Composer Views:

Context in the use of computers for musical composition

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The composer, as creative artist, is an interesting case for the study of computer usage. They typically work deliberately against the grain of convention, are renowned for persisting with awkward and tedious tasks, and produce works not so much with the intent of stabilising data or a situation but, instead, structuring sound to perturb or surprise the recipients expectations to some degree. In this paper I will address how we might look at composers in a way which helps us understand their computer usage.

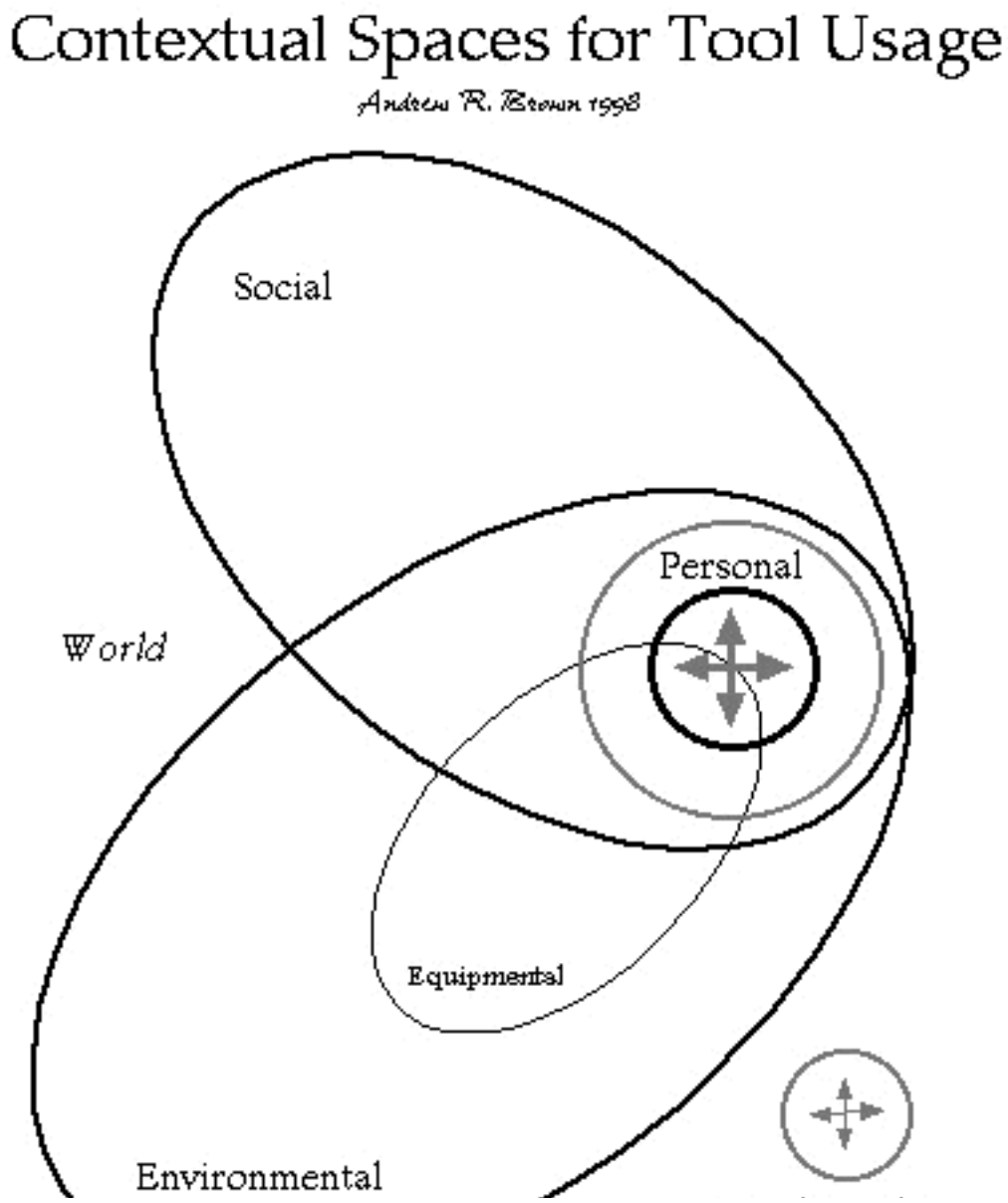

Diagram 1. (back to: Social Situation, Ontological View, Overview)

I will suggest four ways of looking at, or viewing, the compositional process; these are the personal view, the environmental view, the social view, and the ontological view. They are represented diagrammatically in Figure 1. I believe that researchers can create a sophisticated description of the composers' use of computers (and other tools) by looking at each view in turn and how these views overlap and complement one another.[1]

Views of compositional tool usage

Personal view

Composers bring with them to the compositional activity a series of observable or historically evident skills and experiences. These personal attributes are both intellectual; in the form of knowledge, information, desires, and understandings; and physical, in the form of skills, and activities. The examining of the personal attributes of a creative individual is much more extensively explored by psychologists (Gardner 1993, Ciskszentmihalyi 1993, Boden 1990, and others). In following the creativity research of Ciskszentmihalyi (1993: 51-76) I will downplay the issues of personality type, let alone psychoneurological considerations, as personal indicators of creative work in favour of skills and motivations and how they fit into social and environmental situations.

Environmental view

The composing environment provides possibilities and constraints for the composer, and contains residual data for the researcher. Environments are partially chosen or constructed, and partially circumstantial. Either way, the impact on compositional process is similar. It is the chosen, or constructed, environmental aspects which I believe provide most interesting information through understanding how and why environments are constructed, and then what influence they have on composition.

