COVER SHEET

Tools and Outcomes:
Computer music systems and musical directions.

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In the changing context of computer music composition where the computer becomes a commodity rather than a novelty, this paper examines the composers' relationship with the computer and how that relates to music making. Computer music making has a history of close association between tool making and music making. This relationship was first forged out of necessity, then out of interest and a dedication to new ways of composing and performing. At the turn of the century, after 50 years of computer music, computers are becoming just another musical instrument. With the development of a wide range of computer music software and hardware, tool making is no longer a necessity for computer music making, nor perhaps even a badge of honour.

In this paper I seek to present a broader understanding of computer music systems and musical directions by expanding the context in which computer music tools are examined to include the ever-changing social and personal situation of their users. From this perspective it is proposed that while the music is indeed influenced by the computing tools, it is in a way less direct and more complex than previously assumed. The causal effect for composers of tools on outcomes is neither direct nor consistent, I argue, and is less significant than cultural context of and personal engagement with the tools.

Portrayal of tools

In asking questions about the nature of the creative relationship with computers one wades into the currents of an ongoing debate regarding the nature of technology. One of the fundamental themes of this debate that is particularly pertinent to the compositional use of computers is, how important are the computing tools on the compositional outcome and why?

A composer's motivation for using a computer system might be broadly described in terms of her desire for efficiency or opportunity. Computers can be efficient in accelerating the composition, analysis, or publication process. MIDI sequencers, for example, can capture, repeat, notate, and replay music easily and enable the efficient production of music. Music publishing systems are widely available to produce scores, while inexpensive hard disk recording systems and CD burners have made CD production an everyday event for musicians.

In any desire for efficiency the computer is seen in relation to the composer as a utilitarian tool, selected for its speed or cost and ready to be discarded when a more efficient tool becomes available. The assumption about such a relationship with the 'tool' is that it is largely neutral to the music making process, that one tool can be replaced by the next more efficient one with little effect on the creative process or outcome. This

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attitude was expressed by Aristotle and still has a strong foothold in western civilisations. Webster Hood summarises Aristotle's view of technology.

Technology is a human arrangement of technics . . . to make possible and serve the attainment of human ends. Technology is not an activity which in itself satisfies man's nature. . . The value or meaning of technology is determined by this ordering toward something else; it is not thought to have any meaning in itself. It is, as is commonly said, neutral (Hood, 1972:347).

In this Aristotelian view technologies are neutral in two ways. Firstly, technology is artificial rather than natural. An artifact (a 'fact' created by an artisan?) is static and has no bearing on its surrounds. A technology is different from a natural thing, such as a tree, that has the potential to grow without human intervention and so to shape its future and to interact with its surroundings. Secondly, the Aristotelian view sees technology as a means not an end. The technology is created in order to serve some other purpose, a chair is made for sitting upon, a harp is for making music. The questions that are begged by this view are; can the chair be equally replaced by a box for sitting, and can the harp be equally replaced by a flute for music?

One of the distinctive aspects of computer music composers, and indeed other musicians and artists, is that the relationship with their tools is less aloof than that characterised by the Aristotelian view of utilitarian neutrality. Computer music systems are commonly understood to effect the music produced with them, from the more obvious aspects of determining the sounds and their quality, to providing structural possibilities and barriers that direct compositional processes and outcomes. The source of this influence is often cited as being the representational nature of the computer system, or 'Being Digital' as Nicholas Negroponte (1995) describes it. The descriptions of music representations can become quite sophisticated, including broadly theoretical descriptions such as the Generative Theory of Tonal Music (Lerdahl & Jackendoff, 1983) and specific computer music representational taxonomies such as Camilleri's "physical, symbolic, and semantic" musical attributes (1992:176).

I believe the relationship between user and tools can be seen more broadly than as an interaction between ways of understanding and representing music. The interaction with music transcends any single symbolic representation of it, for example. The influences impacting upon tool usage include social and cultural values. One example of such a view, strongly informed by Marxist ideology, is that of Ivan Illich who writes that:

An individual relates himself in action to his society through the use of tools that he actively masters, or by which he is passively acted upon. To the degree to which he masters his tools, he can invest the world with his meaning; to the degree to which he is mastered by his tools, the shape of the tool determines his own self-image (Illich, 1973: 21).

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This socially situated model of user-tool relationship acknowledges the effect of tool selection on production and the influences of social forces in shaping that effect. Illich acknowledges also the connection between a person's self-image and their tool usage, however, he still portrays the user-tool relationship as one motivated by control and mastery. While musicians appreciate the notion of mastery over a musical instrument, compositional process, or computer music system, my observations suggest that effective computer music compositional processes move beyond seeking a dominance over tools to a situation of working-with the tools. In this later conception the tool is allowed to have influence, and is perhaps even selected because of that influence. Technology is far from the Aristotelian notion of neutral and valueless, and more than an imperfect representational construct to be tamed, it is seen as a partner bringing valuable perspectives to the compositional task.

