Compositional Explorations of Plastic Sound

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Complete materials and instructions for performance of *Parables*, *Analogies of Control*, and *K*. Includes zipped, 24-bit audio files for concert use and 16-bit audio files for use in rehearsal. Also includes a .pdf of performance instructions.

Acknowledgements

Abstract

Each piece of music in this research is meant to explore a different aspect of music as a plastic art. Conclusions reached in the review of each new work were used to guide the development of the next.

The notions of plasticity in sound, and sound as a plastic material were used to give the overall research a focal point. In exploring different types of composition, reciprocal plasticity between the materials and the developing ideas of the music are discussed in the context of ecological and biological psychology.

By restricting all these works within the genre of 'plastic arts' it became necessary to introduce a new technique for instrumental composition. An aural model is used to replace the traditional written score. These instrumental works were developed entirely within an auditory situation.

Music as a Plastic Art

The idea of plasticity is explored in several contexts throughout this research. It is used to describe a class of artworks, the nature of the interaction with the acoustic material, and phenomenal qualities of the sound. Plasticity is also used to to describe the relationship between the concrete sound and the concepts that are used to guide the development of the work.

The music in this portfolio starts with the assumption that it is a plastic art, and explores the use of sound as a plastic material. The artist's relationship to it can be thought of in the same way as a painter's to paint or a sculptor's to clay, steel, or marble. In one sense, the argument that electroacoustic music *can* belong to the world of the plastic arts might seem self-evident. However, since the use of sound as a plastic material is a relatively recent historical event, and the reference is not widely used, some discussion is needed regarding the term and this stance.

The Material

Historical and common usage of the word 'Plastic'

Plastikos, from the Greek, means something that is moulded or capable of being moulded. As an adjective the Oxford Concise Dictionary writes, "Characterized by moulding, shaping, modelling, fashioning, or giving form to a yielding material, as clay or wax; capable of shaping or moulding formless matter."

In reference to art, the Oxford continues with "plastic art, the art of shaping or modelling; any art in which this is done, as sculpture or ceramics." The Mirriam-Webster dictionary restricts it even further saying, "visual art (as painting, sculpture, or film) *especially as distinguished from art that is written (as poetry or music)* [1]…"

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1 italics the author's

Plastic Art has been used to describe sculpture and painting as early as the 1600's[2]. Over 300 years later with the advent of acoustic recording, sound is fixed to a medium capable of being shaped and sculpted, and music enters the plastic arts.

Phenomenal sound

The transience and invisibility of sound makes it hard to think of as the perception of a physical object. In comparison, the objects that reflect light to us are experienced as tangible, corporeal. Equating an object with its visual image is a natural reaction. We point at a ball and say, "that is a ball". We don't think of ourselves seeing the reflection of light from that ball. Wishart says, "This recognition may be direct, or indirect in the sense that a physical location … may enable us to identify a, perhaps indistinctly heard, sound source." (Wishart, 1996) However, if we hear a bird's flight or song, we don't normally think of the song as the bird. We know that the song indicates that a bird is present and there is an intermediary process in identification that involves our identification of the bird with its actions.

Sound's wraithlike nature denies its materiality. It passes through solid walls, turns corners, and incessantly bathes us in invisible sensation, even meaning, but it remains ungraspable. Objects, from animals to stones, create sound, but the sound tells us something that the object is doing. Unlike the visual percept, the sound is rarely considered the thing itself.

Alternatively, it only takes a fraction of a second to grasp a visual image. There tends to be no intermediary identification with action in identifying what one sees. The table exists in the dark even if the visual perception of that table does not. Just like the tree falling in a forest, the event happened regardless of the whether or not a squirrel was around to hear it.

But sound does come from an ordered arrangement of matter, and once recorded, the plasticity of the sampled sound is only restricted by the

2   1677 " He [John Dwight] has so far advanced the Art Plastick, that 'tis dubious whether any man since Prometheus have excelled him." Robert Plot (Oxford English Dictionary, Oxford University Press)

plasticity of the medium on which it is fixed. The impression of that acoustic object/event, fixed to a stable substance, can be heard again, manipulated and replayed.

A composer of plastic sound must be able to think of sound as an object in and of itself, but given the sound can't be touched by hands the way that stone or bronze can, saying that one works the sound 'by hand' seems awkward.[3] But bronze is shaped in casts with fire, and stone is shaped by steel. The light from a canvas is manipulated only through the medium from which it is filtered or reflected. With sound, the electroacoustic manipulation of the stored sample, or even the physical manipulation of an acoustic object, is a direct parallel to manipulating paint or stone. It is, in any logical sense, no different than any other plastic art.

Psychologist James Gibson speaks of artistic displays and the *"fundamental plastic act"* as not so different from the *"fundamental graphic act"* noting that "Indenting and hand-printing pass over into molding and modelling: grooving and digging pass over into flaking and carving…" in these examples of plastic manipulation his observations centre on the fact that "the motion 'leaves a trace' which outlasts the act." "There is a persisting record of the manipulation, and newly created source of stimulation. Proprioception leads to perception" (Gibson, 1966) and plastic music fits within that framework. In essence, once recorded, the acoustic object becomes a fashionable material, and artistic use of it makes sound art a plastic art.

On Plastic Music

Concrete sound is plastic

The use of sound as a material for plastic art began with Schaeffer's experiments in 'musique concrète', so named to emphasize the difference between it and what he considered the over-formalized (serial) music of the time. It also signifies a reversal in the way a piece of music is usually created.

3 Although, I can cup my hands to my mouth and filter my voice or breath.

Francis Dhomont describes Schaeffer's use of the term *concrète* saying that the music "... begins with the concrete (pure sound matter) and proceeds towards the abstract (musical structures) -hence the name 'musique concrète' in reverse of what takes place in instrumental writing, where one starts with concepts (abstract) and ends with a performance (concrete)[4].

Concrete practice offers a way to compose and experience a work of music without mediation via a performer's interpretation of a score. The work as 'performed' by the author is presented directly to the audience much the same as painters and sculptors 'perform' and present their works. Schaeffer himself made early comparisons between painting and musique concrète. In 1948 he was aware of the relationship between it and the plastic arts, wondering if plastic sound or plastic music might be appropriate terms, saying "On sait qu'il s'amusa à se demander si les qualificatifs de 'musique plastique', voire de 'plastique sonore' ne conviendraient pas." **(Schaeffer, 1952 p. 115)**[5]

Claude Levi-Strauss does so again (going on to condemn it) saying "Musique Concrète puts itself into a situation that is comparable, from a formal point of view, as painting of whatever kind: it is in immediate communion with the given phenomena of nature."[6] (Levi-Strauss, C., 1970 p. 22)

Over time, concrete methods have become available for composing instrumental music as well. Synthesizers and samplers can be used to give instant access to orchestral sounds so that instrumental music can be explored empirically and then mechanically transcribed to manuscript. This method maintains the variation afforded in interpretation via the performer. Both

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4 Dhomont, F. (1996) "Did you say 'acousmatic'?" eContact!

5 "It is entertaining to ask if the designations 'plastic music', indeed 'plastic sound' would not be appropriate." (author's translation)

6 In a similar vein, James Gibson describes the "fundamental graphic act" and the "fundamental plastic act" as cognates that are primarily concerned with displaying. One changes a surface with the brush or the hand. Gibson contrasts them with depicting and writing, saying "Both depicting and later writing thus differentiate from the act of display-making. But the original undifferentiated graphic act, we may suppose, continues to develop and elaborate in the child independently of depicting and writing. It might be motivated by the mere pleasure of making traces to look at. There seems to be a satisfaction in creating forms even when they do not portray objects or specify speech. This motivation is often called esthetic and is claimed as the basis of art." Gibson, J. J. (1966) The senses considered as perceptual systems, Boston, MA, Houghton-Mifflin.

plastic and abstract (instrumental) composers can work with sound in a concrete way. And, while written music will not be considered as 'plastic' (in this portfolio) it will be shown how instrumental composition can be approached as plastic art.

Is it music? (Does it matter?)

After 40 years of research, Schaeffer denied that sound art, or *musique concrète*, belongs to the world of music, saying, "Painters and sculptors are concerned with spaces, volumes, colours, etc., but not with language. That's the writer's concern. The same thing is true with sound. Musique Concrète in its work of assembling sound produces sound-works, sound-structures, *but not music.*" (italics mine) (Hodgkinson, 1987)

What Schaeffer seems to consider a fundamental aspect of music, as he understands it, is absent in musique concrète.

Schaeffer's comparison to painting and sculpture is acknowledged, and I accept that analogy and hold further that music, in particular the music herein, shares those concerns with "… spaces, volumes, colours, etc.," of painting and sculpture, as well as written music's concerns of rhythm, pitch and duration. This work is plastic music.