The environment, for the purposes of examining musical composition with computer, consists of an equipmental space typically containing computers, audio equipment, acoustic musical instruments, furniture, books, CD's, pictures, lighting, and so on. It is common to distinguish (or only consider) the equipmental environment apart from the physical one: in fact I would suggest that the equipmental space is the singularly most common boundary for useability studies. This distinction between equipmental and physical environment is helpful in focusing a study, but at the same time constraining. Environmental boundaries should not be chosen without thought, I argue, but should be purposefully selected. Such exploration beyond this boundary is argued for by Brown and Duguid (1994) in the domain of Human Computer Interface design.

The environmental scope for this study includes all equipment, computer or otherwise, and how that is organised within the composers' studio space.

Social view

All composers live in a society which provides support, precedent, judgement, and inspiration. The effect of the time and place in which a composer is acting is significant in a complete

understanding of their compositional process, and thus the role of tools in that process.

The social impact is most compelling (although often overlooked) in that the society provides the tools utilised and adapted by the composers. In terms of the computer systems these include hardware conventions and software representations. Physical tools for composition include pianos, manuscript paper, Hi Fi systems, and so on. The society also provides non-physical tools such as systems of harmony, conventions of form and structure, timbral grouping schemes, and their visual and linguistic representational conventions.

Secondly, the society provides an aesthetic framework in which the composers situate their work. This includes historical aesthetic objects in the form of previous compositions, and their analysis and criticism. It also includes potential aesthetic constraints via the field of experts who might pass judgement on the work under construction.

Thirdly, the society provides a financial, or living, infrastructure to support the compositional activity - one way or another - and so consideration of the maintenance of that support is required.

Ontological view

An understanding from the composers perspective, their ontological position, which can be described as the way he or she sees the world and their place in it, manifests itself in the motivations and goals of the composer, which then lead to actions. I argue that because these intentions of composers are significant in shaping their compositional actions, they are significant to their use of a computer system.

Keeping within the topic of contextualisation I will suggest two ways of conceiving of the ontological context that I believe are useful. In the process, I conflate much detailed discussion on (or debunking of) metaphysics which is the realm of philosophy, the details of which I will leave to another time (see Heidegger 1997, Witgenstein 1953 , Dreyfus 1991, Hickman 1990, and others).

Firstly, I suggest that composers have an ontological orientation which can be simplified to a focusing on some of the contextual issues more than others. For example, it may be that a composer is concerned by the social need for acceptance by the field and thus chooses to subsume aesthetic, equipmental, and short-term financial gain, to achieve this social acceptance. Or, it may be that a composer wishes to utilise specific computer software, so in this case their ontological orientation is equipmental and may result in music with stylistic features reflecting the built-in functions or 'natural' tendencies of the software: producing music which seems uncharacteristic of them.

Secondly, I suggest that the composer has an ontological scope. This is the degree to which they are oriented in particular ways: not unlike the radial pick-up pattern of a microphone. A composer with a generally tight ontological scope will be mainly concerned with his or her own interests, that is the personal view (above), and less aware of or influenced by the social or environmental factors. I suggest (after Ciskszentmihalyi) that it is definitional that composers recognised in their life-time have a relatively broad ontological scope, such that they are aware of the way the domain is oriented and how their work is situated in that context.[2]

Methodology

To help illustrate the way these views illuminate different, but complementary, aspects of the composers' computer usage I will present aspects of the working processes of Steve Reich and Paul Lansky. I followed these composers' compositional process over several months during 1997 and 1998, when they were working on *Hindenberg* and *Things She Carried* respectively; both of which have subsequently been performed or released on CD. My method was to interview the composers by telephone on two occasions and once in person at their studios. These interviews were spaced to occur at early, middle and completed stages of the compositional process. The composers provided me with drafts of their work from these stages of the compositional process, in the form of files, scores, written notes, and audio tapes. Also, I collected books, articles, scores, CDs, and other information which was publicly available by or about the composers.

This methodology used the multiple interviews to enable: reinforcing of issues through repetition, capture of changes in different stages of compositional process, capture of stability/ instability over time, the emergence of issues and follow-up questioning, and a convenient method of data collection. The interviews, documents, recordings, photos, video, and personal observation create very rich research data. The ways of viewing I propose serve to both structure the analysis of that data thus helping to deal with the practicality of analysis, and provide a framework which assists in reinforcing the completeness of analysis.

I will present these two cases from each of the four views, high lighting the insights revealed by each view, and the limitations of only considering that view alone.

Personal Perspective

Fig. 1

Steve Reich's personal background includes undergraduate study of philosophy, studies in orchestral composition and classical piano, experimentation with early electronic musical devices such as tape recorders and microphones, studies in the music of Africa and Indonesia, an interest in modern jazz, and he is of Jewish extraction.

The influence of these skills and experiences is easily seen in his use of western musical notation and orchestral instruments in the main, with some electronic additions, and a distinct bias toward percussion instruments. His experiments with unsynchronised tape machines lead, famously, to his employment of various phasing techniques, which were reinforced by the ostinati structure of the music of Ghana and Bali which he studied. Also from these musics is the influence of the use of a limited and harmonically 'pure' pitch set. Reich's harmonic language shows a preference for chords built upon intervals and fourth's and firth's, and combining major and minor tonalities, these giving rise to chords with added 9ths (natural, flat and sharp) and 13ths reflecting his jazz influences. (Davidson 1988)

Music Example 1. 1994 "Nagoya Marimbas" Track 10 from "Works" CD 10.

Aspects of Reich's composing with computer which are not so clear, given only this personal information, are his rejection of orchestral forms for which he is trained, and more recent employment and treatment of vocal sounds for which there is limited personal experience.