This notion of technology having significant and essential influence on human activities is a strong theme in phenomenological philosophy of the 20th century, but was articulated in the late 19th century through the writing of John Dewey who's position is summarised by Larry Hickman.

Tools and artifacts are no more neutral than are plants, nonhuman animals, or human beings themselves: they are interactive within situations that teem with values (Hickman, 1990:202).

Collecting together the differing perspectives on humans' relationships with technology presented above, I propose that an understanding of computer music tools requires consideration of; 1) the tools and their environment, 2) the social and cultural context in which they are used and, 3) the values and motivations of the composer using them.

Partnership in Context

I observe that most artists consider the relationship with their equipment a partnership. This indicates a significant difference between a creative relationship with technology and a more common utilitarian one. The partnership is characterised by the composer having a thorough understanding of the computational tool(s) that is gained through sustained engagement over time. As the partnership evolves the composer comes to think in terms of the tools facilities, and to the extent that the tool is flexible and programmable it can be adapted to suit the preferences of the composer. In the dialogue between composer and computer, as with a human partnership, new musical ideas and solutions arise. This argument assumes a constructive relationship with the physical world which is prevalent in the pragmatic philosophy of John Dewey who vividly described the human dialogue with technology as one where a sharing of meanings "copulate and breed new meanings" (Quoted in Hickman, 1990:37).

This partnership exists in the broader environmental, social, and personal contexts as outlined earlier. The effects of these contexts are more or less clearly evident in the music. For example, the effect of the tools is evident in the music as heard in the timbral influence of Frequency Modulation synthesis in the compositions of John Chowning. The

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effects of limited memory and the computers' ability to repeat and layer parts are reflected in the structure of the Techno music of D.J. Spooky.

The effects of social context are even stronger than equipmental ones for most composers. In the music of Steve Reich and Paul Lansky, tools are widely varied. Reich uses the Finale scoring program as his main computing tool, and Lansky composes with Cmix. However, they are both American, of a similar age, and have strong academic musical backgrounds. Their music displays a similar harmonic language, significant use of sampled materials, a shared focus on developing pieces from simple themes through repetition and 'distortion', and their pieces have formal structures of similar duration and developmental pace. The cultural influences create a musical connection despite the different tools being employed.

Although computing tools can open up vastly different musical possibilities, at times a composer's musical ideas are so strong they dominate the process and product regardless of the tools. One composer whose ideas transcended several different computing (and non-computing) systems is Iannis Xenakis. His dedication to the musical exploration of Stochastic processes influenced all musical aspects of his work including the selection of pitch and duration, and structural features at all levels from macrostructure (form) to microstructure (synthesis). Each computer music system he employed was directed toward this goal, and each piece provides another perspective on his ideas of formalised music.

Evolution of tool usage

Computer music composers gather around them an assortment of software and hardware tools. Just as a guitarist may have several different instruments, so most computer musicians have a variety of synthesizers, computers, or at least several software applications. Which tools are selected and how a collection evolves can be quite significant in the musical directions composers take. Contexts are influential in this arena too, a society makes tools available and provides the means for acquiring them, new tools need to fit into existing physical restrictions (such as electricity networks and operating systems), and personal preferences or priorities also play an important part.

There are at least three ways in which composers approach tool progression. One is a simple transference from one tool to another, usually with periods of short overlap, what might be called 'serial monogamy.' This usually occurs between tools with similar basic functions, such as changing from one commercial sequencer to another. A second model is an accumulation of tools providing an 'expanding vocabulary' in which to carry on the compositional dialogue. An example of this might be learning to use a non-realtime signal processing environment after working mainly with a hard disk recording system.

A third model, more common than the previous two in computer music, is one where a tool is progressively developed or extended. This most often happens in programmable systems but might also be seen as the model for adding plug-ins to extend functionality.

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This extensionist model seems to me to hold the most interest for computer music making, and has proven to be persistent in the past.

In systems that evolve, a serious question arises about what it is they are evolving into. Classic neo-Darwinian evolution is premised on the basis of adaptation and fitness. In a computer music system this often amounts to how well a music representation system fits with a particular semantic orthodoxy, either in terms of musical description, process, or outcome. A system might, for example, be evolved to better replicate acoustic sounds, the musical style of a particular composer, or the appearance of a typeset score. This approach relies on the precise specificity of the goal which tends to be easy when looking for efficiency but more difficult, if not counterproductive, when seeking creative novelty. Because the specification of a fixed goal is easier, many computer music systems evolve toward measurable results such as higher sampling rates, faster processing of existing functions, a greater number of features, and the reproduction of a wider variety of known musical styles.

