Electronic music and life*

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1. INTRODUCTION

At any moment in the history of a particular culture, there exists a dominant paradigm, an idea in the air, that expresses the way the world works. These paradigms are general and their manifestations are interdisciplinary, first expressed as structures, relationships and processes in the avant gardes of all fields, then gradually accepted as a norm by almost everyone. Such paradigms in music are interpreted by composers in terms of the composers' artistic personality, personal history, cultural history, access to tools, and other factors, and may produce a wide variety of specific musical styles. Further, old paradigms may co-exist along with new ones. To whatever extent its manifestations are elusive, however, and to whatever extent a new paradigm may share a concert hall with an older one, the concept of a shifting dominant paradigm offers us a framework for understanding the progress of ideas in our cultural history as the evolving nature of the avant garde. The dynamics of that evolution is best described by what this author has dubbed 'Foresta's Wheel',[1] which illustrates, as drawn by Don Foresta, a cycle of new theories leading to new discoveries that lead to new theories, and so on into an indefinite future.

In the context of evolving paradigms, this article asks: Where have we come from? Where are we now? And where are we going? And it proposes an answer to those questions that treats the structures and processes of electronic music as an integrated aspect of our lives, representing the same concepts that govern our thoughts about the world in general and that have changed our world through the twentieth century and will continue to change it.

My point is straightforward and simple. It is that we are now at the beginning of a musical revolution so profound as to alter our definition of music, our definition of what constitutes a musical instrument, and our perception of the function of music in our culture. Although it is often difficult in making such arguments, especially in the context of shifting paradigms, to know whether technology is the cause or the effect of new concepts, it is clear that our increasing use of electronics, and technology in general, is at the heart of this revolution; and, consequently, it becomes clear that electronic music is undergoing an identity change from that of an artistically marginal medium to the mainstream of future art.

2. PARADIGM SHIFTS

As a brief prehistory, the Western world view between 1600–1900 was of a synchronous and determinist universe; and determinism, which described an ideally predictable universe, subsumed the concept of symmetrical time. This was the age of Newtonian dynamics, modelled in an orrery, a tabletop watchmaker's model of the Newtonian solar system.[2] An orrery contains a main gear that, when turned by a crank, causes planets and moons to revolve around a sun at their relative speeds, always synchronised to the single line of time – Newton called it 'Absolute Time' – as animated by the turning of the main gear. In the motions of an orrery, it is obvious that the future positions of the planets and moons can be predicted with certainty if we know their present positions and the speed with which we turn the crank. The present, in other words, leads to the future, or, put more simply, A goes to B. The crank can also be turned in reverse, however, causing the planets to move symmetrically backwards in time, a feature of Newtonian dynamics – in Norbert Wiener's words: 'The music of the spheres is a palindrome'[3] – that links the past, where all is known, to the future, where all is known in advance.

The period from 1600–1900 also marks the age of tonality in music. The idea that there is a single line of time to which everything is synchronised, that A goes to B, and that structures are symmetrical, are mirrored in the music of the time: every note and decoration is synchronised to a single line of harmonic change, dominant chords go to tonic chords, and forms are symmetrical as they lead from and towards a tonic.

*Based on a paper written for the conference, 'Electroacoustic Musics: A Century of Innovation', 15–17 October 2003, Paris.

[1]Personal communication, 2001.

[2]From Newton's *Principia* (1687), as quoted in Max Born, *Einstein's Theory of Relativity* (New York: Dover Publications, 1962), p. 57.

[3]Norbert Wiener, *Cybernetics* (Cambridge, MA: MIT Press, 1948), p. 31.

Organised Sound **9**(1): 3–6 © 2004 Cambridge University Press. Printed in the United Kingdom. DOI: 10.1017/S1355771804000020

https://doi.org/10.1017/S1355771804000020 Published online by Cambridge University Press

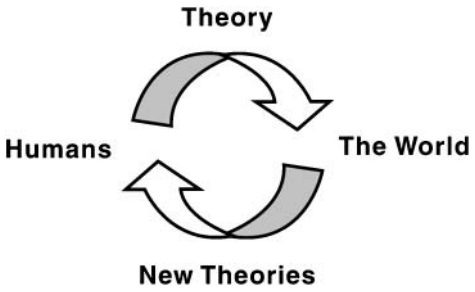


Figure 1. Foresta's Wheel.

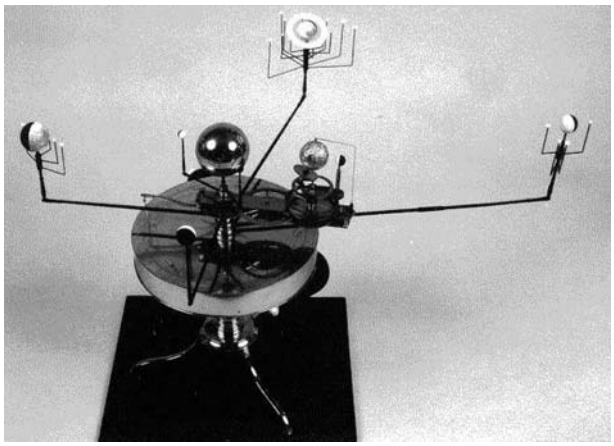


Figure 2. Orrery: Union College, Troy, New York.

