Structuralism, Attitude and the Computer: Questioning the Notion of "Cultural Computing"

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Abstract. The terms "cultural computing" and "entertainment computing" can be disturbing if looked at from the artists' point of view. Computing has always been part of the culture of the time, and this was especially true in the decades surrounding the birth of computing, when the structuralist paradigm was dominant in many areas of human endeavour. Perhaps what distinguishes, or should distinguish, "cultural" computing from other types of computing is its attitude: one of playfulness and light-hearted cleverness. This premise is discussed mainly from a musical point-of-view – examples from the computer music literature, including works by the author, are discussed in this context.

Keywords: Structuralism, post-structuralism, algorithmic composition, inherent structures, emergent structures, John Cage, Iannis Xenakis, Herbert Brun, Lejaren Hiller, Kenneth Gaburo, process composition, computer-aided composition.

1 Dealing With the Terms

When I first saw the terms "cultural computing" and "entertainment computing," I was a bit troubled. "Entertainment computing" seemed obvious, at first. It described computing that was used in the service of the entertainment industry. Industrial strength sound editing systems for the film industry and computer games immediately came to mind. But as an artist, this disturbed me a bit. My job as an artist is to continually change models of culture and peoples' ideas about them. (That is, if we believe philosophers and art critics such as Donald Brook.[1]) So much of what immediately came to mind with "entertainment computing" simply suggested old paradigms, whether it was the mathematical elegance of something like Tetris or the rock-em sock-em action of any shoot-em-up; or the same-old same-old narrative structures of Hollywood cinema – even when those narrative structures were articulated by state-of-the-art computer graphics, such as in James Cameron's recent "Avatar."[2]

Then it occurred to me that "entertainment computing" could also describe the pleasure one gets from crafting a particularly elegant bit of code. Here the computing

[1] Brook, Donald, "The Social Role of Art" Experimental Art Foundation, Adelaide (1977); Brook, Donald, "The Awful Truth About What Art Is" Artlink Australia, Adeliade (2008)

[2] Cameron, James, "Avatar" 20th Century Fox (2009)

itself was "entertaining." Another idea that came to mind was systems which deliver entertainment over the web, such as YouTube and the streaming radio services. One friend, in fact, told me (via email, of course) a couple of years ago, that he scarcely watched TV anymore. Most of his audio-visual experiencing was done through YouTube and other web video services. Finally, I thought of social networking sites such as Facebook, Twitter, Linked-In and the like. Surely these were being used by many people as a source of entertainment. The code that underlay all these uses could be described as utilitarian programming designed to serve the needs of people in entertaining activities. That seemed one good definition of "entertainment computing."

The term "cultural computing" seemed more serious to me, and more worth investigating. On one level, it seemed to imply that the term was invented by someone for whom "computing" was their primary activity, and they drew a distinction between "computing" and "culture." I envisioned a programmer who wrote banking software who instead, wanted to be writing game software, or poetry writing software. A distinction was being made here between computing used for business, and computing used for having fun.

As understandable as this interpretation is, it seems to me that it misses the point. For computing IS a cultural activity. In fact, in terms of the general society, computing is now central to the culture. Hardly any activities, whether business or entertainment oriented, whether artistic or financial, do not involve the use of a computer in some way. Further, the activities of computer scientists are as susceptible t o study by anthropologists and cultural theorists as are any other human endeavors.

Finally, it occurred to me that computing did not evolve in a vacuum. It began in the late 1940s and early 1950s in parallel with, and in interaction with (even if subconsciously) ideas from the larger culture. It is no accident that the computer, that structural machine par excellence, evolved in the way it did, at the same time as ideas of structuralism were prevalent in anthropology, psychology, mathematics, music, literature, etc. And in fact, once the first "proof of concept" projects were finished (such as the CSIRAC music project[3]), and it was clear that the computer could be used in the production of "culture" (in the most traditional sense of the term), the first uses of the computer for music, experiments by Lejaren Hiller[4] and Iannis Xenakis[5] were indeed informed by the ideas of structuralism that pervaded the arts and sciences at that time. And the structuralism which was a part of mathematics, anthropology, linguistics, psychology, and the arts at that time was very much part of the mindset that produced the first programs and programming languages.