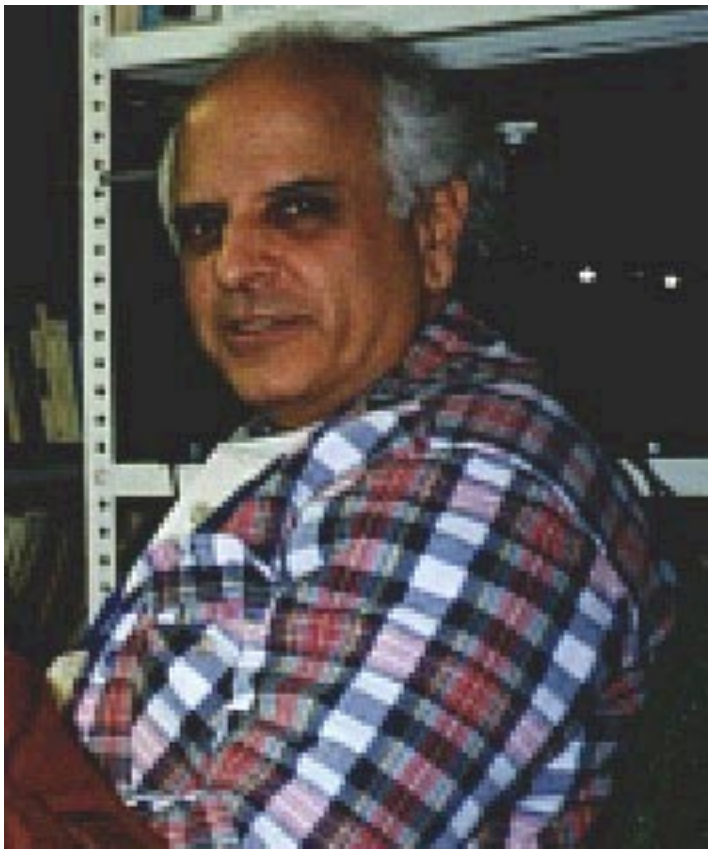

Fig. 2

Paul Lansky is of an age where he has actively lived through most of computer music's history, and therefore has a through knowledge of the products and research in the domain. As the head of a University music school he also has wide ranging experiences in many traditional and contemporary musical styles and practices. He is a skilled computer programmer who writes his own music software, and a competent keyboard player and guitar enthusiast.

Bearing these personal attributes in mind we can see, in even a cursory analysis of Lansky's music, the influences of western art music in his frequent use of chromatic and/or diatonic harmonic systems and in the use of recognisable instrumental or sampled timbres. His computing background and skills are evident in the algorithmic generation of pitch and rhythm material - often remapped features derived from sampled acoustic sounds - and in the signal processing synthesis and distortions used to provide timbral colours.

`Music example 2. Lansky. 1997. "Wish In The Dark", Track. 3 from "Things She Carried"`

Computer music composition is often regarded as quite a cognitive task, but as in all music physical skills play both a direct and indirect role, as reflected in Howard Gardner's comment that "On some analyses, music itself is best thought of as extended gesture - a kind of movement or direction that is carried out, at least implicitly, with the body." (1983 :23). In Lansky's case physical gestures have a direct impact in that he at times performs phrases into a MIDI keyboard and uses features of those performances as raw material for further treatment, also physical skills are used by him in an indirect way for example when reading a Cmix script (score) of pitch values he would 'play' the notes in the air on an imaginary keyboard. In this case the keyboard-tool has been assimilated into physical memory, and used as a way of restructuring the Cmix data into a more concrete understanding through gesture. This attribute of tools - to persist in the absence of the tool itself through transfer to remembered structures - is an important one in the understanding of tool usage, and is a feature of both physical and theoretical tools. (Rowe 1991)

What is less clear given only personal data is Lansky's absence of composition for live acoustic instruments, and his choice not to work with extensive performance input, particularly given that the personal-view data suggests that he would be capable of both, and they are widely accepted as reasonable practice.

From examining personal information useful insights into the reasons for stylistic preferences become evident. Al though this largely historical information is outside the computer system itself it is significant in influencing actions with the computer system. In particular, preferences become explainable in areas including: representational scheme -notation for Reich and text file and RT for Lansky; timbral preference - for Reich acoustic instruments with an emphasis on percussion, and 'found' samples, and for Lansky, predominantly treated and untreated samples, and some synthesised sounds; structural preferences - ostinati and evolution in the case of Reich, and shorter 'song-like' forms for Lansky; finally, harmonic choices, modal for Reich and chromatic and diatonic for Lansky.

