical or purely visual art forms. It is rather another thing, to be entered into with twice the care and thought, and with our eyes and ears wide open.