The paradigms important to electronic music evolved through the twentieth century, from a universe of multiplicities, as in the refutation of a synchronous universe by Albert Einstein, Charles Ives, Igor Stravinsky, Claude Debussy and Arnold Schoenberg at the turn of the century; to perceptions of underlying complexity and a refutation of determinism, as in Niels Bohr, Werner Heisenberg, Schoenberg and Anton Webern between 1920 and 1950, and further by Pierre Boulez and Milton Babbitt in the 1950s; to the articulation of a system as a dynamic whole that functions as it does because of the way its parts interact, first by Ludwig von Bertalanffy and Norbert Wiener in the 1950s, then by John Cage and David Tudor in the 1960s, then by Salvatore Martirano and myself in the 1970s; to more recent concepts of interface, as if to ask: How do we deal with the complexity of the world?

3. EVOLVING CONCEPTS OF MUSIC

Everyone expresses in one way or another their theory of the functioning of the world. Some people theorise a world governed by old paradigms. Others, known in the arts as the avant garde, theorise a world that is based on a new paradigm. Composers express their theories through their music.

The music of the age of tonality was an anthropomorphic projection. Composed directly and intuitively, in its instruments as extensions of the human body, in its phrases based on breaths and arm motions, in its rhythms based on dances and marches, and in its tonal structures based on the morphology of emotion, with harmonic (emotional) complexity causing melodies (voices) to grow higher and louder, it projected the physical and emotional activity of a human being. That A went to B projected the common sense connection between action and result: Would we throw the switch if we did not expect the light to come on? There was little notion before the twentieth century of a world outside of human perception. With notable exceptions, among them Galileo and his telescope, there was no felt necessity for an intermediary technology via which we viewed nature.

But in the 1920s, following the First World War, it became common knowledge that nature extended beyond the human range of perception to objects smaller and larger than we could see with the unaided eye; and that technology was necessary to view atoms and stars. There were two musical corollaries to this: the first was the use of sounds beyond the capabilities of traditional instruments; the second was the use of an intermediary technology in composing.

The use of sounds beyond the capabilities of traditional instruments ultimately resulted in 'the great opening up of music to all sounds', as I have called it in other writings. In parallel with the development of intermediary technologies for music, the use of found sounds began during the first half of the century; then, with the availability of the tape recorder around 1950 and the possibility of editing sounds in a sequence on tape, it became one of the musical mainstreams.

The first use of an intermediary technology in music was Schoenberg's use of the so-called twelve-tone system in the early 1920s. By mid-twentieth century, the use of an intermediary technology, whether that technology was called the twelve-tone system, chance, serialism, algorithmic composition, or any other method, had in itself become a process that represented an underlying complexity that increasingly separated the final musical result from the composer. Music composed in this way is not an immediate result of the composer's creativity, not an anthropomorphic projection representing physical and emotional activity, but rather something more independent, something with its own identity, something that suggests a world that exists apart from the composer. It may seem paradoxical, but the representation of an external world as a musical composition brings the music closer to life because it represents the world in which we live and with which, at least potentially, we can interact.

4. FROM MUSICAL OBJECT TO INTERACTION

An object is a whole that is defined by the boundaries that separate it from the rest of the world. A musical

https://doi.org/10.1017/S1355771804000020 Published online by Cambridge University Press

composition as object has boundaries of time which are defined by its beginning and end, between which time passes in a way that is different from the passing of time in the world around it. Musical compositions through the age of tonality and through the middle of the twentieth century were normally conceived as objects, separated from the rest of the world because their content was fixed in a score and because their temporal boundaries were defined by beginnings and endings. Even when systems, statistics, algorithms, serialism or other indeterministic structural concepts were used in the composing process, the result, as in music by Iannis Xenakis, Lejaren Hiller, Pierre Boulez and many others, was a fixed score, a musical object.

A major paradigm shift from object to dynamic system began to take place in the 1960s in works by John Cage and David Tudor. A dynamic system is typically animated by an underlying complexity but, different from an object, it functions during a performance to generate music with at least a degree of unpredictability. Its boundaries are permeable because it has no beginning and no end and the way its time passes is typically linked in one way or another to the real world, as in Tudor's *Rainforest*, where the public listens to the music by wandering through a space.

In the early 1970s, with modular analogue systems and digital electronics easily available, the first interactive instruments were developed independently but more or less simultaneously by myself and Salvatore Martirano. An interactive instrument is a dynamic system that has its own identity in that it can seem to think for itself, make its own decisions, and produce an unpredictable and distinctive output. In this context, 'interactive' means mutually influential. An instrument is interactive when it influences a performer, by providing the performer with something to react to as a cue for what to do next, and when the performer, in turn, influences the instrument by performing.