The Environment

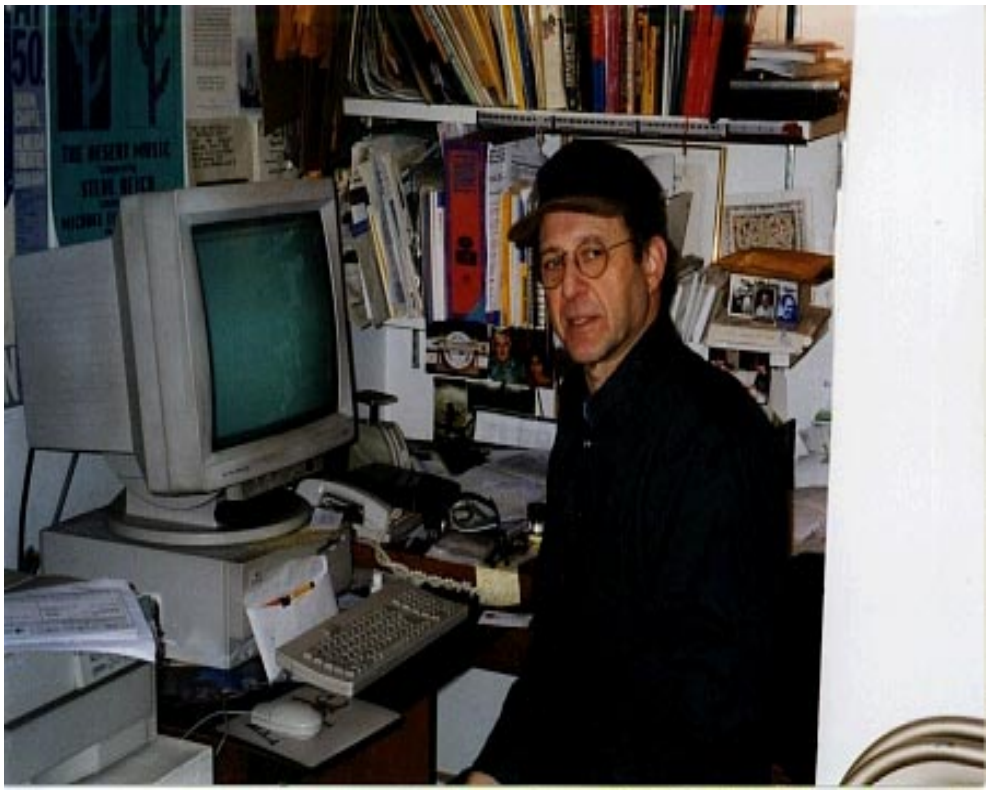

Fig. 3

The equipmental space for Steve Reich includes an upright piano, Macintosh computer with Sample Cell audio hardware, and Finale, Digital Performer, and Sound Designer software, a printer, various keyboard percussion instruments, tape recorders, hi fi system, telephone, and assorted books, scores, and files.

The non-equipmental details of this space include: it is situated in New York city; it is not sound proof , in fact can be quite noisy; it is not spacious such that it discourages frequent moving about or occupation by more than one person; the computer is separate from the other musical instruments but close to the telephone and reference books; it is well lit; and, is organised in a 'busy' manner.

Implications about the composing process from these observations include that Reich works alone (generally), that the keyboard and percussion biases evident from his personal experience are reinforced, that the compositional process is divided between work at the piano, the tape machines, and work at the computer, that the work pace is often fast and equipment is treated as a utensil, or appliance, or (in Heideggerian terms) as present-at-hand. The hi fi speakers face away from the computer sitting position but toward the tape machines, thus reinforcing the compositional divide between choice of taped samples as a critical sonic exercise, while their structural placement in the computer compositional environment is less dependent on critical timbral nuances as it is on pitch and timing which are adequately evident from any location. On this situation Reich comments that "It's just the misfortune of the geography of the studio. . . I really don't pay much attention to it." (Reich Interview '98: 723, 737-738) The choice of software and hardware reinforces the music notation focus for scoring, and the audio editing and

MIDI/audio sequencing environments enable the integration of samples into the pieces.

Reich's more extensive use of voice in the past five years or so is largely due to the ability to control vocal sounds more precisely and use them in novel ways. These abilities were significantly enabled by the availability of the sampler. In earlier works, beginning with *Different Trains* , voice samples were used as motifs from which the work evolved, and appropriate voice samples were sifted from hours of tape according to their melodic and rhythmic attributes. He describes such compositional enabling of the technology in this way: "I guess the real breakthrough was *Different Trains* , where I realised that I had an idea where if I worked on it on tape I guess I'd still be working on it, my fingernails would be bleeding. It was really a piece to be done on computer, and I did that on a Mac Plus! Running Professional Composer and occasionally Performer, then using these outside samplers that Casio had given me. So that was a real eye opener. What it opened my eyes to was the possibility of doing an opera that I could actually believed in." (Reich Interview '97a: 258-262) More recently in Reich's *Hindenberg* piece the samples are shifted in pitch and time to suit the music, thus being brought under increasing control via the technology.

`Music Example 3. Reich. "Check it Out" Part 1 of "City Life", Track. 3 from "Works" CD 10`

Amongst the things which are still unclear even with information about personal skills, tools, and work space, is why particular themes are selected for compositions, or how it is that a large work like *Three Tails* is broken into sections, and of what size, and why they might be completed in parallel or sequentially.

Fig. 4

Paul Lansky's compositional work space is focused around two computers which sit on a desk in front of him. The desk is situated close to the centre of a large room, it is dimly lit by lamps with little sunlight, there are comfortable chairs for sitting and reading, and the loud speakers are positioned some 2 metres in front of the computers forming an optimal triangulated listening position. The room is in Paul Lansky's home in suburban Princeton Junction and is well isolated from the rest of the house by two doors and is mostly quiet.

The computers, which are the focus of the work space, are a NeXT and an SGI Indy machine running Cmix, EIN, GQ, and RT software, all of which are written by Lansky or his associates. Next to this, on the left, is a MIDI keyboard angled slightly to be more accessible, but partially covered by a telephone and other papers. On the right of the computers is a shelf with hi fi equipment, tape records (which also act as Digital to Analogue converters for the SGI), tapes, books and CD's. All this equipment is within comfortable reach. Behind the composer as he faces the computer, is a large desk covered in many papers, obviously used for writing or other 'paper' tasks. Additional equipment not in the immediate vicinity includes an upright acoustic piano, guitar, loud speakers, and various shelves loaded with books, scores, CD's and tapes.

