The aesthetics of interactive music systems

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Computers in music have made possible new kinds of composition at the same time that they have caused upheaval in the social and cultural practice of music making. Interactive music systems have a particular place in this context in that they explore some highly specific techniques of composition at the same time that they create a novel and engaging form of interaction between humans and computers. In this essay, real-time algorithmic composition in works including improvisation are considered as well as the contrasts between interactive and tape music. The author's composition *Maritime* for violin and interactive music system is presented as an illustration of the aesthetic viewpoint developed.

KEY WORDS: Interactive music systems, algorithmic composition, improvisation.

Human/Computer Interaction

Computers are ubiquitous in music, cheap, easy to use, and tireless. These attributes make it attractive to use them for many tasks that previously were performed by human musicians. None of the reasons on such a cursory list, however, have anything to do with the nature of the music performed. In other words, a large part of the motivation for making music with computers on the scale that this is currently done derives from pragmatism and the fact that computers are less troublesome to employ than people. This situation has had a dramatic effect on the economic prospects for musicians, almost as dramatic as the introduction of television and sound recording equipment fifty years ago. One can deplore and condemn this trend in a hand-wringing Luddite reflex, but the fact of the matter is that it is unlikely to change except in the direction of ever greater reliance on machines.

There are other reasons to use computers in music, however, that have everything to do with the nature of the music performed. My own interest in computer music generally and interactive music systems in particular stems from the new compositional domains they open up, and those domains will be the focus of this short essay. An equally important motivation for me, however, is the fact that interactive systems require the participation of humans making music to work. If interactive music systems are engaging enough partners, they may encourage more people to make music at whatever level they can. I believe that it is critical to the vitality and viability of music in our culture that significant numbers of people continue (or begin) to engage in active music making rather than to simply absorb the music coming at them from loudspeakers on every side. Therefore, though the argument presented here will concentrate on musical issues, the social and cultural implications of interactive music systems are an equally important and compelling gauge of their aesthetic value.

Real-time Algorithmic Composition

The formalization of processes for the generation of music has a long and distinguished history in Western art music. From Guido d'Arezzo's chant generation method through the isorhythmic motet to serial techniques and Xenakis's "formalized music", interest in processes that produce music, or that govern many of music's salient aspects, has waxed and waned through several centuries of composition (Rowe, 1993). Through the use of interactive music systems, such processes can now be executed so quickly that they can be realized onstage as part of an ongoing performance (Chadabe, 1989). Moreover, interactive systems are affected by input from devices sensing the playing of human members of an ensemble such that the computer performer is able to respond to the humans (or other computer performers) according to the music being played.

Using processes for the generation of music moves the compositional act to a meta-level where the evolution of the music's character is controlled over time through the manipulation of a limited number of parameters (Loy, 1989). Interactive systems change the values of these parameters through algorithms taking a variety of inputs, including live performance data from other members of an ensemble. My own program Cypher analyzes MIDI data on two levels: first, it classifies incoming musical events across a number of features such as loudness, speed, and register; and second, the behavior of these features within the current phrase is characterized as being regular or irregular. The user (the composer) constructs rules using the output of this analysis. Such rules determine

which compositional algorithms will be invoked in response to which analyses and how the behavior of the algorithms will change over time. As a result of this process the program generates new MIDI output to be sent to synthesizers, thereby providing an additional voice to an ongoing musical texture.

Integration of Improvisation

Because interactive music systems derive control parameters from an analysis of live performance, they can generate material based on analyses of improvisation as easily as they can on analyses of notated music. Such systems become a ligature connecting improvisation to notated composition, as the same processes used to govern the notated music can be employed to generate new improvisations in real time. This possibility is an expansion of the domain of composition, one of the few areas where the computer has actually changed the nature of the compositional act itself. By delegating some of the creative responsibility to the performers and a computer program, the composer pushes composition up (to a meta-level captured in the processes executed by the computer) and out (to the human performers improvising within the logic of the work).

