FOR AN INTELLIGENT USE OF COMPUTERS IN MUSIC COMPOSITION

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ABSTRACT. Computer-assisted Composition encourages a speculative and experimental attitude. Deliberate attempts to find new ways of writing music are facilitated by a rigorous formalism and comprehensive programs. Complexity and elements of randomness are seen as key elements in works which are the result of a collaboration between composers and computers.

For some, Computer Music means digital sound synthesis. Composing with computers is regarded with skepticism and often treated in books, overviews, or tutorials as a poor relative. In the almost 40 years since the pioneering work of Lejaren Hiller, few informed, all encompassing and substantial discussions, going beyond the description of particular methods, took place. Even the way we refer to his activity needs to be given some thought: "computer-assisted" versus "algorithmic" or "automated" composition.

The label is not only a matter of pedantry - it indicates an attitude towards the use of computers in composition. Automated and algorithmic imply assembly line type operations, in which imagination and creativity do not play a major role. Computer-assisted, on the other hand, suggests a tool subordinated to the artist's fancy but also capable of becoming a collaborator - an active participant in the production of new artifacts and a complement to the human mind (Tipei, S. 1989a). In the same way that it is easier to give orders than to stimulate others into action, programming computers to perform routine operations is a more obvious task than that of using them to expand the composer's thinking.

These distinctions make sense especially if we accept the notion that a composition should not be intended only as entertainment and that its speculative and experimental aspects are paramount. In the words of Xenakis: "To make music mean: to express human intelligence by sonic means" (Xenakis, I. 1992). Intelligence also involves dealing with new situations, experimenting.

SPECULATIVE THINKING. All music promotes a world view in an implicit way since the choice of a particular system or language obliges the composer to adopt the vision mediated by it. A good example is tonality where both the pitch and the time domain contain well defined hierarchies. Similar to Newton's mechanics, the tonal system describes a universe with a multitude of gravitational centers around which stellar planets and their satellites turn in complex but predictable ways. It is hard to imagine a better equivalent to the Enlightenment's explanation of the world as a complicated clockwork mechanism which can be understood through rational thinking.

Other musical systems or devices deliver similar types of messages: serialism, a loose hierarchy with elements of relativism, relies heavily on sequential thinking; chance music is a non-deterministic world, devoid of patterns but where only a finite number of events can occur; works based on a cantus firmus (and by extension,
the variations genre) are commentaries on an authoritative statement to be embellished and explained but not challenged; and so on.

To ignore such messages generated by the tools we use is to play ostrich or to become a "self-appointed moron", in Herbert Brun's witty and sharp words (Brun, H.). The only alternative is to take advantage of them in deliberate ways.

Does it make sense then to follow now days a straitjacket that expresses the mentality of three centuries ago? Is that vision of a rational universe where all happenings have clear causes and effects still actual? Contemporary science offers a different understanding of the world in which we exist and the society has different norms and beliefs. People do not dress like Bach anymore, moral codes have changed since Newton, and bleeding a sick person is no longer considered sound medical practice. But C major music is still being written.

Could this be because art deals with permanent "truths" and "emotions"? Some thoughts are more durable than others but the form in which they are expressed is always dated. As a general rule, works of art last longer when they are least connected with a prevailing messiness and, if composition's cognitive and speculative functions are taken seriously, there is no substitute for abstract thinking. Conveying that thinking at least in a contemporary if not in a fresh idiom is an honest attempt to advance our knowledge about the world and about ourselves as opposed to repeating like parrots what we already knew. New knowledge requires new words as well as new ways to connect them and computers turn out to be helpful in this endeavor in a number of ways.

One of the strongest challenges to the mechanistic view of the world comes from accepting the fact that there is a degree of haphazard in it. Because of their conditioning and learned biases, humans can never hope to produce a truly random event ( Xenakis, I.). Yet computers can get close enough, at least for musical purposes, when generating 'pseudo-random numbers.

The type of texture known as "sound-mans" is not present in traditional music (although some fragments in Mahler and in Beethoven's last String Quartets come close to it). Typically, such aggregations involve large numbers of sounds which are, inevitably, hard to handle by hand. Computers become indispensable especially when such clusters are controlled through stochastic distributions.

Matter, we are told, contains at the particle level complex symmetries or invariances under certain transformations. They are masked by a plethora of concrete manifestations and shimmering details at the macro level, the one we come in contact with. Any music trying to parallel this reality (or our present way of interpreting it), will have to reach a level of complexity which requires the help of a computer. A similar metaphor is the production of multiple variants of the same work; all sharing the same abstract symmetries but each exhibiting different arrangements of the perceived detail. Obviously, the mass production of unique variants of the same piece or Manifold Compositions is also a task for a computer to perform (Tiptoi, S., 1959b).

Many other examples, from the use of chaos theory (Choi, I.) to genetic algorithms and neural networks, are available. They represent new approaches to composition which are facilitated by the use of computers since they share elements of randomness, a high degree of complexity (number of elements, ways of connecting them, sheer amount of data), and the need for fast experimentation.

EXPERIMENTAL ATTITUDE. Traditionally, composers were expected to manufacture art objects
conforming to established standards. Learning from the "masters" enabled them to eventually gain enough skills not only to produce similar artifacts but also to introduce variations and modify those standards over a period of time. Without questioning the particulars, the results implicit in their common language, they did concentrate mostly on questions of detail and craftsmanship. But, when composers start being inquisitive and aspire to be more than entertainers, artisans or conduits for a higher level authority, experimentation becomes an indispensable part of any compositional endeavor. The present lack of a lingu/anza franca is both a consequence of and an incentive for exploring farther and deeper. Computers can help us experiment more: certain tasks such as the use of chaotic systems or fractals involve too many computations to be dealt with without them.