It is clear from this environment that Lansky's work is focused around the computers. The reason for two computers is unclear from observation alone, but it is reasonable to suggest that different tasks are completed by each, and an understanding of computing history would suggest that as the NeXT is no longer produced the SGI has taken over from it, and indeed this was the reason indicated by Lansky in interviews. The number, prominence, and sophistication of the computers in this studio suggests a particularity of focus on computing resources beyond that required by Steve Reich. The convenient location of the MIDI keyboard would imply an interactive style of performance and processing, however the use of it as a 'desk' for papers and telephone, indicate that it such use is perhaps intermittent. The positioning of hi fi equipment and choice of a quiet location shows special concern to audio feedback which of course is reasonable considering that Lansky's music is more often reproduced on CD only, not as live performances, therefore his version is the final version, unlike Steve Reich who's audio version is only a draft, and who's speaker positioning reflected this being less than optimal.

Music Example 4. Lansky, 1997. "Things She Knew" Track. 8 from CD "Things She Carried"

What remains unclear in Lansky's case are issues including the choice of projects, their duration, and scope, and (still) the issue of why recorded format is the preferred output medium, and also how the writing of software relates to the composing process.

Social Situation

Diagram 1 (Again)

The social context is clearly very extensive, and is well covered by domains such as sociology, economics, history, and the like. I will outline some of the aspects of social context which I consider significant for two composers by way of demonstrating what I believe is a reasonable

coverage of such contextualisation.

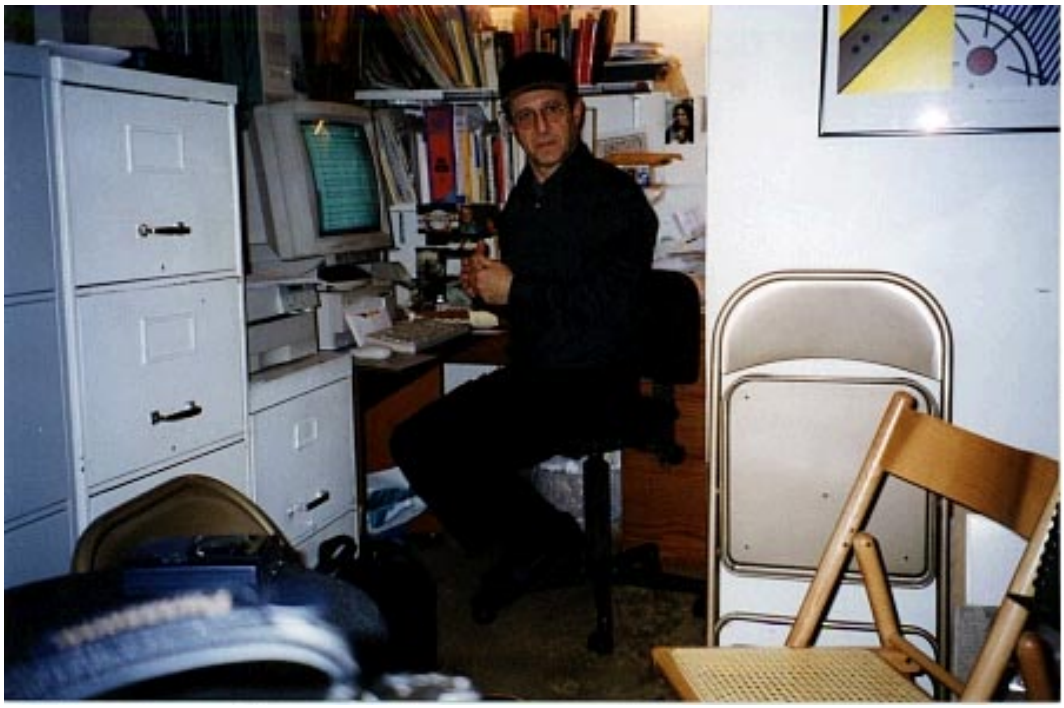

Fig. 5

Steve Reich is a professional composer such that his sole means of support is his composition and activities directly related to it. Such full-time composers are rare today, as they have historically been in Western artistic history, and this places Reich in a privileged, if at times precarious, living position. Reich's music is clearly regarded as aesthetically worthwhile by many, and as a result he has the artistic freedom (and responsibility) that such popularity engenders. Reich's composition draws strongly on the Western European tradition in its instrumentation, presentation, and to some degree structure. It also integrates features of other cultures, notably in its rhythmic organisation and to a lesser extent pitch organisation. His work also is influenced by, and influences, styles of electronic music from its structural derivation from tape recorder experiments, to the incorporation of sampled sounds as championed by Musique Concréte, and more recently the digital processing of those samples to musical ends.

The ways in which these social forces are evident in Steve Reich's compositional work with computer include: his reliance upon audio feedback via tape, MIDI, or samples during the composing process, his utilisation of samplers in live performance for artistic, economic, and pragmatic reasons; and his recent work with video, made possible via computer synchronisation which aesthetically extends the notion of 'Opera' as a form. The broader social forces (non technological) are evident in Steve Reich's: practice of completing large works in sections to enable performances of these prior to the conclusion of the whole work; his ability to work on projects of his own choosing, but the need to allocate time to securing associated commission, publishing, and performance arrangements; by allowing the intrusion of interviewers such as myself to perpetuate his reputation and influence in the 'minimalist' and/or 'maximalist' compositional style.