Other Kinds of Plasticity; different contexts

The score as a vehicle for plasticity

   Written music can be said to have a great degree of plasticity in the variation of interpretation that each player brings to it. Christopher Parkening's rendition of a Sor study will not be like John Williams's. In any era of music, much of what is expected in performance is often unspecified and is filled in by cultural norms and personal preference. Throughout all these different audible results, the paper score remains constant. It is a starting point from which to create music and the music continues to change as practice and culture evolve.

   The kind of plasticity afforded the performer in a written score is a given in the composer-performer relationship. For the player it might be the window to self-expression, and for the composer it provides another view. In another sense, performance is also the task of a "paper composer". The idea of the sound must be translated to paper and given in such a way that an instrumentalist can mediate its realization. It is a source of infinite variation between performances. Sculptors 'perform' their artistry on their materials, as do painters. The absence of a stage or live audience makes it no less an artistic performance.

Apparently plastic

   The appearance of plasticity can be affected through continuous morphological transitions, without audible breaks, using either electroacoustics or manuscript. The composer achieves these by exploiting the possibilities of precise and subtle changes between fixed sounds and-or traditional instruments. Using graphic symbols and orchestral instruments in this way demonstrates an apparent plasticity of morphology attainable through written composition. But again, performance is the vehicle for plasticity, and the composer does not perform the sound, only the construction of the score.

Shaping plastic sound

The studio composer can (and in this case does) perform nearly all the gestures that form the music. Microphones are dynamically guided in order to shape the movement of the sound while sampling. Close-up microphones can make small sounds large. Volume and spectral balances can be shifted in order to take sounds' proportions into unreal scales. Computer controlled changes for any parameter of sound, from volume to grain size and speed change, can be done by hand. Sliding faders, rotary knobs and their digital analogues, pressure sensitive interfaces, and even clay pots or heat activated metals are some of the tools with which sound can be shaped in the studio.[7] As haptic and kinaesthetic control of audio tools have become more fluid, allowing better proprioceptive control, the plastic nature of sound art has become more apparent. It is this 'hands on' approach to plastic on which this portfolio is centred.

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7 In the works *Taut, Parables* and *Analogies of Control*, some of the sample sources are of objects manipulated prior to recording.

Structuring emergence

Background

My discovery of acousmatic music was actually not from my music education, but from my research in my undergraduate psychology degree. While looking for papers on ecological psychology and music, I found Luke Windsor's PhD thesis "An ecological approach to the analysis of acousmatic music"[8] which described a kind of music closely related to my nascent attempts at (digitally mediated)[9] electroacoustic composition.

Although Windsor's article was very specific about not attempting to prescribe a method, ecological psychology is about the structure between the organism and the environment. Where there is analysis of structure, the possibility for the reproduction or mimesis of that structure exists.

The perceptual model as formal constraint

Ecological psychology describes the relevant scale of observation for perception as the combination of the organism and its environment, and the two, although separable in study are actually two "resonating subsystems' of the ecological whole. Perception can be looked at as something that happens between the two of them, instead of something that happens as a result of the organism gathering information and processing it to 'figure out' what is going on. The environment and the organism are tuned to each other. The things that happen between them are 'lawfully related' and that their co-evolution endows them with traits that respond to each other's presence (note that the environment is said to respond as well).

Gibson refers to "ambient energy arrays" in the environment to which the organism is sensitive saying that the organism and environment can respond to each other through these structures in a direct manner without having to abstract behavioural logics or conceptual constructs. This doesn't mean that internal constructs do not exist. They do. They are part of the organism's

8 Windsor, L. (1995) A Perceptual Approach to the Description and Analysis of Acousmatic Music. London, City University.

9 I had worked with tape before this, but in a mixed media situation either with video or manuscript.

experience and they are integrated with that ecological interaction. These past experiences and the constructs that they provide have shaped the organism's resonant space.

Ecological constraint as formal model

The composer, the studio, the sound, and the sources are the environmental components in these pieces. I propose that Gibson's notions about the systems being tuned to each other apply here and the composer responds to these structures in a direct manner. It is not necessary to impose a priori abstract forms onto the work. Relatively consistent constraints are already present in the filter processes, computer interface analogies, sliders and sound sources. Structure, particularly musical structure, is 'picked up' by the composer and shaped with other perceived structures.

Precedence

Ecological psychology has been used before as a way to compose music.

Damien Keller used it to design software for composition, (Keller, 2000, 55-60) and his work *Touch and Go,* is the first time ecological concepts have been used to compose a piece of (computer-based) composition. His approach was to build "compositional models that parse time into event-dependent chunks…" creating a "system that is reconfigured whenever it finds new information." In other words, the temporal unit within which an event is observed, is (re)defined by its context.

Oliveira speaks of "music as emergence of a self-organized system" (Oliveira, 2003) and uses Gibson's notion of a 'self-organizing system" to describe an interactive work in a social situation in which the musicians and the listeners participate to create an "ambiguous Soundscape in the sense that the audience will make (conversation) sounds"… and this is mixed by the artist "with the previous sonic material of the bar and some non typical bar's sounds." The end result is a work that is emergent in the same sense that perception is emergent from the interaction of the organism-environment system. While the audience is adding their ambience to the pre-recorded material, they will react

to that situation, and the musicians will re-adjust accordingly, creating a piece of emergent music that only exists the way that it does through the mutual interaction of all parties.

The compositional environment

I use ecological psychology's model of "resonating sub-systems" in composition, as a special case of the organism-environment system in which, by awareness of the system's dynamics, and the system's parts, the system can be manipulated, not just reacting within it, but also by using the conceptual model of the system as a tool.

The composer, the studio, and the research plan together are conceived of as nested feedback loops in which each part informs and is informed by the activity in the others. These interconnected feedback loops comprise the system in which all these compositions were realised. This model, borrowed from psychology, biology[10], and system dynamics is applied here to composition. These compositions explore ways to guide (and be guided by) the outcome of 'emergent' percepts. These could all be realized as fully auditory, but will always be affected at some level, overtly or covertly, by non-auditory information, such as semantic, spectromorphological, visual or kinaesthetic qualities.

The sound sources and sound samples will encourage reciprocal plasticity between the sounds and the concepts they might inspire or illuminate. Sounds that are musically useful can be created from combinations and permutations of each work's samples or chosen from stochastic processes or even from accidents. Often extant sounds are 'discovered' to fit the changing context of the developing work. The work's larger form is developed within the context of the existing sounds and, since the sounds that will be used are often yet to be known, the structures of the piece cannot be pre-defined.

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10   Transactionalism as developed by Lehrman, is a branch of developmental biology that describes the development of the organism as an interaction of its environment and its genetic blueprint.

These works depend upon emergent qualities and dynamics and a continuous re-evaluation of the extant material to accommodate any new interesting content or context that the system (composition in progress) might illuminate. Therefore intent is continuously dependent upon the results of the ongoing analyses of the material, both sonic and conceptual.

Compositional constraints are considered to be the materials in the compositional environment and the structure of the environment itself. What differentiates the context and content will vary, dependent upon the scale observed and point-of-view whether semantic, morphological or even kinaesthetic, and each piece's materials are intended to affect that point of view.

As an example of alternative ways to manipulate a part of the compositional environment, consider the way in which the sources were chosen and gathered for *Gravity's,* as opposed to *Cross Country Runner.* Whereas the sources in *Cross Country Runner* were chosen for their long familiar associations of sound to action, I began my training as a climber with the intent to gather sounds yet unheard and associated with actions yet unknown. Therefore, all my experience with those sounds originated with (and are strengthened by) the extensive physical changes in myself to which they are associated.

Specifics for each of the research works change, and are discussed in the portfolio section.

Subsystem Dynamics

Neural plasticity

Our brain changes shape as it absorbs new experience. That new experience may be a subtle as the repeat of an already familiar sound in a new context. The new context may be a subtle as the third to the fourth hearing in the same chair in the same room two minutes apart. "… cortical maps for somatic sensations are dynamic, not static. Functional connections can expand and retract. The cortical maps of an adult are subject to constant modification on

the basis of use or activity of the periphery sensory pathways."[11] This neural plasticity is the biological substrate of thought. It is that sensitivity to, and physical response to change that creates in an organism a mutually resonant relationship with the world. A sound will change the brain's shape and the newly moulded shape of the brain changes our percept of the sound.

While the prospect of thinking about thought might seem so self-referential as to be useless, it is in this resonant space of neural growth in which a continuously recursive network of feedback loops, nested within other loops and fed by more, comprise a system that reaches beyond its auditory channels. Audition is only part of the system in which the composition and even the hearing of the composition is achieved. This feedback system is fully interconnected and any starting point might be considered arbitrary. But since the subject is sound, we start by describing the auditory signal loop.

Loops in Loops

The auditory loop

The border between the structures we normally think of as the ear and the brain that interprets what the ear gathers is fuzzy at best. Moving inward from the outside, the ear begins at the pinae, and extends past the tympanic membrane and ossicles into the cochlea. There, the mechanically amplified vibrations shake the inner hair cells producing nerve impulses. These impulses proceed toward the auditory brainstem and olivary coliculus, through the medial geniculate nucleus in the temporal lobe and spread throughout the brain to join with neuronal bodies it shares with the other senses (eyes, touch, etc.) and is mixed with the traces of all past experience distributed throughout the system[12].