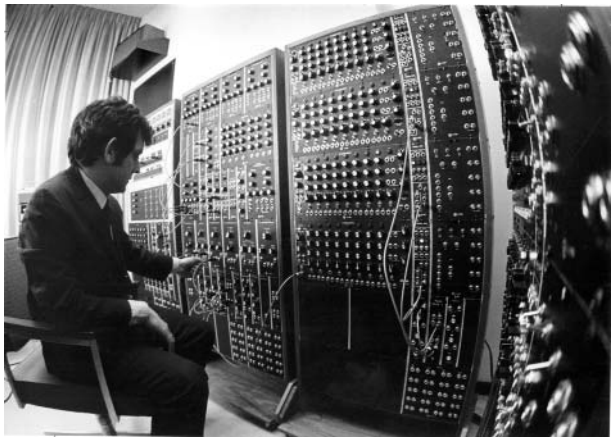


Figure 3. Joel Chadabe, 1970.

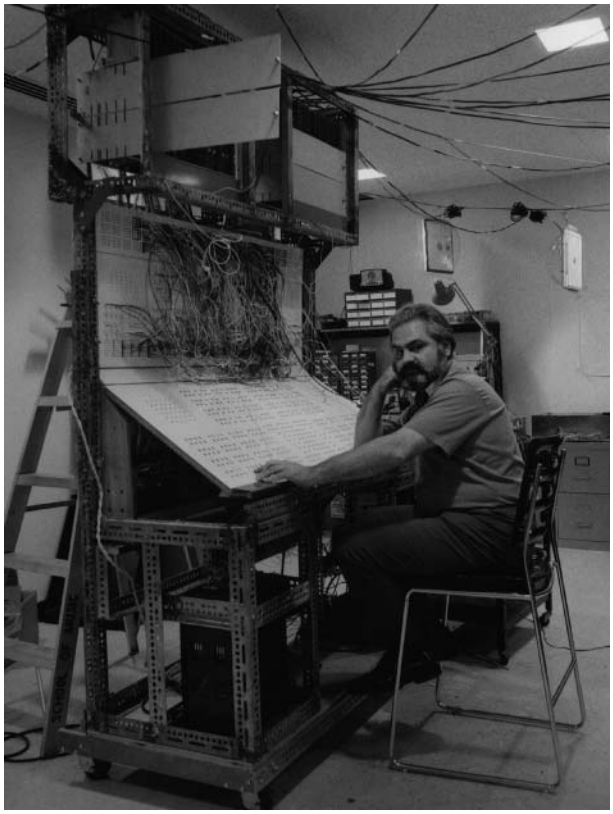


Figure 4. Salvatore Martirano, 1974.

A performer and an interactive instrument have a relationship that is conversational.

5. WHERE ARE WE GOING?

The evolution of paradigms through the twentieth century has brought us to a point where interaction, and consequently interface, are the dominant concerns of the avant garde. But the current avant garde, unlike the past avant gardes that have shocked but not changed the art world, is now participating not only in developing new musical forms but also in exploring and shaping a new musical landscape that contains the seeds for a significant cultural and artistic revolution.

At the base of such change is the availability to the public of affordable technology and the consequent empowerment of individual creativity. This democratisation of the music world means that composers that use technology are perforce explorers in this new landscape and that their audience, which will enlarge as larger numbers of the public become technology-savvy, consists mostly of practitioners. These practitioners will not likely need instruction in the use of their computers and instruments, since the equipment manufacturers will provide at least a basic knowledge. But they will need creative models for what to do, and composers, whether knowingly or not, will be playing that role. They will be playing that role in a world that brings technology and musical creation into the

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contexts of diverse cultures, sometimes leading to results that are not recognisable as part of a western-world tradition. And this democratisation of music creativity is largely made possible by the quick distribution of materials and instant global communication offered by the Internet.

In the context of Internet distribution and communication, interactive instruments and the use of all sounds in music become significant far beyond the presentation of new techniques in a concert hall. For one thing, interactive instruments can obviate the need for a musical score by providing guidelines for performance actions, thereby facilitating musical creativity for people that may not have musical training; and, more, not only can people around the world communicate musically via the Internet, they can create music to make any point. The use of words as musical material can instruct and inform and convey additional meanings when embedded in a musical context. The use of environmental sounds can bring environmental issues to our attention. In short, the use of sound can lend impact to any point that a composer may want to make.

This multiple potential for music is at the heart of the new musical landscape. And this is where we are going, not abandoning our historical traditions of appreciating exceptional talent and skill in a concert hall, which may indeed play an important role in the new landscape, but forming a greatly expanded means of musical creativity and meaning. Is this closer to life than the classical concert tradition? Of course it is. A Beethoven symphony, for example, may convey innovation, talent and genius, but it is also an object apart from us. By contrast, we are now developing an approach to music that will integrate it into the fabric of our lives, that can be accessed by anyone, that can communicate ideas as well as abstractions, and, one might dream, lead to a better world.

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