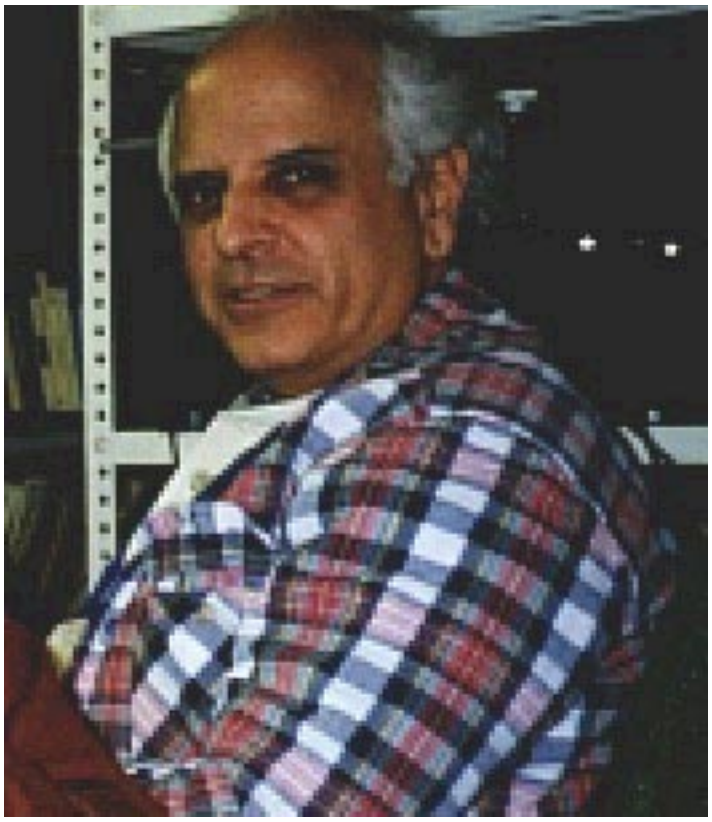

Fig. 6

The social environment for Paul Lansky includes the fact that he has a full time job as head of music at Princeton University, and the demands and opportunities that flow from that position. It is of course not uncommon for composers to be associated with academic life, and the connection between Lansky's life as a computer music researcher and tool developer, are integrated with his compositional activities. Lansky's is well schooled in the traditions of Western European music, but also is influenced by contemporary and traditional American society and the increasingly multi-cultural nature of that society. He occupies a position of 'seniority' within the computer music community, and can act as a significant player in the field.

In contrast to Reich, Lansky does not need to make a living from composing directly, although one could argue that his University position is (or at least was) directly related to that activity. In any case, despite this difference, both share a similar aesthetic freedom that comes with having established a relatively secure place in the society. Thus Lansky works on those projects which interest him and has the opportunity to push the bounds of the domain. Interestingly both Lansky and Reich choose not to make music radically different from what they made previously, but rather having found a synchronicity between their personal style and the society - while not at all static - move progressively rather than radically from that position. [3] That Lansky's music draws on American culture is evident in the use of electric guitar in a number of pieces, and the influence of American folk music especially on the 'Folk Images' CD, more recent works also include harmonic influences from other cultures.

Musical Example 5. Lansky. "Hammer" Track. 5 from CD "Folk Images"

Lansky's academic position also provides him with access to the ideas and skills of his many

students and colleagues, and the compositional software environment he uses benefits significantly from their direct or indirect influence. For example, the pitch tracking algorithm and the GQ program he often employs were written by graduate students, and the EIN software was written for students, but he now finds it compositionally useful at times, and he makes use of a Flute synthesis algorithm written by Perry Cook, who also works at Princeton.

Ontological Perspective

Diagram 1 (Again)

Understanding the ontological view of a composer is informative in regard to computer music system usage, in that understanding a composer's ontological orientation and scope, can explain preferences for particular musical or equipmental choices, and enable such preferences (biases) to be taken into account when interpreting their composition with computer. I will now detail my understanding of Steve Reich and Paul Lansky's ontological orientation and scope while working on pieces during 1997.

Steve Reich was working on *Hindenberg* , a video opera with vision by Beryl Korot. He was concerned to convey through this piece, and *Three Tails* trilogy of which it will ultimately be a part, the influence and potential threat of technology in the twentieth century. Reich comments that "It's basically a look at the 20th Century. It's one of those pieces at the end of the century. The due day is 2001 and it's looking at it in terms of technology." (Reich, Interview 97,1: 20-22) In particular, *Hindenberg* follows the story of the construction, flight and the tragic crash of the Zeppelin in 1936. Reich's motivation to divide the work on *Three Tails* into sections was partly practical, that it made the sections of music manageable, and partly economical, that performances of sections could be produced as they were completed. The sceptical view of technology expressed as a theme in T*hree Tails* is also evident in his comments on technology and use of the computer (and piano) in a quite a utilitarian way

After the tape pieces I felt well I don't want to spend my life making tapes and if this process of phasing doesn't work with live human beings then I think it's a kind of gimmick; which is something I would still believe. So the result of that was *Piano Phase* and all the other pieces leading to *Drumming* , which was the last of the phase pieces. The whole phasing process is basically taking something discovered with technology, taking the differentiation in speed between two tape recorders and transferring that to human beings, which is an unusual way of going, a different direction that people mostly move in. (Reich, Interview 97,1: 287-292)

His original reason for using the computer was stated as enabling the economic production of scores and parts, and similar motivations underlie current use, however the complexity of human-computer involvement for Reich has become more intricate over the years. Reich's chosen theme for *Three Tails* is also influenced by his Jewish heritage, in that his view of the place of technology reflects his understanding of the Genesis story as one charging humankind with the care of the world. This becomes a major theme beginning Act 2 of *Three Tails* . His relationship with his Jewish heritage has previously been expressed in many pieces including *Different Trains* , *Telhillim* and *The Cave* .

Aesthetically, Reich is aware of his niche in the musical community and that can continue to be

successful composing music in the style he does. Happily, he is also writing music he enjoys and is enthusiastic about. He is aware of the works of his contemporaries and keeps up to date with the new work of those he admires. Thus his music is composed within that awareness of the state of the domain at the time.