11   Principles of Neural Science Edition 3rd ed. / edited by Eric R. Kandel, James H. Schwartz, Thomas M. Jessell, Publisher London ; New York : McGraw-Hill, 1995. Page 680 (best to read all of chapter 36) Also see Hebb, D. O. The organization of behavior : a neuropsychological theory New York : Wiley, 1949 xix, 335p to see where most of this started.

12   'Experience' can easily be extrapolated to epigenetic predispositions. A species is the result of its evolutionary history.

All along the way, fibres feed backward along the path with the brain's response to the original signal, to the cochlea. (Figure 1) There, the organism uses the outer hair cells to modulate the incoming sound according to pre-existing information from auditory *and other modalities* in order to create a useful model of the world around it. (Géléoc and Holt, 2003)
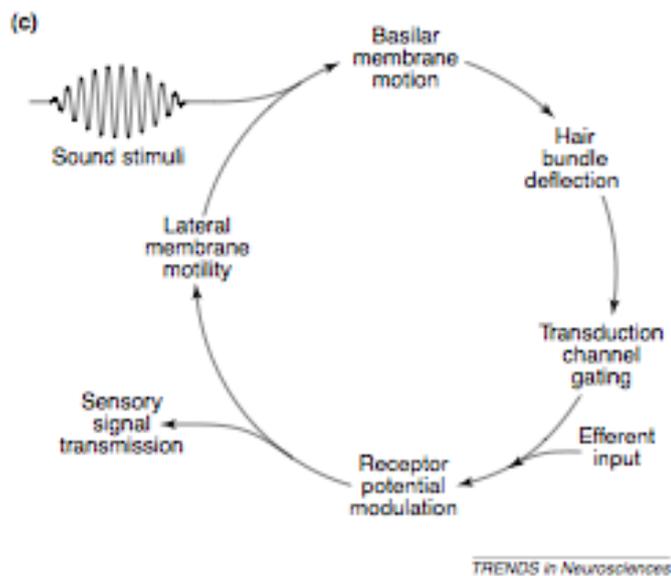
Figure 1 (Géléoc and Holt, 2003)

Information from any sensory modality is affected at some level by all senses and predispositions, in all parts of the brain (Lloyd, 2004). These processing areas, despite their predisposition toward vision, haptics, kinaesthetics, language or any other, add more information to the aural result. Learned predispositions can be so strong, particularly where language is concerned, that some people (this composer being one of them) can 'hear' the change between the apparent sound of 'd' to a 'b' by simply covering and uncovering the screen while watching a demonstration of the 'McGurk Effect'[13]

Perception is a combination of active searching, extant memory, epigenetic predisposition and environmental circumstances. What we hear relies on the combined perspectives of multiple senses. It is within this "inexhaustible

13   Harry McGurk and John MacDonald in "Hearing lips and seeing voices", Nature 264, 746-748 (1976)

relata"[14] that sounds are chosen, rebuilt and re-related to construct a musical work.

The second loop (studio augmentation)

The studio composer inhabits an environment with a special emphasis on sound interaction and manipulation. Source sounds are brought to the studio and enter the system via microphones and analogue to digital signal converters.

The composer is also part of that system, and his experience of the sound enters the studio via the body. He has, in effect, recorded that experience, been changed by it, and participates in the system 'weighted' towards his experience with the sound.

Transformations by digital and analogue processes are constantly re-evaluated by the composer and continuous replay-feedback allows further aural consideration. Multiple listening strategies are made available by studio software and hardware, as well as various conceptual schema such as reduced listening and following semantic relationships, or (more likely) a combination of both.[15] All these 'filters' influence the way in which is sound is heard.

The studio situation enhances the perceptual sensitivities of the composer by extending the sonic analysis through its analogue and digital system and external memory. I envision the composition studio as an electroacoustic extension and augmentation that is analogous to (if a somewhat simplified version of) the composer's auditory system.

Sounds can be compared directly with their variations or even with themselves. They can be re-associated according to the processing techniques, semantic links or morphological similarities with other unrelated sounds.

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14   According to Whitehead's Principles of Relativity "Fact..." (In our case auditory fact) is "... not the sum of factors; it is rather the concreteness (or, embeddedness) of factors, and the concreteness of an inexhaustible relatedness among inexhaustible relata." (Whitehead, A.N (1922) p. 14)

15   For instance, granulation was used in *Taut* as a way to achieve sustain from the guitar samples. Tremolo is a type of granulation used to achieve sustain in plucked strings and so it seemed to be an appropriate method for use in *Taut*; a work made of guitar sounds.

The studio situation, with its constant feedback loop of mercurially shifting audio data reshaping perception and the resulting perception's re-evaluation and further exploration of the sound, affords the emergence of new structures; acoustic, perceptual and conceptual, in which the composer can guide the music while being guided by the sound.

This signal loop is a structural aspect of this work at the psychoacoustic level, the psychological level, and the working method. It also reflects the changes in compositional perspective brought about by focused listening. That is, how the idea of the piece changes from concept to completion as a result of interacting with the extant and reshaped sounds.

Research as feedback loop

This research project is led by the creation of artistic works. In this research model, each stage is initiated by the creation of new music. Conclusions and considerations brought to the fore by reviewing the compositions are then used to influence subsequent works, which are, in turn, evaluated and used to inform further work. It is another feedback loop of a larger orbit that contains the two previously discussed. It is a feedback loop not unlike the studio situation itself, albeit a good deal slower.

Whereas the monitor-computer-composer interaction is generally an analysis/resynthesis loop that occurs at a duration between seconds and maybe days, the written analysis-composition loop is occurring over a period of weeks and maybe years. It could, in fact, continue far beyond the composer's own research to be continued indefinitely.

Plastic Music:
Composing with plastic sound

Cross Country Runner

Cross Country Runner is a composition for fixed sounds. The music's sound sources are of a runner passing through fields, along canals, and on pavement. Interwoven with the sound of the external environment are recordings made at close proximity to the runner and the materials with which he came in physical contact, such as leaves, gravel, breathing, heartbeat and trainers on different surfaces. These sources were gathered both in the field and in the studio. Field recordings were made along the Great Central Way, the River Soar, canal towpaths and Leicester's neighbouring fields. Studio recordings were made in DeMontfort University's recording studios.

Originally, this work was intended to be an exposition of physical gesture and kinaesthetics, ideas developed in two of my earlier compositions, *Between Dog and Wolf* and *The Transatlantic Half-Pipe*. The large gestural dynamics of those source recordings (mountain bike and skateboards) were absent in this piece. Due to the static, or steady, nature of the sound of running, and the predominance of outdoor sources that were gathered, the music resembles soundscape composition. Soundscape works, according to Barry Truax, focus on "… the re-integration of the listener with the environment in a balanced ecological relationship." (Truax, 2000 p.14) More at issue here is the behaviour of the organism-environment system and how the emotional and physical relationships within that can be reflected in a purely sonic series of events.

Ecological psychology (Gibson, 1966) does mirror soundscape thinking in its vision of the organism and environment in a continuous exchange of action and information. However, Truax's concern for integration is taken for granted as a lawful state of existence[16]. *Cross Country Runner* uses sonic transformations to signify shifts in the runner's perception. It attempts to convey a sense of unity, or singularity, of an organism embedded within the continuum of its

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16   It is understood that Truax is concerned with conscious awareness of the natural environment
as a philosophical and possibly, moral and/or political point that needs to be made, or can be made
with soundscape art. Whereas it is hoped that this work might increase one's awareness towards that
goal, it was not the initial intent of the work.

ecology by shifting aural focus between the runner's internal states and the environment in which he runs. The sound world of the runner stays in flux. It is intended to occupy the border or membrane between the world outside and the world inside. The runner's introspection is represented as various levels of recognition regarding the sources from the environment.

The work opens out of doors with the sound of breathing, but breathing that has been cross-synthesized[17] with the sounds of a leaf being scraped against itself. The result is a sound that bears little resemblance to a breath, save the shape of its envelope. As it opens to a wider soundfield, square wave pulses resembling frog calls (00:05) rise in pitch as the recording of the natural soundscape with birds and water take over. Altough the false frogs are processing artefacts they seemed appropriate to the scene, but probably more from my own memories of my runs in the USA. Another 'false' image is that of a bird flying across the runner's path (00:45). The bird is actually a speeded up version of the runner passing under a heavily echoing arched bridge. The false bird recurs throughout the work. In the case of both the false frogs and the fake flying birds, the recordings of real birds and outdoor ambience worked together to provide a contextualising cue[18] enhancing their approximation of the 'real.' It also is intended to sonically bind together the act of flying and running.

