

The computer as alter-ego

The use of computers in the composition of music

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The Computer as a Catalyst for Interdisciplinary Communication

There is a growing communication among intellectuals taking place around the digital computer. However this may appear, to regard the computer as the focus of interest, is to miss the point. The computer is playing the role of a generalised multifunctioning catalyst. This catalyst enables communication of new, often abstract, structural ideas across different intellectual disciplines. It is assisting in the exploration of the intersections between sometimes widely varied disciplines and in doing so is producing a more wholistic approach to research and composition in both the arts and the sciences.

All those who use computers in often complex, exploratory ways, are using computers to understand design and the processes of design. The challenge is that with computers, we have to be more explicit about what is involved in creating a design, a composition, and this allows an exploration of what takes place while this creating is happening.

This new focus of attention by intellectuals from so many diverse fields, then, is not the computer (hardware *or* software) but our own thought processes, processes of judging, deciding, choosing, in short of what we choose to call "creating". In short, each of us are making alter-egos with and through which we converse and debate our compositional and aesthetic predispositions. Perhaps we are creating "The Soul of the New Machine".

One recent model for the mind² suggests that it is an agglomeration of a large number of centres of local or specific knowledge (local experts) which cooperate in the pursuit of not only mental but emotional tasks. These centres work with access to a global memory space. This memory space is accessible to all of the centres which make their contribution to the task at hand for both reading and writing. Often these local centres will access the same data in a different way - not unlike the use of Union or Multiform structures in computer programming.

¹ Minsky, Marvin: *The Society of Mind*. New York: Simon & Schuster, 1985.

¹ Hillis, Daniel W: *The Connection Machine*. MIT Press, Cambridge Massachusetts, 1982.

² Minsky, Marvin: *The Society of Mind*. New York: Simon & Schuster, 1985.

When some of these local centres become automated by way of artifacts called computers (and their programs), a reorganisation of this "society of mind" takes place. This reorganisation ripples through and causes a reconfiguration of the space/time equation (i.e. memory vs computation time) for the whole of the "society". This is one way in which a new mode of thinking is born.

The Composition/Design Environment

There is a widely held suspicion that composers who work with computers have given up their intuitive involvement in composition. Such suspicion is based on a lack of knowledge about the composer's task environment, as well as the present limitations of artificial intelligence.

For composers using computers, much of their design environment consists of techniques (otherwise known as 'algorithms' or 'programs') that act as external 'memories' holding musical knowledge; like other compositional techniques, these programs represent objective thought, without which the composer cannot function.

To more fully understand a composer's approach to composition, it is necessary to understand the design environment within which s/he works. In this environment the composer undertakes such things as:

- design and planning (precompositional sometimes associative explorations (both musical and extramusical), sketching etc),
- generation of composition data (perhaps via algorithm),
- notation and storage of this data for study, reproduction and recording,
- sound design and modification (microcomposition)
- physical implementation of the composition's performance (spatial layout, recording medium etc).

The exact nature of the design environment and the way a composer operates within it can vary from composition to composition. One feature of it is the numerous possibilities for feedback. Whilst it is not the case that making music with computers is necessarily quicker (often quite the reverse!), the turnaround time between a compositional idea and the heard result can be significantly less than for instrumental music - particularly orchestral music.

The Generation of Compositional Data: Algorithmic Composition

In the short time that computers have been used in composition, there has been an enormous increase in the sophistication of the algorithmic generation of compositional data.

There are three different approaches to, or if you will, types of, algorithmic composition. They are:

1. **Rule-based or Interpretive composition** - is based on the interpretation by the composer of computer-generated data. In this situation the computer is used to analyse and synthesise processes; to generate data according to various rules, some deterministic, some probabilistic. The composer maps the data into the musical space in varied ways and with various degrees of rigor.
2. **Example or model-based composition** relies on examples extracted from remembered musics. This model yields a definitive score based on highly detailed input data or specifications. Neural networks and the connectionist/learning based approach - a relatively new field - seems likely to make significant inroads into this type of composition, especially as the new parallel processing architectures become more readily available.³

This approach can be seen as freeing composers from having to come up with the rules for a music that they might not think of in a rule-based manner. The connectionist approach allows one to compose (or find) examples of music one wants to create and to use a network trained or focussed on these examples to help explore the works that exist in the spaces between the original compositions. Musics of the past as well as musics created by the composer, whether through-composed or even generated by some rule-based method are equally suitable for use. The neural network can then be used by the composer to go beyond these works and explore new aspects of them.
3. **Improvisational composition** starts from a sketch or outline - of variable detail - which is elaborated by the composer/performer or composers/performers during a performance. This use of computers has

particular types of machine-based constraints because of the 'real-time' requirements of live performance.

Elsewhere at this conference there will be a discussion of this use of computers with demonstrations using *EventMaker* - software written at ACAT - which is specifically designed to integrate this type of composition with rule-based methods mentioned earlier.

Conclusion

As part of their compositional process, composers use two complementary approaches:

- Goal driven (top-down), and
- Data driven (bottom-up)

Whatever combination of these approaches a composer chooses for a particular work, computers can be useful in this process because:

- They can be used for creating new social and physical design environments in which to work; thus enabling them to distance themselves from conventional approaches;
- They are good modelling tools which inspire new understanding of the artistic processes which they help to objectify;
- They help focus on the imaginable, i.e. the possible, in contrast to the existing, and are thus liberators;
- They can extend the power of the composer's technique by the enabling the rigorous exploration of new structuring principles of previously unachievable proportions;
- They can increase the efficiency of the composer by assisting with the mechanical aspects of the craft.
- They are stunning synthesis and resynthesis tools, whether it be for sonic materials or thoughts;

There is little doubt that the digital computer is the most powerful human artifact yet produced. In all cultures, music reflects the age in which it is written. So, just as the introduction of that other extraordinary digital instrument, the overstrung grand piano - which in itself encapsulated the height of 19th century engineering technology, radically affected the music of its period, the act of composition itself is being radically altered by the use of this special tool.

³Hillis, Daniel W: *The Connection Machine*. MIT Press, Cambridge Massachusetts, 1982.