Obviously, not everything computers can do is necessarily interesting from a creative point of view and most attempts to apply Artificial Intelligence techniques in music fall into this category. The problem starts with the emphasis AI puts on learning as well as on parsing and detecting hierarchies as crucial attributes of intelligence. There are two biases here: one towards imitating a model and gaining expertise in applying given rules, the other towards pattern recognition. The first takes us back to the old-fashioned concept of a common practice to be learned from some sacred cows and the second leaves out John Cage's chance music or stochastic distributions. If a theorist is fascinated with the computer's ability to write four-part chorales or even to imitate 2-be style of Bartok or Varèse, the experimental music composer is more interested in devising new, original ways of putting sounds together. AI can help understand better the process of writing music and, conceivably, could become a tool helping composers jump into the unknown after circumventing the biases described above.

By the same token, not all experimentation is equally valid. How tempting it is to take a mathematical expression of eloquent beauty and assume that it will translate into equally interesting music! Unfortunately, such a simple-minded mapping will lead often to some sort of boring noise which could have been obtained cheaper. An intelligent experiment has to be set up in a musically meaningful way and the experimentalist has to have in mind a reasonable idea of what the results will be like. Unexpected findings should be welcomed but the search for them needs to have a direction: the composer needs to control the experiment and not the other way around.

Sometimes the "gone fishing" attitude is praised: the artist lets the software ramble and hopes to catch something of use. No doubt, it takes a while to learn how to use a new technology or a new piece of software but that kind of exercise should not be equated with composing. "Gone fishing", like the foggy "inspiration", is a thin cover for abdicating from someone's responsibilities, for refusing to think and letting the flow of common place realities take over. Could the moron, self-appointed or not, be far?

Herbert von Bora also talks about the "new piece": he 'did not learn to like yet' (Roads, C.). That kind of piece is the consequence of a logical process setup by a composer who then becomes a creator of ways of making objects in stead of a creator of objects. No doubt, computers are ideal tools in such situations. However, in order to insure the integrity of the process, the program should be comprehensive and the user should not tamper with the output. A comprehensive program writes the entire piece from the premises offered by the composer as opposed to routines which perform specialized, local tasks to be placed later in the context of the piece.

When faced with unexpected results while using such a program, the composer will have to figure out why that happened. If the logic is sound and the data appropriate, the results should be accepted and everybody, including the composer, will learn something - after a while the piece might even become "like usable". A
disappointing outcome though should trigger some soul searching and a reassessment of either the algorithm or data. Manipulating the output is obviously a practical solution (employed by many luminaries) but also it defeats the whole idea of experiment. On the other hand, by forcing a re-evaluation of the process, the computer helps the composer to learn more about his own habits and ways of thinking.

"HUMANISM" AND COMPUTERS. Lately, there has been a trend toward rejecting strict formalism in music. Complains that formal structures generate a dry, inflexible and ultimately unattractive music have lead to the conclusion that the composer’s interference with the process is necessary. Out of the closet come the old ghosts: we are told that “emotions” (impossible to verbalize) are missing from this forbiddingly abstract music which lacks “humanity”. As Boulez put it: “the exalted absurdities circulating on this subject are of inexhaustible monotony; they can be reduced, all of them, to a very low conception of what is understood by <human>” (Boulez, P.). As many examples from Maccaus to the Art of Fugue to Webern and Xenakis attest, stringent logic never stood in the way of good music. Unattractive works are the result of a clumsy and un sophisti cated formalism and, as Boulez’s evolution from Structures to Le Marteau and beyond shows it, the solution is not to abandon the rigor but to refine the system by adding more rules and by increasing its intricacy.

Sound synthesis illustrates well the same situation: crude attempts are immediately recognized as sounds generated through electroacoustic means. But once the partials acquire small independent variations in stead of forming fixed “structures like packets of spaghetti” (Xenakis, J.), once a slightly irregular vibrato or tremolo is added, once pitches and durations are allowed to fluctuate a little, the same sounds are no longer perceived as “artificial”. Complexity and the increase in information delivered by unexpected events is what differentiates dry from appealing music and it is the merit of Hitler and Xenakis to have recognized this right from the beginning.

Ultimately, computers are meaningful in composition when they help expand its limits. One way to assess their contribution is by looking at the complexity of the task and the intensity of the computations. A good example is the Environment for Experimental Music Composition, a project being developed both at the Argonne National Laboratory and at the University of Illinois. It involves Computer-assisted Composition, Digital Additive Synthesis (Kaper et al.), Automatic Music Printing and the use of a massively parallel supercomputer, the IBM SP. That limits are transgressed is also evidenced by the fact that such a project can not be handled by one person only: people with expertise in computer science, mathematics, acoustics and psychoacoustics, besides composition, collaborate on it - the way we make music is already different.

References:
Pierre Boulez - Also, in Notes of an Apprentice;hip, Knopf, New York, 1968.
Brun, Farber - The Promise Is That There Be Music, Proceedings of the 1985 ICMC, Vancouver, Canada.
Tipei, Sever - Manifold Composition - A (Super)computer Experiment in Progress, Proceedings of the 1989 ICMC, Ohio State University, 1989b.