From here, the runner begins a long steady pace with first slow, subtle, then faster, and more obvious spectral concentrations in the running. At first there are left to right crossings as the runner passes under a bridge, taking advantage of the natural reverberation offered by the arched underpass over water. As it progresses, however, the stereo field movement of the runner

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17   The computer resynthesis of a sound done by adding or replacing spectral and morphological information of another gives opportunities for poetic devices such as foreshadowing and variation. Even sounds that may be so far removed from their source as to be unrecognizable by the casual listener may be useful for the composer's own organizational rationale.

18   Trevor Wishart discusses contextualization in *On Sonic Art* using Gestalt principles in a discussion of *Red Bird*. He uses the sound of pages being turned conjoined with a book slamming to get the 'scene' of a book slamming shut. He interweaves this with the sound of a door slamming. The difference between the door and the book are both provided by their contexualising cues. The book has its pages and the door is defined by the metallic handle sounds. (Wishart, 1996 p. 155-159)

centres, letting the spectral changes of real and artificial environmental sounds define the wider soundfield. It closes with a simple slowing to a stop in the leaves. There is a short pause between running sequences and isolated breathing is bracketed in silence (03:38).

The next part (03:55) begins by using speed to break away from the first section's spectral stasis. Recognizable sounds of footsteps accelerate and reach terminal velocity crashing through to an image of fantastic speed. To do this, steady and quick granular streams of gravel are used with irregular explosive interjections. It is mixed against high frequency breathing also at a very fast rate. It may be too fast to recognize at first hearing that is derived from breath. The pulse-like sounds are not completely regular, although they have a somewhat generalized speed. They were made using my recorded heart beat as a trigger for a noise gate over the running sounds. Where their peaks coincided the beat showed through stronger. The section closes with the sound of a metal gate swinging (05:44).

When a runner goes for a run, he (normally) comes back to where he started. This circularity appears in the next section recalling the start of the piece, passing under the bridge and circling back to the original opening breath. The running continues, but at times the footsteps give way to breath and blood alone. The runner continues as in the beginning but here is an abbreviated version with more extensive spectromorphological[19] variations than before. It does not stop, but foreshadows the next launch with an extended hop before the acceleration and build up. The second launch sequence is more intense, has a longer build up and a markedly stronger explosive transition. At its crossover, the sound world is calmer and less expectant. There is a transition using the metal swinging gate (08:37) and the rest emphases long slow shapes with high shimmering grains.

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19   Spectromorphology is a way to view and discuss the shaping of frequency components. It is "… a framework for understanding structural relation and behaviours as experienced in the temporal flux of the music." (Smalley, 1997)

All of the earlier samples reappear mostly in highly transformed versions, unlikely to be recognized by the casual listener. The closing sound is an exhaled breath filtered and mixed with leaf and gate spectral elements. The general morphology of the breath is easily recognizable while the spectral content is harder to identify. Spectral companding (Soundhack and Soundhack Plug-ins) and convolution were used to cross-synthesize the two. Symbolically they can both be seen as membranes that tie their particular organisms to the world, through the air and eventually to each other.

Speculation on soundscape music

This work could bring forward some the issues of rupture and re-integration between the listener and the soundscape with which Truax is concerned. It is specifically about the relationship between an organism and its environment. During the course of the work the aural focus shifts between the runner, the environment and the integration of the two.

The sounds of the runner's internal world of heartbeat, breath and blood, combines and alternates with the world in which he is running. The flipping back and forth between perceiver and perceived, organism and environment, naturally highlights their sonic relationship and, if a rupture in conscious awareness exists, the dynamic illustrated here could serve to remind the listeners after they leave the concert hall.

Glint

Glint is a short work that proceeds from *Cross Country Runner* using sound samples of the contact points between the runner and the world around him. The source samples are the closely recorded sounds of leaves, shoes, and shoes against gravel, and tarmac. The music is concentrated, quick and dense. Its parts are "strung" together with the sound of a shoelace and divided by the rise and fall of tapping leaves. This work could possibly be presented as a part of *Cross Country Runner*, but the sound world and overall structure are different enough to warrant its separation. However, it is from that autonomy that a relationship between the two can be expressed.

Oliveira describes perception according to ecological psychology as "… an emergent property that can't be reduced to physics. Perception is a higher level, over the mutual interactions of perceiver and environment." (Oliveira, 2003, p. 3). It is along these lines that *Glint* drives its structural metaphor. The sound sources that make up *Glint* are the materials that make up the contact points between the runner and the trail. These points of impact where muscle pushes against the ground and recoil pushes the runner forward are points of transduction. It is from this point of contact and transfer of energy; this interaction, that *Glint* is constructed.

Symbolically, *Glint* emerges from the interaction of the runner-land ecology, as perception emerges from the interaction of organism and environment. *Glint's* relationship to *Cross Country Runner* is an analogy to perception in the organism/environment interaction. It occurs as a result of the interaction of the materials used for sound sources in the other work. It is sonically autonomous while retaining conceptual ties to the other work. They are companion pieces. The organism and its environment are to perception, as the runner and its environment are to *Glint*. In this way Gibson's theories of ecological psychology are used as a poetic device, or an analogical methodology.

Soundscape dynamics

The leaves were gathered as sources for studio recordings in late autumn. Later in the season, during listening sessions in the field, it was found that the leaves, having been weathered by rain and wind, had taken on a new spectromorphology. Their sounds were softer, less brittle that the dry leaves of earlier in the year. On returning to the studio, attempts were made to imitate the new sounds using smoothing filters and multiple windowing using a phase vocoder. These were partially successful. The sounds were made softer, but not quite in the same way as the naturally weathered ones. If it were it possible to gather more recordings, the work may have sounded different, but to what extent is unclear. The real significance of this was the way that the studio affected my field listening and the subsequent attempt to incorporate the new information.

As a result of continued listening both in and out of the studio during the construction of the works, the notion of plasticity extended beyond the realms of the studio and into the sound structures of natural and cultural environments leading to a view of the environment as a dynamic sound-making system. Thus, the notion of plasticity has embraced the relationship between a sounding agent and its environmental surroundings initiated through the recursive relationship between them.

Plastic intent

Not only is the nature of the environmental sound world shown to be dynamic and plastic, but also the ideas that are used to analyse them. As the construction of the work progressed, the intended analogies of physical gesture and complex dynamics that were drawn from my works completed prior to this research's beginning (*This is Not a Model*, The *Transatlantic Half-Pipe, Between Dog and Wolf*) were found to be unsuitable to the sounds I had collected. Therefore the original conception of the work had to be adapted in order to better suit the source sounds.

Dynamic physical gesture was less central to the captured (running) sources than expected. Large gestures were found or created, but the more complex ones that I'd hoped to discover were not there, so additional structuring ideas were sought. By using ecological psychology as an analogical construct, the work became a narrative of the organism-environment relationship, first by elaborating on the imbeddedness of the runner-organism in its environment, and then by bringing *Glint* forward as an emergent work resulting from the sonic contact points between the two.

MasterSplasher

The plasticity of spatial representation

Recordings were made at the locks[20] on the canal in Leicester. The microphones were lowered into the chamber to record the water escaping through the gates. The gates were opened and shut (slightly) in order to record the variation in water volume, and also to record the gears of the lock mechanisms.

The culvert beside the locks was also sampled. The narrow, tall chamber was more reverberant and also attenuated a lot of the higher and lower frequencies. The result was a more constricted sounding space.

Most of the water sound was variegated pink noise. Much of it bordered on white noise. Articulation was found by using close-up recordings of individual water splashes and droplets, as well as cross-synthesis of water and lock mechanisms.

Finding ways to make differences in the pink noise was the main technical work in the studio. This was done using real time equalizers, and automated equalization as well as graphically focused interfaces like Audiosculpt, NiSpectral Delay, Frequency, Audacity and Spectral Shapers.

Space as narrative device

Written in response to a request for works about the river Thames and James Faraday, it is meant to be narrative. The sound follows a course of tighter and tighter restricting spaces signifying the channelling of the river's energy towards the city's purposes. As the river enters the city, it is redirected in order that power can be extracted from it. Eventually the water is released and the restricting spaces around it disappear in a dizzying field of off-kilter phase relationships. This 'release' was created by lowering the microphones into the canal locks on separate lines and swirling them in the air over the escaping water (07:25).

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20   This is a canal lock for lowering and raising boats through different sections of the waterway.

The piece was a chance to approach the idea of 'plastic sound' in a simple and direct way. The wide band sound of the rushing water was 'carved' with different kinds equalization tools. This EQ sculpting altered the waters' spatial representation and provided the poetic device that pushed the narrative forward.

The concert setting was on a riverboat, on the Thames, and the speakers were placed around the boat inside and outdoors. The sounds of the river rushing by the boat and the recorded water rushing through the locks and sluices were at times indistinguishable from one another. The different social and ambient settings from deck to deck made for different experiences of the work. The room at the top of the boat was for people concentrating on the work, in more of a concert setting. The real river's sounds became the background to, and the context for, the music. Since the Thames' sounds were so much stronger on the outside deck, the music "bubbled up" out of the background of river and conversation, sounding at times as if the river's waters were coalescing to take form as musical entities.

