

The Digital Art: Notes for "The Computer in Music —Comings and Goings" James Dashow

The three main uses to which computers are being put as musical instruments are:

- imitation of traditional acoustic sounds by analysis/synthesis
- synthesis of unique electronic sounds
- transformation of previously existing sounds, acoustic or electronic, by signal processing procedures

Imitation provides insights into the nature of sound used for musical purposes. Psycho-acoustic principles may be discovered which can then be manipulated as structural determinants for musical compositions.

Performance constraints associated with live performers may be eliminated: expressive (especially rhythmic) complexity may be called for without fear of physical impossibilities, and the composer may verify if the complexity is necessary or perceivable, or if the same idea could be expressed in simpler, possibly more effective ways.

The digital synthesis of electronic sounds challenges the composer's abilities to create a coherent musical language out of the new sounds unique to the electronic medium. In particular, the composer invents timbres that can only be realized electronically; the music itself is often an attempt at making timbral development and transformation the primary structural concern of the composition. Such questions as when does a pitch become a tone color (and vice versa) are fundamental to works conceived in these terms. The computer provides precise, repeatable control over all elements contributing to the synthesis procedures, the composer may "fine tune" his timbres until he achieves exactly what he's looking for, or stumbles by happy accident (a misplaced decimal point) onto an unexpected sound that stimulates his imagination in new ways. There is continuous feedback/interaction between composer and his digital instrument: re-combining frequency components of a complex sound often yields new musical ideas that take advantage of the contexts suggested by the re-composed sounds.

What was said previously with respect to the perception of complex rhythmic structures is true here as well. The question of psycho-acoustics is now more critical: the composer has the task of defining timbral reference points with great clarity now that more familiar identifiable timbres have been dispensed with, so that compositional distinctions may be perceived.

Transformation of previously created sounds, particularly of recorded acoustic sounds, is equally unique to the electronic medium, and especially to digital sound processing. Transforming identifiable sounds into other familiar sounds (a tenor into a bassoon), into purely electronic sounds (and vice versa), or their manipulation, by cross-synthesis or other such techniques, often yields a strong enough gesture in and of itself as to be capable of defining compositional structure, sometimes dramatically. Sounds of one kind can be made to emerge from others, or the actual process of re-structuring a sound to obtain timbral variants can become a musical phrase. Transformations via spatial manipulation (the illusion that a sound is moving in space or even different kinds of spaces) can become a powerful means of delimiting musical structure, as well as being fascinating to the ear. The computer as a musical instrument has permitted the emergence of a wide variety of styles. "Computer music" is not one school of thought; on the contrary, composers are freed from having to satisfy the demands of what contemporary music "must" according to the latest fashion, and

the socio-economic obstacles posed by reluctant performers and concert managers is considerably reduced. Hence, composers may develop their ideas within an environment of constant musical feedback, perfecting their work in the privacy of their studios, confident that when the work is at last presented it represents no less (and no more) than their precise intentions. Clearly, the composer is now his own performer; he must learn not only the art of composing for computer but also the art of performing the computer by means of effective programming, not an easy task.

Finally, it should be mentioned that there is a tendency to find ways to let digital programming concepts influence or even determine the compositional process. Some composers are working with ideas directly related to or drawn from artificial intelligence in an effort to find musical (compositional) results unique to the computer. I do not disagree with this tendency; however, at this stage, it becomes necessary to choose between spending an enormous amount of time and effort in programming the computer to make subtle compositional decisions, or composing and making those kind of decisions on one's own. Until software/hardware developments succeed in endowing a computer with the capabilities of human sensibilities, it is my opinion that the live composer using the computer as an instrument rather than as his substitute will produce far more effective music.

My own work has been largely dedicated to exploring the realms of inharmonic sound, and seeking solutions to the problem of constructing a coherent functional language based on these sounds conceived of as chords. I have discovered procedures that permit controlling various components of inharmonic chord-spectra, and these controlled components are the structural bases of each composition. The procedures have been applied to modulation spectra (FM, AM, ring modulation), to a special use of the foldover phenomenon, to additive synthesis with inharmonic "overtone" or scalar relationships, to exponentiation (and exponent modulation) of simple sine tones, to a variable sampling rate procedure, to non-linear distortion and wave-shape modulation, and other signal generating/processing algorithms. Each algorithm so treated has produced distinctly different families of sounds, such that I now have an "orchestra" of a dozen different signal generating "instruments" and five signal processing "instruments".

"The little prince", my two-act opera for 7 live voices, multichannel digitally synthesized sound, computer graphics and lasers (at this writing, still under construction"), makes use of my orchestra in as wide a variety of ways as possible. I am still discovering new timbral capabilities of these instruments used in isolated groups; the combining of unlike instrumental types into new complex chord-spectra is a difficult task made more so in the absence of real-time digital synthesis resources. There is no way of predicting the result of adding through synthesis two or more dissimilar sounds. Experience has repeatedly shown that two interesting sounds are just as likely to get in each other's way and produce an unwelcome effect as they are to complement each other and yield a new special sound; similarly, combining two immediately less successful sounds can yield a fascinating sound by virtue of a mutually beneficial interference that leaves a sum of their more successful components, or transforms the less attractive components into something altogether different and provocative. These combinations must all be tried out individually—a lengthy operation given the enormous variety available. It is clear, however, that with experience, one can begin to "get a feel" for what works and what doesn't; and it is in these manifold combinations of inharmonic spectra into genuinely new complexes of sound that is the exclusive domain of the computer and certainly the most promising for the development of contemporary music. For with the arrival of digital synthesis, composers now have the means at their disposal for calling forth with precision and confidence music based on inharmonics and timbral manipulation that is as

convincing and emotionally compelling as any music based on systems of the past. Just as Newton's principles are now seen as a (major) subset of Einstein's more comprehensive universe, so the diatonic, chromatic, dodecaphonic organization of music based on (variants of) a well-known and understood system of frequency relations will come to be understood as contained in a (major) subset of that larger universe that is inharmonic music.