An interesting effect of this delegation is that it requires a very detailed specification of the musical decisions needed to produce a computer program at the same time that the composer cedes a large measure of control over musical decision-making to the human improviser. The resulting music represents a new kind of composition at the same time that it necessitates new kinds of performance skill. The human player working with an interactive system can learn how to perform with it much as she would learn to play with another human. The very real differences between computer and human performers mean, however, that the human has also a new degree of freedom in invoking and directing real-time algorithms through different styles of performance. An interactive composition changes and matures as the human and computer performances increasingly intertwine.

Tape Music

Since tape music was developed there has been ongoing debate about the aesthetic experience of listening to music with no human performers. Detractors feel that watching a tape hub go round in a darkened hall is a less rewarding (some would say ridiculous) concert-going activity

compared to seeing the interplay and virtuosic exertions of trained performers. Champions point out that music is now most often encountered in recorded form and that in that context the presence or absence of human players is irrelevant. Further, the communal experience of hearing tape music is a large space through superlative sound equipment is a valid and exhilarating aesthetic venture in its own right. The arguments I am advancing concerning the aesthetic qualities of interactive music are agnostic regarding the worth of what is often taken as its technical counterpole, tape music. Personally I have attended tape music concerts that were sublime and some that were appalling, and I must make the same observation of interactive performances I have seen.

It must be noted, however, that the two genres are not equivalent. It is obviously impossible, for example, for a tape to change its behavior as a consequence of any kind of real-time decision-making. Even in terms of simple coordination between electronic sounds and human performers, the kinds of music that can be made with the two technologies are different and have different sorts of constraints. In writing for tape and performer, for example, one simply cannot write a passage in which the tape and player must simultaneously make an attack after a silence of any appreciable length unless the human is listening to a click track or watching some timing display. In interactive music, the execution of such a passage is trivial. Some performers prefer to play with tapes, however, because tapes are much easier to set up and are always the same. The number of unpleasant surprises in performance is dramatically reduced when the technical requirements are limited to tape playback.

Maritime

My composition *Maritime* for violin solo and interactive music system (1992) was written to explore the compositional domains opened by the technology of musical interaction. Approximately two-thirds of the work is notated and the rest improvised. My interactive music program *Cypher* takes MIDI input from an electric Zeta violin played by Mari Kimura, the new music performer/improviser for whom the piece was written. During the performance, *Cypher* listens to the violinist, and makes up responses according to how it thinks she is playing. The way it responds changes often during the piece, as well as the sounds it uses. Some kinds of response are determined in advance, and in some sections the program asserts its own personality, and decides itself how it will play. The composition explores several textures and ways of combining the two players. The opening contrasts long, held notes with fast virtuosic

flurries, an idea that returns and expands throughout the work. A fasci-nation with triple meters alternates with the first texture. Through these strands, both the human and computer players are left areas of freedom to add their own commentary to the ongoing elaboration, producing a composition stable in its overall development, but with different realiza-tions at each performance.

Conclusion

There is very seldom something new under the sun of composition. Algorithmic thought is certainly not new, having in fact been in evidence in Western music composition from the beginnings of its notation. Using processes in performance that change their behavior according to an analy-sis of other players's music, however, was never possible before the ad-vent of computers and interactive music systems. Such systems therefore engender a realm of composition that was unknown only a few decades ago. I believe that this music, however, cannot be described as being "in its infancy" or passing through an "experimental" phase. The musical values evinced in interactive compositions are ultimately the same as those underlying a string quartet. By transferring musical knowledge to a computer program and compositional responsibility to performers onstage, however, the composer of interactive works explores the creative potentials of the new technology at the same time that he establishes an engaging and fruitful context for the collaboration of humans and computers.

Sound example

23. *Maritime* (excerpt)
     duration: 7'
     Mari Kimura, violin, and *Cypher*, interactive music system

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