The Plasticity of Time: Free improvisation and electroacoustic composition

The 'primacy of the ear' practiced in plastic music is not restricted to studio composition. After leaving written composition for a time, and before becoming involved with plastic music, I was introduced to free improvisation, another type of concrete music. Saxophonist Wally Shoup, violist LaDonna Smith and guitarist Davey Williams, a group known as Trans Museq invited me to play guitar and trumpet with them.

Trans Museq's approach was that nothing mattered but the ear. As self-proclaimed Surrealists, they considered what they (or we) did was 'automatic writing'[21].

According to LaDonna Smith, speaking of her early work with Trans Museq, "...We tried to steer clear of anything that sounded 'like' anything else and sometimes engage in just raw energies leading the body into making all this noise but with a 'listening ear to shape it' like free composition so when you'd hear a rhythmic set up, you'd solo on it, or set something up..." (Burnett, 2003, online)

I am not a surrealist, at least in any defensible way. My impulses crossed with theirs in the way sound related to the body. I was (and still am) attempting to find a way to distil my experience of the world through one modality: sound.

Some of these notions of "energies leading the body..." with a 'listening ear to shape it' or that a logic of hearing might be the only 'technology' sophisticated enough to find the structure in sound and build on it, followed me into electroacoustic composition, or perhaps led me to it.

For me, free improvisation is composition with a very short time frame in which to organize one's thoughts; it is instantaneous composition. In my early works in electroacoustic composition, I considered that I might be composing

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21   Automatic writing is a technique employed by surrealists in which one writes (or in this case, play music) without premeditation and without editing in an attempt to access subconscious thought.

with the same priorities and intentions as I did in improvisation. The main difference to me was being able to extend the window of organizational reaction time from seconds into minutes, days, or months. This was and is done now by using fixed media. Magnetic tape was the first step, and then inexpensive non-destructive editing became available through digital media.

Three Studies From Guitar

This return to instrumental composition begins by using free improvised guitar and, by recording it, extending the timeframe for making compositional decisions. Three improvisations on a classical guitar were recorded and each one rearranged in a digital audio editor. The only digital processing used on each rebuild was the mixer/editor. I wanted to isolate the effect of that expanded window of time allowed by fixed media and apply that to free improvisation. The pieces are meant to sound as if several guitars were being played and less as if it were an electroacoustic composition.

Materials

The first improvisation used no special preparations save a random detuning. In the second and third improvisations, the strings were prepared by clamping lead fishing weights in various positions along the length of each string. Positions of the weights were chosen by first clamping them at the nodal points and re-adjusting them by ear to find richer partials.

These preparations were a way to further isolate the 'time -frame expansion' by moving the overt spectromophological transformations, into the acoustic (metal, nylon and wood) domain. Hopefully this made the time frame the most relevant difference in these works than in real-time improvisation or my own plastic music.

Plastic time

During an improvisation, an improviser listens to what is presently available, remembers what has happened before that, and plans what will happen next. The past sound is already concrete, and the 'present' sound might be considered less so, in that the evaluation of it is still in process. The future sound is in flux and dependent on the evaluation of the present being compared with the past in an attempt to form a decision about what needs to happen next. In addition to the sounds already in place there are also constraints from the physical limitations of the situation. That is, the position of the hands on the guitar and the limitations of the performer. In

these improvisations the decisions for all of this had to be made within a time frame that kept the act musically cohesive. Once the pieces were fixed, the time frame for finding musically cohesive structures changed. Theoretically there is no limit to the time in which the decisions can be made. The parts can be reordered to create new music, or possibly just to make that music more concise.

Keeping the order of the original performance was part of the restrictions I assigned myself to the rebuilding of the improvisations into new works. However, think of the compositional time frame of an improvisation as a short window. Within that window the composer is negotiating the memory of sound that has gone before, the sound that is being played at the moment, while assessing the possibilities of what may come. How long that window is and how it is experienced as to what is possible to anticipate, is directly related to how predictable the situation is. A solo performer can control the situation to a certain degree, and a player in a group is subject to the performances of the other members.

By fixing the sound to disk, the window of opportunity is no longer bound by the volatile persistence of memory and acoustics. The compositional window is theoretically limitless.

Results

All three finished pieces (not the original improvisations) were then treated as source objects for the next work. The first improvisation-remix is included in the portfolio as *Overlook*.

Taut

Strategic sources

This is another example of using personal, physical interaction in a search for structure in the same way as *Cross Country Runner, Transatlantic Half-Pipe,* and *Between Dog and Wolf.* All the sources are guitar music, and they are strategically varied to include the different performance relationships that I have with the guitar. They cover improvisation (with extended techniques), composition, and common practice performance. In addition to the three studies previously discussed, there are *Robin's Blues*, written by me, and my rendition of Bach's Gavotte II[22].

My considerations for the sources were such that the differences between them would bring their similarities into relief. The improvisation/ recomposition studies, even with their post-improvisational editing, are spontaneous physical and aural interactions. Their gestures are the reactions of my hands and ears to the sounds that I had just made. The Bach and the blues pieces have been practiced for many years. Their sounds and movements are deeply ingrained. Robin's Blues is my own writing. Although one is my own composition and the other is not, they differ from the improvisations in that they are very much not spontaneous. Jeffery Wagman and David Miller have a term that describes this proposed interaction and my relationship to these sources.

They use the term 'nested reciprocity' to describe larger informational loops orbiting smaller ones. (Wagman, 2003 p. 9) The free improvisations I would categorize as primarily concerned with immediate responses. These ears-to-hands loops are the proprioceptive ones. They are the small orbits while the Bach and blues are the results of larger orbits. The Bach and blues include the proprioceptive loops, but also include more direct social, historical and personal reflective feedback that take place over longer periods of time.

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22   BWV 1011 Gavotte II from Cello Suite V (guitar transcription)

By including them all, I thought it would lessen the influence of one specific type of relationship, or type of music, over another. I don't want the piece to be about 'the blues' or an interpretation of Bach, or my relationship to free improvisation. I want the structure of the piece to be the result of my experience with the guitar, and that should be discovered through the physical interaction with the guitar and the aural interaction in the studio. What the piece is about, if it is about something, I want to discover from doing the work of composition. It is as much a process of self-discovery as is it creation.

This is another example of the notion involving the composer's physical relationship to the sounds that was explored in *Cross Country Runner/Glint* and the section titled *Studio Ecology*.

The spectrometamorphological guitar

Since the constraints of the composition are devised to explore the relationship between the player and the instrument, I expanded the sounds available from the instrument. By changing the guitar's timbre for each of the performances I thought to further diffuse the influences of any specific sound that the classical guitar lends to the piece. Normally this (plastic manipulation) would be done via digital filters in the studio after the recordings were made. But I have already noted that sonic plasticity need not be restricted to electroacoustic tools. In *Cross Country Runner* the landscape's dynamic nature rendered the source sounds plastic (as well as the composer's hearing). This work adapts that idea to overtly alter the morphology of the sounding object.

For the blues piece the strings were loosely tied to one another with copper wire. As well as the strings' slight resonance with one another, the loose wire rattled against the strings and the guitar body near the bridge. It made the guitar sound less like a nylon string classical, and more like a steel string "folk" guitar. By speeding it up (shortening the reverberations) it resembles banjo.

Studio ecology

In addition to the recorded guitar sounds and the studio development of them, the studio system contained its own sounds. The studio ambience was an active dynamic that was integral to the listening situation. Whereas the studio sounds were not recorded or directly a part of the final work, they greatly influenced the choices made during the composition. The sounds of printers, an aluminium ladder, traffic and passers-by, were all a part of the compositional environment. They led me to consider the studio itself; not just the computer and monitors and software, as a dynamic environment. Like *Cross Country Runner,* this environment had profound effects on the way I listened. The sounds were not subtle. As a result, I became more amenable to the sounds of processing "gone wrong". In the most overt examples of this, I amplified the clicks and pops in the middle section of the piece, eventually framing and foregrounding the 'glitch' sound (08:12). To close the piece, dithering from the tail of a fading string pluck was normalised and mixed with a final cadence chord from a less processed guitar sound. (21:00)

Analogies and narrative

The opening of the piece is a long granulated and time stretched drone[23]. It can be heard as the beginning of a classical guitarist's rest stroke. In a rest stroke, the string is pushed down towards the guitar's body, gathering potential energy until it is released across the nail. The sound transitions through a single open harmonic. The chaotic vibration at the beginning of a string's release is heard as hundreds of 'random' notes that scatter from far distances all the way up to what seems to be inches from the listener (02:19-04:24).