My own relation with the computer is a utilitarian one. I am primarily a composer of music, animated graphics, and sound poetry. The computer is one very important tool among many that I use to create my work. The work comes first, however: the computer is a tool, and one that I am not obligated to use. I can, for example, also

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[3] Doornbusch, Paul, "The Music of CSIRAC, Australia's first Computer Music" Common Ground Publishing, Altona, Vic. (2005)

[4] Hiller Lejaren, and Isascson, Leonard, "Experimental Music: Composition with an Electronic Computer" McGraw Hill, New York (1959)

[5] Xenakis, Iannis, "Formalized Music: Thought and Mathematics in Composition" Pendragon Press 2nd edition, Stuyvesant, NY (2001)

whistle. I might also point out that even though I started my artistic career in the mid-late 1960s, it was not until the very late 1970s / early 1980s that I fully embraced the computer as a creative medium. Before that, I could see the potential of the computer, but working with them was just too expensive, required access to guarded institutional facilities, and was just too hard. It was only when computers became inexpensive enough that I could afford to own my own (most of my career as an artist having been spent outside of institutions), that I really began to get my hands dirty with them. Before that, for example, I was just as happy to build and design my own digital circuitry for use in my music and performance art projects.

So for me, the computer has become, as said above, just another art-making tool. However, I acknowledge this thought by composer, percussionist and writer Gino Robair: "I am reminded on a daily basis that we are creating music on general-purpose business machines, which we cleverly subvert for our creative purposes." So it's a tool, but one developed primarily for other purposes than mine. Robair's thought seems to suggest to me that he, too, would subscribe to there being a difference between "cultural" uses of computing, and other uses.[6]

As an artist, I am very interested in the uniquely inherent possibilities of each medium I use. I'm continually asking myself – for each new tool I come across - what are the compositional implications of this tool? What can it do that no other tool can? Are there any artistic possibilities I can see in this tool that are unique? I am also interested in not just how I can affect my tools, but how they affect me. On a note which is either light-hearted or ominous – and I'm not sure which – when I was discussing this paper with my wife, the multi-media artist Catherine Schieve, she said "Cultural computing? Have you noticed in the past year, that as you've spent more and more time on the email, you're beginning to talk like email?" She pointed out that in my day-to-day speech, I was using phrasing and structures that seemed like they were derived from email – "talking in blocks" she called it. I was quite embarrassed by this – I believe my response to her was a worried, "Oh, dear……" On later reflection, she said that she thought that "cultural computing" was what the engineers at Google and other high tech companies had been doing for years – engineering the culture by creating structures for computer use (cloud computing being only one of the most recent). I replied that I thought that social networking sites were another example of this - an area where people were creating their own cultures using computer tools.

2 Structuralism as a General Cultural Condition

In the mid-20th-century, the idea of structuralism took hold in many intellectual fields. The idea was that underneath the surface of "a thing" were inherent structures which, to some extent, produced the surface that was observed. In anthropology Claude Levi-Strauss proposed these ideas; in psychology, Jacques Lacan; in

[6] Robair, Gino, "Robair Report" http://blog.emusician.com/robairreport/2010/02/11/longterm-investing/ - access 12 Feb, 2010.

mathematics, Nicholas Bourbaki's work is paradigmatic.[7] In music a number of people worked with ideas such as these. Although it might be argued that Arnold Schoenberg's use of his "method of composing with 12 tones related only to one another" in the 1920s-40s was more expressive than structural, by the time working with his method was expanded into that many-faceted phenomena known as "serialism" in the 1950s and 60s (and indeed, in many different guises, up to the present) it was definitely a part of the structuralist sensibility. Nor was serialism the only manifestation of structuralism in music. Composers critical of serialism, such as John Cage and Iannis Xenakis, wrote a number of pieces in the 1950s in which the generative structure they invented for a particular piece produced the surface of the music that was listened to. And they did this, for the most part, without the use of a computer. (Neither of them began using computers in a serious way until the 1960s.) Their work at this time stands as a fascinating example of "computing without computers" that is, they worked out their scores and processes by hand, but their work was of such a systematic nature that they could have carried it out with the aid of a computer.

An example of this is Cage's tape collage, "Williams Mix,"[8] from 1952, which was computerized by Cage's colleague Larry Austin in the mid-1990s, several years after Cage's death. Austin's program has the potential of generating an infinite number of different versions of Cage's original collage. Austin's composition "Williams Re-Mixed" consists of a number of variations composed with this program.[9] At about the same time, I reconstructed the process Cage used (using a computer) to compose his "Two" for flute and piano (1987).[10] Using John Dunn's algorithmic composing environment "Kinetic Music Machine"[11], I composed a piece called "(There Will Never Be Another) Two," for microtonal flute and piano samples, in which the textures introduced in the Cage piece were extended into the realm of sampled timbres and microtonality.[12] So Cage's "manual" composing methods were indeed susceptible to encapsulation in computer programs.