Reich is not so active in keeping abreast of music technology developments, but does install and use the latest versions of the software as they arrive and appear to offer 'useful' new features, and he uses new features as they seem appropriate. There is a convenient link between technological advancements in commercial software and Reich's use of them for his music. Historically, of course, this began with the phasing with tape machines, but continued through computer assisted score notation, to MIDI playback, and to the use of keyboard samplers which lead to the use of internal computer sampling hardware, and recently - for the *Hindenberg* project - the use of digital signal processing software to 'tune' samples, Reich has progressively assimilated technologies to the point where he states that about 30% of the work is done away from the computer, which is reinforced by seeing that the computer occupies the central activity area of his studio. It seems that Reich's use of these technologies corresponds with their widespread commercial availability, such that he does not pioneer the musical use of such technologies, but incorporates mature music technologies into his compositional process as they pass into his ontological scope. However, given his position in the generally conservative western art music field, he may well be the point of first contact with those technologies for many of his audience.

As for positing Reich's ontological orientations during this project, I would suggest he was concerned with making a statement about the role of technology in the Twentieth Century, refining the 'Video Opera' form to a more music-centred art form than that which he first used for *The Cave* , and continuing his search to write music which touched people in some way. These foci are evident in 1) the choice of compositional themes and subject matter, 2) the presentation of Hindenberg with one video screen rather than five in *The Cave* and the less-dramatic staging of singers and musicians and the greater altering of found sounds to the composed material, and 3) his continued use of musical 'primitives' of pulse, repetition, and pitch relationships of the harmonic series, and an endeavour to create playable as well as listenable pieces.

Music Example 6. Reich. "Who is Abraham?" from "The Cave", Track. 3 CD "Works" 9

Issues of analysis which in early sections of this paper were unclear become understandable with the accumulation of views. For instance, Reich writes for small ensembles and rarely for orchestra; with only personal skill information it was unclear why this was so when clearly he has the skills. His overt interest in rhythmic juxtapositions might be cited as being problematic in large ensembles, but Reich's view that the Orchestral form is historic and aesthetically and culturally burdensome combined with his desire for control over preferability of his music makes this appear as less of an anomaly. He notes that "there's a whole lot of things that go with the orchestra with it's traditions of the forms that were written for the orchestra, there's the fatness of the sound you talked about which is absolutely true, [and] there's the sociology that goes with it." (Reich, Interview 97,2: 428-430)

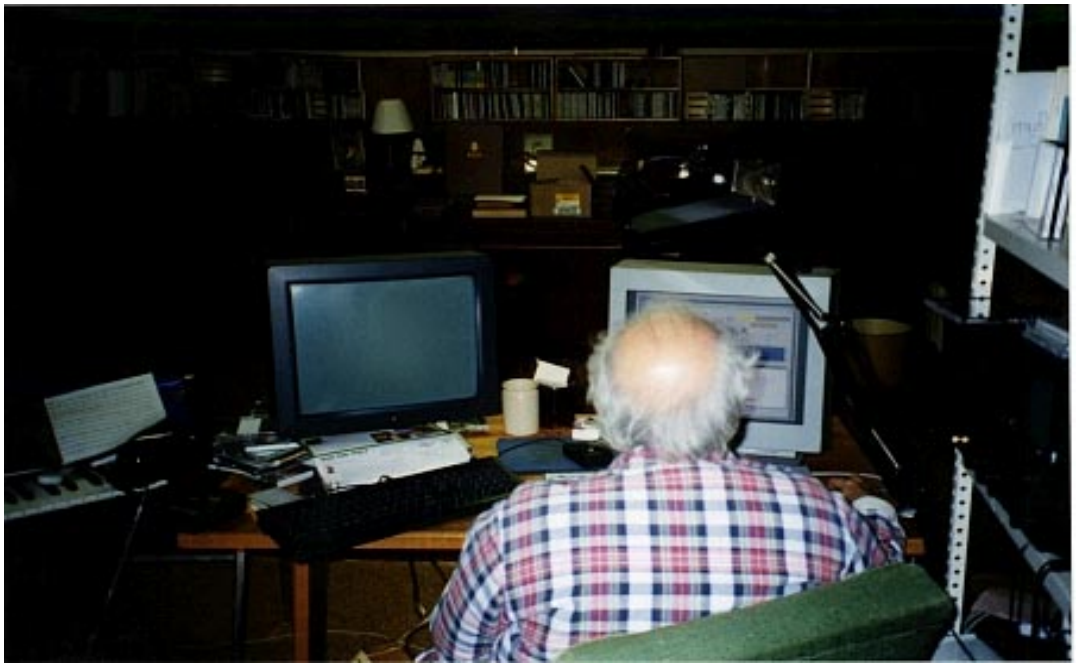

Fig. 7

As for Paul Lansky's motivations and goals, I would posit that he is interested in pushing the' musicality' of the computer as instrument. "What I'm trying to do is impose a fairly traditional way of thinking about music on sounds as real world." (Lansky, Interview 97,2: 270-271) This appears more directly as an interrelationship between exploring the possibilities of musical expression - particularly the extraction of expressive features from captured gestures and sounds - and the challenges of computer music tool building. Lansky seems most content when deeply involved in a project, and the task of building and using computer software tools appears to him as an evolutionary one, rather than a pursuit of an ideal. In considering the computer his instrument, rather than simply a utensil, the output from the computer as final product makes sense and the limited amount of acoustic composition seems less curious. In producing recordings as his distribution medium, Lansky assumes for himself the traditional roles of composer, performer, recording engineer, and record producer and posits himself as a sound-givers. "In some ways, composers, performers, and listeners are subclasses of sound-givers." (Lansky 1990:108)

The fog lifts from our earlier observation that Lansky chooses to work with minimal gestural input when we understand that his view of the computer is not to replace human performance by simply recording and replaying it, but to expand upon it and to transcend performance, by gesture capture and feature high lighting. In fact, in his compositions he often toys with the listener's expectations by using acoustic timbres or found sounds but then pushing the envelope of believability that they might be human produced, he achieves this by maintaining a gestural quality to phrases but uses sections where speed, polyphony, or timbral manipulation would be physically impossible.