Through the middle section of the piece, the blues and noise vie for dominance. The blues piece was given a banjo-like effect by speed shifts and the wired string preparations taking on a comic-slapstick[24] effect, leading

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23   Tremolo is the classical guitarist's primary method to sustain pitch and is a kind of manual granulation. It is therefore used quite freely in this piece as the primary means of sustain.

24   I think of it as a Carl Stalling line.

into an alternate view of the blues, (12:58) and then becomes instantly dark. Although the darker section was not (primarily) made from the Robin's Blues recordings, the bass, chords and leads are all blues based[25].

Throughout, the piece refers back to the opening drone and foreshadows the ending chorale (17:19). The end is built of time stretches of the Gavotte's chords. The chords were stretched, detuned and heavily overdubbed, eventually reminding me of and leading me to approach something resembling the micropolyphony of Ligeti's *Atmosphère*s. (This final section is an homage to that work in the context I first heard it, in Kubrick's film, *2001: A Space Odyssey*).

Variations of the material from the opening drone became the lower register of the finale. It ends with a unification of the digital tools and guitar using the decay of the strings fading through the jittering, amplified noise shaping of the dithered digital noise floor (21:00).

The last section is dedicated to two friends, Malcolm McRae and William Watlo Wilson.

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25   Listen to the bass and the flattened third after the initial bass strike for a path to follow (13:12).

The Instrumental Consequences of Plastic Music

The schism

In creating scores for instrument and fixed sounds the tradition has been to continue with graphical scores using traditional manuscript or idiosyncratic symbols singular to the composer of that piece. But working with plastic sound is fundamentally different from 'writing' music.

In the past, when writing for instrument and tape, I found that switching back and forth between imagining the sounds I am putting to paper, and actually experiencing and fashioning the sound in the studio, felt as if I were alternating between art forms. The processes are different enough, that creating works for fixed sounds and instrumental performer was tantamount to working in mixed media. It was a procedural and an aesthetic dilemma. I was using instructions on paper with written and graphic symbols to control actions and convey aural concepts to an imaginary performer about imaginary sounds. Conversely, in the studio, I use electroacoustic tools to fashion tangible materials.

I had already defined my own position as a plastic artist, but I was faced with creating music for a performer. I wasn't satisfied with concrete practice via orchestral samples, nor was performer improvisation an option. In the past I had attempted to create a work from which I would derive the written score (by ear) from a fixed sound work. Even there, I was switching media. Instead, I unified the procedure and placed the performer and the composer under the same (aural) paradigm.

Plastic models for performance: The aural model

In order to bring the composer and performer under a common method and aesthetic, one of plastic sound, the performer's score (the graphic and textual model) is replaced with an aural model. These new instrumental works use plastic sound as an alternative to written instructions and allow the composer to work entirely in a single medium. The aural primacy of the compositional process now applies to the composer and performer alike.

This is a logical step forward in the evolution and integration of the performer-composer relationship, as well as the relationship between live and fixed performances. This technique brings issues regarding primacy of the ear 'in line', with instrumental composition.

Parables
Five electroacoustic models for solo cell*o*

1. *Click Glut*
2. *Texture Study*
3. *Questionable Intense*
4. *Reaching (ungrasped)*
5. *String Storm*

Method

The aural model

These five pieces were conceived as preparation towards the following work, *Analogies of Control.* Although they were intended to be a minor step towards a larger goal, they turned out to be more important than first thought. Following through the contextual switch to plastic arts in an instrumental situation makes these pieces the first of a kind.

Fixed sound pieces are used in place of musical manuscript. The performer is asked to imitate the sounds heard as accurately as possible. This use of an aural model allows an instrumental work to be conceived and realized entirely within the aural domain.

The model retains one aspect of the traditional graphic score. It is a set of instructions for interpretation by a performer. Whereas the written score is supported by many decades of formal instruction and cultural evolution as to what these symbols mean, the aural model relies on aural acuity and technical virtuosity, regardless of cultural-educational background.

Source choice

The sources for the model were recordings of metals placed on frozen carbon dioxide. The energy released in radiation of the temperature difference, combined with the evaporation and sublimation of the dry ice made a variety of controlled chaotic sounds all alien to, and some impossible for, any standard musical instrument's ability.

I want the source material to be simple enough to be easily picked up or 'understood' by its interpreter, whether that is an audience or performer. By

using the heat radiating metals I hope that the shape of these thermodynamic reactions would seem familiar enough to allow a level of prediction, but complex enough to allow for wide varieties of interpretation.

I thought that the thermodynamic reactions could be so basic to experience it might be indicative of some kind of ecological primitive[26], and composing with these chaotic heat releases might be able to tap a familiar reference point for the performer, and ultimately for the audience.

Complex intents

While the method for composition is simplified, and the instructions to the performer simple, the interaction between the model and the player pushes the boundaries of what is possible to achieve on the instrument. The sounds that are to be mimicked are (possibly) beyond the range of the cello.

The inability of the cello to produce the sounds in the recording has several implications. It leaves the performance open-ended; no player will interpret the part like any other. There is no ideal performance, and the electroacoustic part is not a model *of* an idealized performance. It is rich enough, and the choices as to what in the model is reproducible is varied enough, that every player should be able to make vastly different choices without needing to stray from what is there.

Brian Ferneyhough has a similar approach when it comes to the performablilty of his scores in that his concerns are more focused on the "the player sensing the variable distance, as it were, between the image, the possible sound which may emerge from realizing that image and the degree of difficulty with which the instrumentalist must confront himself in order to produce that result". (Ferneyhough, 2005)

The 'distance' between what is possible for the instrument and its composed model is infinitely variable in any score, written or audible. This break is what allows a performer to interject aspects of himself into the work.

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26   This is discussed by John Young as a "morphological primitive" in Sound Morphology, p. 7-14
   Organised Sound Vol.9, No. 1 April 2004

Umberto Eco comments further about this distance between what is written on the page and the reader's subjective interpretation of it. In the book of essays *Six Walks in the Fictional Woods* it is proposed that the text provides the reader with a myriad of personal interpretations as the story could relate to the reader's own experience. He says that a 'great' story provides entrance points by using a 'disjointed' or broken narrative leaving the reader to interpose the experience of their own lives into the story. (Eco, 1994, p. 127-129)

These aural models, and the music of Brian Ferneyhough area similar in the way they allow the performer to interject the traces of his own experience into the gap between what is in the model and what is possible to achieve on the instrument.

There is a time delay of around a half second between the performer hearing the model and his reaction. Whereas in written music, especially where tempo is a concern, a missed note would be skipped by or compensated for in an effort to keep the meter unbroken, or to stay in time with the ensemble or recording. In these studies I think it is preferred that the events *do* occur, even if out of time a bit. I feel that the leading of events is more important than the time in which they occur. One confound to that is that the longer the gap between model and reaction, the more information has to be remembered, so holding a 'missed event' or two could become a strain on memory. It is expected that as the player continues to learn the part, that time delay will decrease. Eventually I would expect the work to be known well enough to be anticipated and the time delay reduced to nothing. By the time the work is this well memorized, the temptation would be to play it without the headphones. Instead, I would encourage a performer to persist performing with the model present. I would expect that the more familiar the player is with the material, and the easier it is to anticipate the next move, the easier it will be to hear more subtle details in the model.

Performers respond

There have been two players to attempt the studies (*Parables*) and two for *Analogies of Control*. Craig Hultgren's rendition of '*Parables*' was the first ever attempt at this method. The difference between how listeners vary in their reception to the aural model was immediate. At first hearing I didn't understand how he arrived at the sound that he did, but once I compared the model and the recording of the performance the similarities showed through. This is, of course, also affected by what is possible on the instrument. I had however considered multiple approaches that he might take, nothing I'd anticipated predicted the paths that he actually took.

In conversations about his performances of the studies I asked him if my presentation of the works did or could affect the way he approached them. I was concerned about how semantic relationships would affect his choices, and I earlier had mentioned to him about some considerations that were similar to music in the realm of New Complexity.

Specifically I asked him if it would have made a difference if I had instead referred to them as 'spectralist' works, to which he answered "I imagine I would have been more ghost like and shadowy in my approach. Semantic orientation to sound has captured the imaginations of experimental composers and improvisers alike. I tend to be more instrumentally pragmatic and concern myself with the successive organizations of sounds, but that's more or less the domain of a player." He went further saying, "As a player and interpreter of scores, I do look for rhetorical or semantic instructions to help characterize the manner and inflections of my playing. You're correct in that the pragmatic part comes in the actual act of playing where I'm not really thinking "blue" or "green" or "spectral." Cognitively, I'm oriented to the actual sound and its production from the instrument." (Hultgren, 2005)

Judith Mitchell takes the mimicry very literally and is determined to clearly match the model. She has held a class in extended techniques that she based

around the concept using one of the studies. She and the class explored a variety of ways that the sounds of one study could be produced. Practical matters, such as moving from one position to another in the course of the class were sought out in order to facilitate performance.