A number of other composers were involved in different aspects of this structuralist enterprise. The German-American composer and philosopher Herbert Brun's "Sawdust" series of electronic music pieces, for example, are examples of sound structures which emerge from the properties built into Brun's automated combining of a set of rules. That is, the actual waveforms – the timbres – are assembled from a set of automated rules that Brun specified.[13] [14] Xenakis also explored such a rule-based generating of emergent timbres in his Gendyn series of

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[7] Aczel, Amir: "The Artist and the Mathematician: The Story of Nicholas Bourbaki, The Genius Mathematician Who Never Existed" High Stakes Publishing, London (2006)

[8] Cage, John, "Williams Mix" C F Peters, New York (1952)

[9] Austin, Larry, "Williams Re-Mixed" EMF Music, Albany, NY (2001)

[10] Cage, John, "Two" C F Peters, New York (1987)

[11] Dunn, John, "Kinetic Music Machine" http://algoart.com accessed Feb 13, 2010

[12] Burt, Warren, "(There Will Never Be Another) Two" Scarlet Aardvark, Melbourne (1996)

[13] Brun, Herbert, "Sawdust, Computer Music Project" EMF Media EM112, Albany NY (1999)

[14] Brun, Herbert, "A Manual for Sawdust" http://grace.evergreen.edu/~arunc/brun/sawdust/ accessed Feb 13, 2010

computer programs.[15] These programs are distinctive in computer music because most of the work to that date in timbre research involved having the ability to precisely specify what each component of a musical timbre would be. The idea that one would write a program to produce timbres, the details of which one could not predict, was quite different from mainstream musical interest in timbre. As Herbert Brun said, "This is not just a different aesthetic attitude, it is a political difference as well."[16]

Another example of structuralism in music is the work of the Los Angeles based microtonal music theorist Ervin Wilson. In fact, Wilson's seminal papers on musical tuning consist of nothing but diagrams of his structures, with no explanation[17]. He claims this is because he doesn't want to dictate to people how his ideas should be realized. He has also said that this cryptic means of presentation is a means of making sure that only people who are dedicated to the ideas are able to use them. When a musician realizes one of his structures into sound, whether it was me making a long-tone drone, or Marcus Hobbs making a pulse-pounding techno piece, he seemed equally happy. Maybe Wilson just happens to like both drones and techno, but I do get the feeling that for him, the structure is the main interesting part, with the realizations being simple manifestations of one form or another of the structure.

One of the most interesting of contemporary composers, and one whose life exemplified the turn away from structuralism that happened in the last third of the 20th century, was Kenneth Gaburo. His early 1950s work in what he termed "compositional linguistics" – the making of sound structures derived from both musical and linguistic ideas, was as much based on the structural linguistics of Jakobson and Chomsky as on ideas of musical serialism. By the late 70s, he had turned decisively from structural ideas into a more radical consideration of the human body. His later work used a process he called "scatter," in which unconscious and subconscious bodily processes, often accomplished under sensory deprivation conditions, were used to generate a set of stimuli, which were then used to generate a piece of music. Some of these involved unorthodox approaches to the use of digital devices, and some didn't. However, notice that he was still engaged in searching for an emergent structure, one that grew out of a carefully specified set of initial conditions. It's just that the materials here were not machine-based (even when technology was used), but body based. Another example of the remnants of structuralist thinking in his work can be seen in this excerpt from his 1970 essay, "The Beauty of Irrelevant Music." "If the world-at-large never awakens to the incredible structures which some have given it, but could never *demand* that it accept, the beauty will never-the-less, remain."[18] Notice that what is given to the world are *structures*. We are all still heirs to the legacy of structuralist thinking. But Gaburo's position was, I believe, that the body was central to art making. And it is a position that I would still support, two decades later. Despite various Extropian and

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[15] Hoffman, Peter, "The New GENDYN Program" Computer Music Journal, Vol. 24, No. 2 (July 2000)

[16] Brun Herbert: Selected Articles http://grace.evergreen.edu/~arunc/brun accessed Feb 13, 2010

[17] Wilson, Ervin: "Wilson Archives" http://www.anaphoria.com accessed Feb 13, 2010

[18] Gaburo, Kenneth, "The Beauty of Irrelevant Music" Lingua Press, La Jolla, Ca (1970) now distributed by Frog Peak Music, www.frogpeak.org

Transhumanist fantasies, I think the fundamental stuff of what we are IS our bodies – and the more we learn about computers, and artificial intelligence, and the body, and its embodied intelligence, the farther we realize we are from making a machine that is either a reasonable approximation of the body, or a reasonable "vessel" in which a body-based consciousness could comfortably exist.[19]

In computer science, there are a number of fields which also share this interest in emergent structures. In their own very different ways, the ideas of neural networks, cellular automata, and genetic algorithms all propose that the functioning of very simple networks of rules can produce results with very complex surfaces in ways that are somewhat analogous to the functioning of biological life forms. The early structuralists proposed that there were underlying structures which produced various kinds of behavior. But more recent investigations of emergent properties seem to take this one step further, in that structures are being intentionally developed in order to explore the kinds of behaviors that result.