He is acutely aware that the static nature of the recording medium he uses means that there need to be layers of detail sufficient to withstand repeated listenings, but still space enough to draw the listener in. He explains that:

"a lot of the work that I've done has to do with designing pieces of a certain level of complexity that engages the listener. And in some pieces, like my *Idle Chatter* pieces its a kind of mathematical complexity, there are tons of things going on and you don't really know what the main voice is. You sot of have to decide how to listen to it. Like a big abstract painting, where you have to decide what to look at." (Lansky, Interview 97,2: 40-45)

This manifests itself, in many pieces, with a three or four layer structure. Varying from a background which is harmonically and rhythmically static and utilises relatively concrete timbres, through to foreground layers of increased complexity, often microtonal or atonal, which appear with more surprise than consistency, and often use heavily treated timbres which are difficult to associate with their source.

Lansky considers software writing, or 'instrument-building' as he calls it, integral to the composing process, so stopping to code a new feature or algorithm is not considered an interruption to the composing process. Although he provides the applications (Cmix, RT, GQ, EIN) to anyone who wants to use them, via the Princeton Sound Kitchen web site, he considers the algorithms (Cmix scripts) of his to be integral to the composition and does not distribute those. In this way they can be considered as partial scores describing the works or more usually sections of the work and specific timbral manipulations. Through his action of non-distribution, supported by interview comments, another aspect of his ontological scope is revealed: regarding the border between the score and instrument.

Overview

Diagram 1 (Again)

Whilst, up till now this paper has considered the views individually, they of course interact and are each required for a comprehensive overview. In this section I will examine some of the features of each view as they relate to, and interrelate with, the others.

One of the interesting differences between views is the persistence, or stability, of the elements made prominent by that perspective. There are elements of the environment such as the working space, and equipment which are quit persistent - they commonly change slowly over time - while changes in personal compositional goals and opportunities in the social sphere, such as concert schedules or compositional commissions, are less persistent. It is usual for composers to take advantage of this feature (often subconsciously) by structuring their environments to reflect longer term or deeply held attitudes, such as the different ambient noise levels, and speaker locations in Lansky and Reich's studios. Also they use the persistent environment to buttress or scaffold their composing practice, as for example in the way both these composers situated reference books and telephones nearby, and studiously maintained computer files for backup and holding the work at various stages.

The social environment can be similarly manipulated by the composer, through accepting or rejecting work commitments, maintaining (or not) links with specific people in the field, keeping up to date with various literature and CD releases, and so on. These social aspects are often less persistent than environmental ones, reflected in the need for social contacts to be regularly

reinforced in order to persist.

This coordinating of personal, environmental, social aspects by the composer impacts on their computer use in concrete ways, such as how open they are to explore and or implement new computing tools, or features. Reich, for example, allows the detailed filtering process of commercialisation to restrict his choice, and the equipmental changes evolve slowly, while Lansky keeps well abreast of new developments in computer music practices, and his equipmental changes are rapid at the software level, more rapid at times than the progress of pieces themselves.

Does this make the task of understanding computer usage in music composition intractable? I don't believe so, although it certainly makes it more rich, and less amenable to one dimensional (for example statistical) analysis. It also reflects the flexibility of the computer and the diversity of applications to which it can be put. The computer has both features of physical instruments in its sound generating capacity, of score mediums in its ability to visually represent music, and of theoretical concepts in its ability to do symbolic processing. As a result, the computer system acts as a utensil, in the case of Reich, or as an instrument, for Lansky. I believe this analysis demonstrates that there are social, aesthetic, and physical capacities beyond data structure and representation which impact upon how the composer uses a computer.

It is clear that in a computer system design there are environmental concerns about the work location and surrounds There are physical concerns, such as portability, connectivity of gestural controllers, and screen display. There are social concerns in respect to its cost, distribution, chosen platform(s). As well, there are aesthetic dimensions to a system, intricately related to data structure and representation, but also to audio quality, data throughput, and so on.. The malleability of the computing medium, means that many of these concerns are determined by composer-choices and so reveal something of the composers thinking or habits. Thus the study of context seems to me to be tractable (at one level self evident) but in my view too often ignored in the examination of composition with computers. Too often the focus is only on the space intersecting the personal and equipmental somehow assuming all else, the environment, society, and personal ontology is stable, or worse, inconsequential. The context of use is broad, but I hope I have shown, manageable and enlightening.

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Footnotes:

1. These views are designed to observe action. That is, they are focused on the compositional activity and how the computer is involved . Activity leads to products, in the composers case to works of music, either as score or sound, and throughout this paper the activities as viewed in different ways are constantly referenced to the music products which result. A 'product view' has not been specified because a product is not a process or action, but this does not diminish its importance to a thorough understanding of the process, rather it is in fact of meta-importance, and is most tightly related to the ontological view as a primary motivating vehicle.

2. I should emphasise that this is my interpretation of their statements and actions, and rarely do people talk about ontological positions directly, so my comments should be accepted as my, rather than the composers' opinions (lest they be taken out of context or do a disservice to the composers).

3. In fairness to Reich he does see himself as shifting significantly, if not radically, although admits that he has found his niche and is happy to work in it. So my interpretation suggesting a more consistent stylistic trajectory is perhaps attributed to my view being dampened by a more distant perspective.

If you have comments or suggestions, email me at *a.brown@qut.edu.au*

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