After finishing the study, she then asked the group to play a Bach prelude, and listen to it in the same manner as the study, asking them to listen to the Bach as "pure sound." Her intent was to deepen their auditory understanding of the Bach using the lessons learned with the aural model.

Ungraspable

Each performance is a new realization that is a reflection of the player's interaction with the sound world of the model and the possibilities in the sound world of the cello. Each player will need to choose his own path through the myriad possibilities the model offers.

Thomas Gardner, (in *Analogies of Control*, the work for which these studies were made) has approached the model as a symbol of the sounds he is presumed to make. Remarking that since the sound itself is an impossible task, then he chooses to determine what the sound might represent, and he attempts to represent that on cello.

One difficulty I have with that approach might be the possibility that a player will attach an emotional content to the sound in the model and allow that emotional framework to determine the representation of that 'sound symbol'. I would find it more interesting (and closer to my original intent) if the player were to use his closest possible imitation of the actual sound, regardless of his ability to infuse the gesture with the perceived emotional content of the model. Maybe then we could get another emotional perspective on the piece as a whole.

I am hoping to discover how the intersection of cello and aural mimicry produce actions and sound. It is the cellist's experience of the sound, as facilitated by his relationship to the cello that we hear.

Analogies of Control
for cello and fixed sounds

1. *Bell Crawler*
2. *SlipIn*
3. *Skimming*
4. *999 Parables*
5. *The First Minute*
6. *The Last Three Minutes*

Alternatives to control

Analogies of Control is the second realization of the aural model approach. It is a mixed work for fixed sounds and instrumentalist. In some ways *Analogies of Control* is more typical to instrument and fixed sound works in which the performer reads a score written to integrate with the electroacoustic part. However this work, by approaching the instrumental part of the composition as plastic, allows both parts to be created as a singular work of plastic art. It is only after the work is finished that the part to be performed and the part to be diffused are separated. In fact, one important aspect of the piece is that it can be presented acousmatically, that is, with no performer, using the un-separated original in diffusion. These two aspects of the work introduce a kind of open form not explored before now.

The parts that were to be later separated and used as an aural model for the cellist were made from the same source objects that the cello studies used; heat activated metals. The rest of the piece is built from cello sounds and their electroacoustic derivations. I used various approaches with the instrument as a sound source, including standard practice bowing all the way to a complete physical dismantling of the instrument and 'playing' its separated parts. Tuning pegs were bounced on the body and fingerboard, strings were drawn through the f-holes. Bow and pegs were swirled across the back of the body. Strings were twisted against themselves and resin was crushed and sprinkled across the body. Some improvisations on cello by Craig Hultgren also were included as sources.

It is important to stress, that during the course of creating the work, little regard was made as from where the sources came. The extraction into model (score) and accompaniment (diffused) happened after the fact. Three tracks are made with two being diffused to the audience and the model delivered to the cellist via headphones. Just as in the *Parables*, no one but the cellist hears the electroacoustic model. For the audience that means that what is heard is sound either made of or made from a cello. The audience doesn't hear the original composition as it was made as I, the composer, heard it. It has, as Eco might suggest, been put out of joint. The cellist reassembles the work according to his own reading of it.

The end result of this process is that the audience hears a performance of acoustic cello and cello-derived plastic sound.

K
for trumpet and fixed sounds

This is a continuation of the process explored in *Parables* and *Analogies of Control. K* also uses an aural model in place of a written score. The accompaniment (diffused) part is made primarily from slide trumpet samples recorded in the studio and the model's (soloist's) primary sources are (again) the samples of heat-activated metals. Gathering the trumpet sources included (like the cello work) dismantling the trumpet and improvising with its different parts, as well as playing a simple Dixieland tune[27].

Unlike *Analogies of Control*, there was not a strict adherence to the origin of the sample source as material for the model. The trumpet player's model is sometimes based on cross-synthesized sounds made of both trumpet samples and the heat processed metals, and the accompaniment also contains parts included in the model. Like the cello piece, headphones are used to deliver the model to the trumpeter and the rest is to be a multi-speaker stereo diffusion.

One additional aspect of the piece is a re-emphasis of physical familiarity with the source of the sounds as an organizing principle. As a trumpet player, I am long familiar with all these sounds and the actions necessary to produce them. As in *Taut* and *Cross Country Runner*, these neuro-muscular relationships are expected to act as top-down organizing forces in the same way as narrative or any other analogical methodology.

Performance instructions

Parables, Analogies of Control, and *K*

The cellist will choose the order of the movements in *Analogies of Control*. *Parables* is a series of studies and order is not an issue, nor is there a necessity for all of them to be presented together. There is no diffusion to the audience for *Parables*, the signal is routed only to the headphones.

27   *When the Saints Go Marching In,* traditional gospel-blues

CD 4 has folders with complete materials for the performance of each piece. Channels marked .R and .L are routed to the concert hall mixer for multi-speaker diffusion, preferably with 12 monitors or more. The files marked as the instrument being performed are routed to the headphones or in-ear monitors of the performer. Thus far two cellists have requested that a mix of the diffused part and the model be sent to the headphones. This and other variations (headphones with a room mix and the model, or a instrument monitor mix, also including the model, for example) are acceptable. The requirement is that the model must be heard by the performer, and not by the audience.

This is to be an active diffusion, not a passive playback of the diffused part. The diffusionist should rehearse at much as is practical with the performer, but it would also do well for the diffusionist to practice with the acousmatic version. Both performers should be familiar with the acousmatic version of the work, but there is no need to feed the model to the diffuser during the performance.

The player should endeavour to memorize the model, but should not perform without it. The difference between the actual sound of the model and the sound of the performing cellist is meant to be part of the structural tension of the work and is produced because of the performer's awareness of that difference and his attempt to rectify that difference.

The folder titled "Rehearsal Audio" contains 16-bit two-channel compact audio files. These can be used to create a rehearsal CD. To facilitate rehearsals the model and diffused parts are separated on the left and right channels (respectively).

Figure 2 (following page) is a signal routing example for *Analogies of Control* and *K*.

Aural Model → Cellist

3 Channel Work

← Diffused Part →
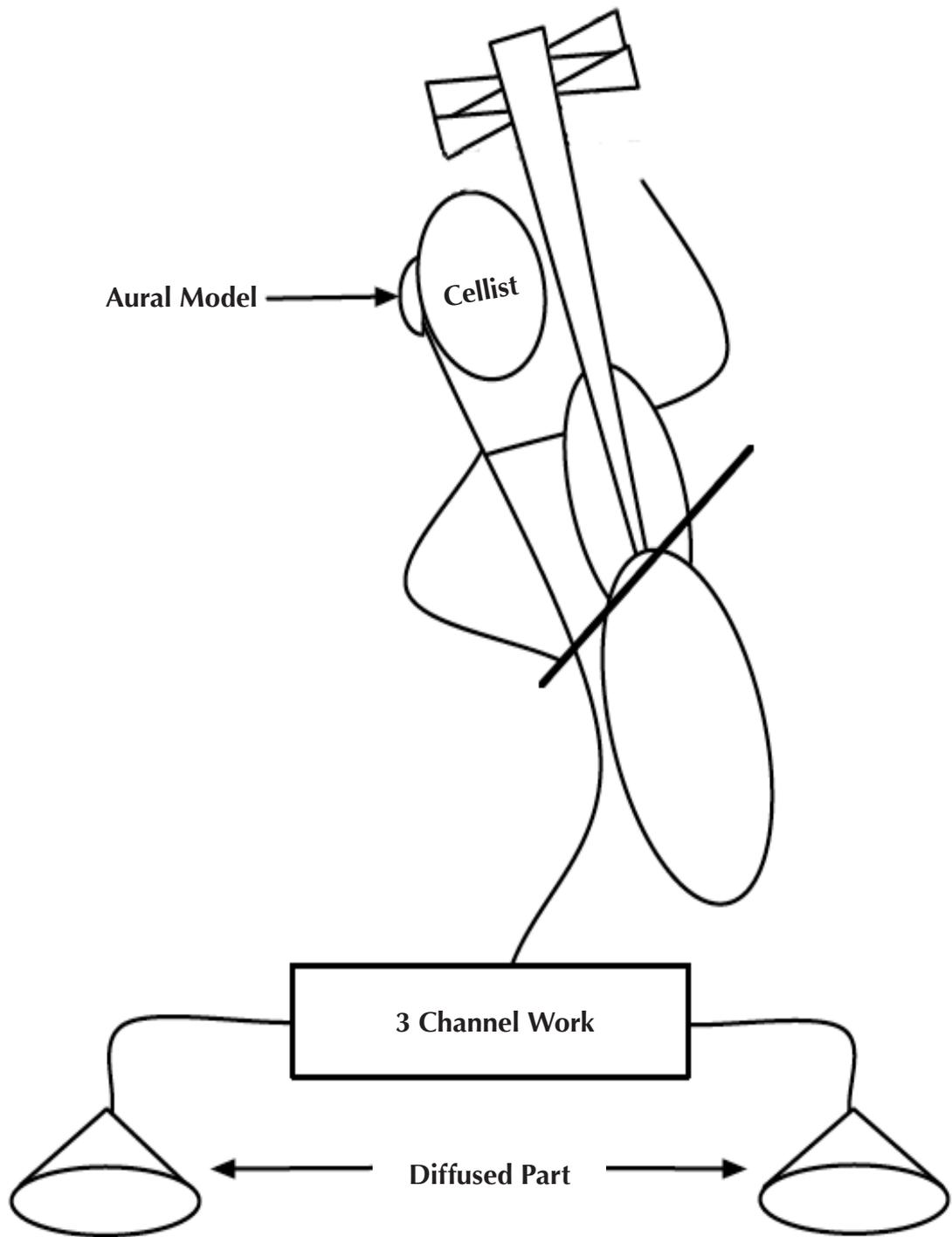
Future Performance

Variations in performances are expected for any player adopting these scores as part of their repertoire. Hypothetically there will be a gradual change over time, and possibly it will settle into a more standard performance. It might be interesting might be to switch ears with which one listens to the model and attempt taking advantage of the processing differences offered by right ear versus left ear hearing. (Y. S. Sininger, 2004)