Another characteristic of neo-Darwinian evolution is the value of persistence. The survival of the 'species' is the dominant measure of fitness. In computer music tool development this can be paralleled with the need for backward compatibility where functions are added but never deleted. This increases complexity and may not improve usability. While persistence is obviously a useful characteristic in many respects it can tend to restrict development in particular directions.

Although the notion of evolution is purely metaphorical, the assumptions of the metaphor can often be detrimentally transferred. In uncovering some of the adaptive assumptions of neo-Darwinism it will become clear how they have interesting parallels in computer music tools. As a stimulus for this revealing I will draw upon the work of Francisco Varela and his colleagues who suggest that to overcome the assumptions:

The first step is to switch from a prescriptive logic to a proscriptive one, that is, from the idea that what is not allowed is forbidden to the idea that what is not forbidden is allowed (Varela et al., 1991:195)

Computer music systems display prescriptive logic when they allow only a selection of functions with no user-extendible opportunities, also when they operate with limited rules which serve to corral users down particular pathways. These characteristics are frequently found in commercial music software. Proscriptive logic is a feature of most programming language based computer music systems that are highly open-ended. Such systems are often difficult to learn because the possibilities are extensive and not clearly evident, Varela et al. go on to suggest that:

The second step then, is to analyze the evolutional process as satisficing (taking a suboptimal solution that is satisfactory) rather than optimising. (Varela et al., 1991:196)

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In the compositional process there are many time when a suboptimal solution is quite adequate. General MIDI versions of orchestral drafts fit into this category. Some computer music systems allow users to test ideas at low sample rates to speed up compile times. In a small way the 'preview' functions on software make this step. But at a deeper level the message here for computer tool evolution is to reassess the drive for constant optimisation of measurable goals, and to focus more effort on the development of user control over the level of detail and to scaffold the user development of new features.

The computer as a compositional tool provides numerous new opportunities for music making. The effect of this explosion of opportunities over the past fifty years has been an exploration of many new paths. The evolution of compositional tools will continue to explore new paths. The usability of the computer will be improved most by evolving the tools in such a way that rather than following each new path in more detail, which leads to increased complexity, the tools should work in partnership with the composer to select the most promising paths and reduce complexity. In this way computer tools will assist aesthetic and expressive progression, not just technical possibilities.

Implications

For computer music composers, a critical awareness of the functions and assumptions of tools and their inherent representation systems will help them to understand how those tools influence music making by opening up or delimiting compositional opportunities. Tools, however, cannot be considered in isolation from cultural and philosophic contexts in which they operate. There is additional complexity in music making which simple tool-causality theories ignore. Composers should expect to continue making use of new tools as a way of expanding their compositional practice. Composers and tool developers should see it as mutually beneficial to work closely together in the evolution of computer music tool development.

Computer music educationalists need to acknowledge that an understanding of a variety of tools is necessary for an understanding of different computer musical outcomes. However, an understanding of tools is insufficient for cultural understanding or as preparation for students' future cultural development. This will require a greater awareness of the importance of social context and personal ontology. At the heart of this debate is the question, What is the computer musician? What are their core skills? The student themselves should be encouraged to grapple with these questions, and the place of the tools in any answer. A useful starting point for such a discussion might be to consider Paul Lansky's notion of the composer as 'sound giver' which implicates that distribution as well as production is necessary in defining a musician.

While most computer musicians will do some tool modification or design, there will be those within the computer music community who dedicate themselves to tool development. The computer music tool designer and builder should expect that tools will constantly evolve. That evolution should take into account the social and cultural aspects of composition and not focus simply on notions of more, faster, and bigger. A proscriptive model of evolution can be encouraged by building into systems a structure

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for user extensibility. It should be acknowledged that the context contributes extensively to the musical produced with the tool and that it is easier for the tool to fit into the context than to try to make the context fit into the tool.

Conclusion

The composers' relationship with the computer can be characterised as a partnership. It is an evolving process where both composer and tool should interact with each other and their broader context. Although changing tools appears easy in comparison to changing external social situations, or even personal predilection, computer music composers need to look for a synchronicity between their musical ideas, their cultural surrounds, and the computer music tools they employ.

Tools are not value neutral or uninfluential, quite the reverse. A composer's tools are strongly implicated in their musical output. However, tools exist within contexts that can in turn effect the appropriateness and usefulness of the tools. Composers should look at both their tools and their situation when considering how best to move in new musical directions. By creating new music and new ways of making, computer music composers will continue to contribute to the ongoing evolution of their culture, which in turn defines them. Tools and outcomes do not exist within a simplistic causal relationship, but are situated within a cultural context. It is through engagement with tools as part of a cultural context that musical outcomes of the compositional partnership can be most productive.

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