

# A Few Quick Notes on Opportunities and Pitfalls of the Application of Computers in Art and Music

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## Bootstrap Loader

0. 1. A value signifying nothing. A value signifying something. From this pair of abstractions, representing the most fundamental of distinctions, all other abstractions in the digital world are constructed. Simple values such as numbers and letters can be encoded as strings of zeroes and ones. A concept can be represented by encoding its attributes, operations and relationships to other concepts. A network of concepts can be assembled to form a microcosm, an artificial world. The operations and relations that define these worlds can be set in motion.

Computers are the engines that drive these worlds. They are engines of abstraction, of symbols, of concepts, of ideas. In the last few years these engines have reached fantastic levels of performance and will continue to progress. As performance increases, things that were impossible become possible. I remember the moment when I first compiled one of my synthesis engines on a machine that was capable of computing sound faster than it could be played in real time. That was a turning point for me. When you can create sound in real time you can interact with it, and interaction makes possible things that never could have been achieved by typing in lists of commands.

Computer languages are the tools we use to encode the concepts. As computers get faster we are able to apply languages that present higher levels of abstraction to problems where performance had previously been a barrier. This allows more sophisticated worlds to be created with less effort. Different languages are based on different paradigms and lead to different types of approaches to solve a given problem. Those who use a particular computer language learn to think in that language and can see problems in terms of how a solution would look in that language.

## Self and Society as Fitness Functions

The speed of computers and the expressivity of computer languages have enabled the exploration of the space of possible sounds, sound processes, musical processes, and compositional algorithms, all to an unprecedented depth and breadth. Early chance music by Cage and others were based on simple algorithms. Many of these early compositional algorithms require relatively few lines of code in today's languages.

When searching for a solution to a problem with a computer, a function is needed for determining whether the search is going in the right direction. This is the basis for genetic algorithms or the A search algorithm. At the very least a function is needed to determine whether a search has succeeded. For art, it is not possible to write such a function with a computer. Even humans cannot agree whether a work of art is successful, interesting, or relevant. Individuals and society provide the fitness functions for art. Society will determine whether some art is valuable, and that value may change over time as fashion and human circumstances change. And each person applies their own evaluation to

art which may and often does differ from that of society. For these reasons fully autonomous composition programs cannot be successful with others or society until the time, if it ever comes, that computers can be said to be aware of the human relation to art and the social context of art.

Computer music presents the same problem as modern art does for an audience: how do you judge a work or appreciate it? It is often hard for an audience to know exactly what is going on in a computer music piece. Did the composer choose all of the events, and use the computer merely to render? Or was there a composition algorithm? Was it an interactive algorithm? A random algorithm? A deterministic one? How many decisions were the result of the program and how many were from the composer's intervention? Without program notes there may be no way to know since there may be no live process that the audience can see. Even when there are program notes, often a composer's clever algorithm is too subtle to be perceptible or is obscured by surface details. Does the audience need to be aware of the inner workings of a piece in order to appreciate it, or is the sensual perception of the final product enough? A composer may value her work based on its inner workings, but an audience may reject it based on the sensual aspect since there may be no other way they can understand it.

### Meta-Compositions

Jean Tinguely's meta-matics were works of kinetic art that created works of art. Computer programs such as Harold Cohen's AARON or David Cope's EMI are works by artists that create art. AARON, EMI and meta-matics are works of meta-art. People who write composition algorithms in the MAX or SuperCollider languages are creating meta-art. A composition that is written as a program is no different than an aleatoric composition except that we are instructing a computer how to make choices instead of a performer. I wrote SuperCollider because I was interested in listening to music that was different each time it was played. I also wanted to be able to specify a class of compositions and then listen to instances of the class. Using a computer to generate variety can be a way to avoid becoming bored with one's own work. There is also an emotional freedom in not having one's ego invested in each decision point in a composition, while remaining responsible for the rules governing each decision.

### Application of Immediate Results

Any time a new medium or new tool is introduced, different ways of grappling with the harnessing of possibilities must be explored. Often the first strategy is the application of immediate results, i.e. do the first and easiest thing you can do with this new medium, find the idioms natural to this medium. At first there is excitement about these idioms, but later these same idioms become clichés. This tendency can manifest in other ways such as factory presets of the latest synths appearing in multiple pop songs on the radio. Or, me going to a concert or having someone send me a CD of their work and hearing my own demo examples in the piece. Or, whole genres based on the use of the computer's ability to loop a section of audio or MIDI data. "Repetition is a form of change" as the Oblique Strategies card says. But change is often a better form of change, especially after a couple of decades of extremely repetitive electronic music. A few years ago at a music trade show it seemed like every manufacturer was advertising software and gadgets to do looping. I decided then that I didn't want to do any more loops. Better to struggle with change.

## Exploitation of Limitations

Because the information that drives human perception can be encoded and manipulated, computers are a very good but not perfect plastic medium. Some artists try to exploit the limitations of the digital representation of sound: limitations in sample resolution, limitations in bandwidth, limitations of models, limitations of some software's built in algorithms to generate or process sound. The limitations of a medium as important for our culture as is the digital medium, are probably important for an artist to express. As important, I think, are the new possibilities that the digital medium presents. It is often easier to exploit the limitations than it is to successfully explore and discover new possibilities. A direction more interesting to me than exploiting the limitations of the digital medium is exploiting the limitations of human perception. How can ambiguities of sensory input be exploited? On how many levels can information be encoded and perceived? There is some intuitive understanding of human information acquisition that composers exploit when they write a piece. Attempts to apply information theory to music in a direct way result in dense music that cannot be acquired. Human perception saturates quickly at a single level, but can operate at multiple levels. Fractals present information at multiple levels, but simple fractal formulas present information that is too similar at multiple levels (either too regular or too random), so the result is just multiple levels of boredom rather than a single level of boredom.

## Romance of the Naive

I sometimes hear an artist claim that they are using a tool in a way the designer never intended. I find this kind of comment more self congratulatory on that artist's part than anything else. They imagine that they are an artist and the designer is an engineer. But many engineers at synth and software companies are musicians too, and the best engineering is like art, so that conception is likely not a valid one. Designers of tools go to great lengths to make a tool as flexible as possible and often such a user doesn't realize even a fraction of that potential. So yes, perhaps they are using it in a way it was not intended to be used. But I doubt the designer would be impressed by that, having known before what the capabilities and limitations were, and I doubt much artistic value was attained that could not have been attained better had the user understood the tool better.

## Terra Incognita

What I am interested in is, what is out there beyond the application of immediate results, the exploitation of limitations, the romanticization of naiveté? This might be labelled a modernist position, a position of someone who still believes in the inevitable progress in art in a forward direction, like Schoenberg did. But I don't agree. The result of the modern art revolution is that we are left with the option to use any means, without limitations, to solve an artistic problem (and the audience is free to like or dislike it). But still there is terra incognita. New tools are like new vehicles that allow us to get to that undiscovered terrain. And as someone interested in hearing new sounds, I want to go there.