However, in the past 30 years or so, ideas of structuralism have taken quite a battering. In Aubin's essay on the work of the Bourbaki group of mathematicians, he writes about mathematics, but the thoughts expressed quite easily apply to music, psychology, visual arts, and any number of other fields. "Surveying the mathematics of the 1970s, Christian Houzel, soon to be the elected president of the Societe mathematique de France, revealed to the public that "the age of Bourbaki and fundamental structures is over." While the previous period was one that had witnessed the development of powerful new theoretical tools of great generality, he noted, the 1970s were characterized rather by a tendency to revive an old interest in more concrete problems. Houzel did not venture an explanation for this reversal. "I cannot say," he simply wrote, "to what extent this [tendency] is conditioned by the internal dynamics of the development of mathematics, or by ideological currents like the degradation of science's superior image in public opinion and scientists' questioning of the social status of their practice."[20]

This turning away from the importance of structural ideas, or a turning away from the idea that the observation and study of emergent properties might be a fascinating thing in itself, has been replaced, in some peoples' minds, by a renewed fascination with the qualities of surface. In this view, it's the surface of a work of art (or work from other intellectual areas) that creates interest. Structure may be all well and good, but if the work is not attractive in some way, it will fail. In the arts, this has produced a lot of writing under the banner of post-modernism; in psychology, there has been a re-emergence of interest in the reactions and the emotions of the individual; in music, a renewed interest in the traditionally attractive qualities of timbre, harmony and rhythm, or the sociologically "easy" forms of popular music and culture. One early example of this was the work of the California minimalist sculptors of the 1960s. While their New York counterparts used plain, often rough materials, according to Peter Schjeldahl[21], the West Coast sculptors, such as James Turrell and Larry Bell, fused a concern for structuralist rigor with the use of beautiful surface materials.

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[19] http://www.extropy.org/ accessed Feb 13, 2010

[20] David Aubin, "The Withering Immortality of Nicolas Bourbaki: A Cultural Connector at the Confluence of Mathematics." *Science in Context*, 10 (1997), p. 297-342

[21] Schjeldahl, Peter, "Way Out West", New Yorker Jan 25, 2010, p. 76-77

"Finish Fetish" was a term that was applied to this work. Another example of this would be the computer music that came out of Stanford University in the 1970s, from composers such as John Chowning and William Schottstaedt, which was notable for the clean, elegant and sensuous qualities of the sounds used.

At its worst, this surface oriented new sensibility simply produced work which was overly familiar, weak and indulgent – it was simply an expression of the worst aspects of the immediately expressive ego that had been put aside during the structuralist experiment. But in the best works of this type, the toughness of structural thinking was combined with a concern for the sensuous appeal of elegant sonic (and other) surfaces.

A friend tells me, and I haven't followed this up or found references for it, but mentioning the idea should be sufficient for purposes of this discussion, that there are some perception scientists who are now claiming that, for human perception, there is nothing BUT surface, that all ideas of sub-surface structure are illusions, or at best, fanciful after-the-fact constructions. That those who are investigating structure - "that which cannot be seen immediately" – are in fact, investigating "nothing." If so, the work of the Bourbaki mathematicians, who produced 12 volumes of writing investigating deep mathematical structures – that is – "nothing" – and attributed them to a non-existent author, Nicholas Bourbaki, has a certain pleasing elegance and symmetry about it, at least to my mind.

McLuhan points out[22] that the first duty of any new media is to reproduce the old. Consider Greg Schiemer's work with mobile phones as a continuation and complexification of his earlier work with portable analog oscillators, the UFOs, as an example of this.[23] However, the quest for works of art or forms of art which uniquely come out of the inherent characteristics of their media is an ongoing one. Once we have new tools, we can figure out what might be uniquely made with them. If this quest can be combined with a consideration for the sensuous qualities of the expressive medium (sound in the case of music, metal in the case of (some) sculpture), that is, with a concern for the properties of the materials being used, then perhaps works which combine the best of structuralism with the best of the contemporary quest for sensuously engaging materials can be made.

Another thing that might be considered here is attitude. Perhaps one of the essential aspects of "cultural computing" might be revealed by considering the difference in attitude between, say, making or using a piece of accounting software, and making or using a piece of music software. Although I don't accept that the accounting software (or accountancy) is any less "cultural" than the music software (or making music), I do acknowledge that both fields have somewhat different attitudes towards creativity. I recall that an old accountant of mine once wisecracked "The only creative accountants are in jails." According to him, the free wheeling sense of fantasy that was valued in music creation was definitely a quality that was not wanted in accountancy.

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[22] McLuhan, Marshall, "Understanding Media: The Extensions of Man" Gingko Press (2003)

[23] Schiemer, G and Havryliv, M, Pocket Gamelan: a Pure Data interface for Mobile phones, in Proceedings of NIME 05 New Interfaces for Musical Expression, Media & Graphics Interdisciplinary Centre, Vancouver, 156-159.

As an example of what I mean by "attitude," I offer a recent piece of mine "Finnegans Wake versus the World's Longest Prime."[24] This is a piece of computer music in two channels. In the left channel is some bell-like music which is produced by interpreting the digits of the world's longest prime number (as of December 2009) as pitch, duration, and loudness specifications for an ongoing bell-sound texture. In the right half of the stereo sound space is a sampled Irish folk band, playing a demented, microtonal version of Irish folk music. This is produced by taking the letters, one at a time, of James Joyce's *Finnegans Wake*, and using those (modulo 26 of course, since we're dealing with the English alphabet) as pitch, duration and loudness instructions for four sampled Irish folk instruments. The two musics – the bells and the folk band DO sound different – although how much of that difference is due to my algorithm and timbre programming, and how much is due to the inherent difference in structure between the prime number digits and the *Wake* is perhaps a question best left to musicologists. (I mean, let's be serious, folks. What could be more ludicrous than making music by sonifying materials like prime numbers and the letters of *Finnegans Wake*?)

But the playful and irreverent handling of materials typified by this piece is an example of "attitude" that I think should be a clear part of at least some efforts in cultural computing. And as a further example of the conceptual playfulness of this piece – both the *Wake* and the digits of the world's longest prime number are, of course, enormous data sets. I figured that if played for its full length, the piece would be several months in duration at least. But I decided to give people only 5 minutes of it. Not only am I playful and irreverent with my materials, I'm teasing people with them as well.

I think that when we begin to emphasize attitudes to our technology that are not reverent or earnest, but playful and light-hearted, when we start treating language as a toy as well as a tool, that is when we might begin to assemble something that is truly "cultural," in the sense of being distinct from the earnestness of business and science oriented computing, and thus have a different attitude and a different context for computing; something that might indeed be a gift to the larger "culture."

3 A Question

Has computer science come into its (to use flawed terms) post-modern, post-structural period yet? To be sure, there are many artists *using* the technology in this way. Consider any of the many pieces made in the past few years which feature sampling of random sounds stored on the net, or a number of web-based improvisation ensembles, in which composers spread all over the planet improvise with a set of hardware or software instruments in a remote location as but two examples of this. I was involved in one such performance in March 2009. Performers in Belgium, Portugal, Mexico and Australia improvised using a scripting language which controlled a set of computer-controlled acoustic musical instruments

[24] Burt, Warren "Finnegans Wake Versus The Worlds Longest Prime" Scarlet Aardvark, Wollongong (2009)

in the concert hall of the Logos Foundation in Gent, Belgium.[25] And in mathematics, it could be said that the non-linear mathematics of fractals, chaos and the like might be considered as a kind of post-structural mathematics – as distinguished from the elegant linear-logic structures that fascinated the Bourbaki group.

But seeing as how early computer programming and business applications from the 1940s-1960s seem to be so closely related to the structuralist nature of work in other fields, I wonder if there are any developments in computer science today which parallel contemporary developments in music, art, psychology, etc. Or could it be that the nature of the tool itself – digital logic – precludes the participation of the computing community in experiments such as these. (I mean, how post-modern can a NAND gate be? And while we're at it, take my XOR gate, please! (nyuk nyuk nyuk)) I speculate – it might only be when one is dealing above the level of digital logic that one can talk about non-linear, post-structural, post-modern, (call it what you like) uses of the computer. This is a speculation from an outsider. I await responses from the members of the computer science community with interest.

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[25] http://logosfoundation.org/mnm/index.php accessed 13 Feb 2010

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