A few thoughts about aural imagination and the score

Scoring written works involves imagining sound, and people are capable of doing this to greater and lesser degrees. I think it could be argued that a paper composer deals with sound in a direct way if one considers how well he might imagine the music he writes using his 'inner ear'. But when a composer imagines the sound of a trumpet, there are ways the trumpet is *supposed* to sound. The performer is aware of that intent. They share common performance practice and are aware of the possibilities of that instrument and the ways in which writing conveys that intent. In other words, the communication is bi-directional. Intelligence exists on both ends of the communiqué. With concrete sound, the intent, or imagination is only from the composer.

How a sound will behave in a signal transform is predictable in varying amounts. Some things like equalization, fades, reverberation and some convolution might be fairly simple. Others, maybe based on more complex algorithms, or perhaps on factors not easily perceived in the sound, might behave in entirely unexpected manner. The combination of two sounds, even in as simple a process as a cross-fade may not be what the composer had in mind when he started it. At some point, the results have to be accepted for what they are and used accordingly. One of the charms of plastic music is the feeling that you are somehow 'facilitating' musical possibilities within the sound.

Alternate approaches

The aural model's future method is undetermined, and to a degree indeterminable. It is yet unknown what future performance practice might bring to it. For example, in the first performance of *Analogies of Control*, the instrumentalist produced an aurally derived visual aid, akin to a diffusion score. My original purpose of eliciting a pure auditory response from the performer was usurped in the very first performance.

Some questions have arisen during the course of this part of the research. Some have been addressed by the differences in results already obtained between the three cellists. Others will take more time to answer and will require more performances and performers.

I am interested in how these performances will change over time. If the same player performs the music over several years, how significant will the changes be? As players approach their own ideal mimesis with the model, how different will they sound from their earliest attempts? Will different players' renditions eventually converge with one another? So far all the performers involved have had significant experience with improvisation. How will that differ from a player whose experience has been limited to reading written scores?

Possibly the most significant question remains to be answered. How would another composer approach instrumental plastic music? It would be exciting to hear other composers attempt this. Variations of this general approach might lead to some new standard method by which to write for instrumental performers.

One variation has been suggested by Dr. D.J.T Harrison[28]. In one plan for ensemble it was intended that one could use written manuscript in combination with aural models simply by sending the models along with the written score. In this case proportional notation could be used with indices

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28   Personal communication with Dr. D.J.T. Harrison (2005)

of where the ensemble is to begin their interpretation of the aural models. This would provide an extended interpretable source for the ensemble, an extended aural pallet for the composer and still includes the opportunity of an acousmatic listening.

Two faces of a single composition

Parables, Analogies of Control, and *K* are possibly a "special case" of electroacoustic composition.[29] *Parables* was created in the studio as an electroacoustic model to be performed as a solo cello work. Whereas the construction and delivery of the model is by concrete, electroacoustic means, the only sound the audience hears is live, solo cello; an acoustic performance. *K* and *Analogies of Control* were also studio creations, done in a concrete fashion as if they were being made for acousmatic presentation. At the end of the process specific parts (specified by source object) were separated and mixed onto a third monaural track for use as the instrumental model. The 'acousmatic version' is a presentation of the model and the diffused parts *as they were originally created in the studio.*

The instrumental performance is technically a "mixed work" for instrument and fixed sounds. Once there is a performer visible on stage, it no longer qualifies as an acousmatic concert. However, one performance of *K*, by trumpeter Drew Petrie, was done in the dark in order that the audience be put in the acousmatic situation.

It bears repeating that these works were created entirely in a concrete, studio situation as sound files on disc. Therefore all the parts are interpretable without any kind of cultural mediation. There is no special code, (Gibson, J. 1997), there is no need for an interpreter such as a cellist, or trumpet player or any other trained reader of musical manuscripts. Any listener can experience these, as music, regardless of training.

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29   Mooney, J. PhD dissertation "Sound Diffusion Systems for the Live Performance of Electroacoustic Music" Sheffield, University of Sheffield 2005

Most works of open form are concerned with the order of the work's parts (Mozart's *Dice Music*, Pousseur's *Scambi*), some might have a specified structure but with a variation of content (Cage's *William's Mix*), and there are others that depend on the interaction and interpretation of result-dependent instructions (Zorn's *Cobra*).

With the aural models the works are created in such a way that at the end, two version of the same piece are created: One, with an instrumentalist, and one without. In written music, the model for performance is not music itself, but it is instead a representation, or a plan, by which music can be made. These models for performance are actually audible pieces of music. Both versions are valid representations of the same piece and both can be presented to an audience. It could be seen as a new type of 'open form', and this resultant duality is one that is inseparable from the process of composition.

Gravity's

My earlier physically orientated works, such as *The Transatlantic Half-Pipe*, *Cross Country Runner* and *Between Dog and Wolf,* involved recording the composer engaging in physical play. *Between Dog and Wolf* used samples from a mountain bike and the piece was modelled after several myth narratives combined. The *Transatlantic Half-Pipe* was made of samples from skaters in Berlin, the UK and Alabama, recordings of myself, skating in Bangor Wales's concert halls, in addition to studio recordings of dismantled skateboard parts. It was another motion/travel work, intending to invoke feelings of speed and distance. *Cross Country Runner* used my physical actions again, by recording my runs through the local countryside in Leicestershire. *Taut,* as well as *K,* both drew from my physical relationship to the guitar and trumpet respectively.

All these activities and the sounds they make were well known to me long prior to the recordings being made. It was intended that the long-practiced involvement with these items and actions would act as top-down organizing influences.

The plastic body

As mentioned before, the composer himself is a recording device of sorts. Experience changes the body and those changes follow the composer into the studio. In the earlier works, experience was extant and sounds were gathered around them. The composer, due to many years experience, is weighted towards listening to those sounds in a certain light. Turning the order of this around, I began recording samples for *Gravity's* while I was fairly naïve to the sport of rock climbing. It was an activity begun in order to explore sounds yet unknown. As I grew more familiar with the discipline, my listening attitudes were already in place in a search for musically valuable sound. The neurophysical changes (arguably large changes) were being made as the sounds were discovered.

Materials and dynamics

There are two main activities in climbing. Bouldering is done without much gear, usually with only rock boots and a bag for chalk. The climbs are short, usually less than 3 meters high, the moves are physically intense and regularly more complex, but the whole effort may only last a few seconds.

Lead climbs include rope and metal gear. The climbs are higher, can go on for much longer, and may include stops and rests depending upon how hard the climb is or how high one is going. The sounds include the rope sliding through the karabiners and the metals clacking and scraping against the rock. The overall shape of the event is more drawn out, all stitched together with smaller actions. Occasionally there may be a fall with the clash of tackle and the sliding or snapping taut of several meters of elastic rope.

Bouldering, instead of climbing with gear, is how I spent the majority of my time. But, as it turns out, the sounds of bouldering are fairly subtle. The sounds of bare hands and boots against rock (and faux rock) provides a limited palette, although there is some noise in failure as they slip off and one's body slides down the wall and onto the floor.

Despite of the majority of my training in bouldering, the majority of the samples used are of longer climbs and climbing tackle. There are two binaural recordings made of climbs in the Peak district. In another case a stereo pair of microphones was lowered over the crag's edge to sample my partners' ascents. There is one binaural recording made indoors of a ten-meter climb that precedes a five-meter fall. The fall was staged to imitate an earlier accidental drop in the same space.[27]

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27   The sound that was recorded was, however, very different from the one that I remembered. My memory could and probably was affected by my surprise. It was the first time I'd fallen on a rope. I heard the rope snap taut and reverberate in the hall. The staged event was nothing like the one I first experienced. The recording made was of a rope sliding through tackle and the only sharp attack was that of the gear slamming the wall. I used the staged version, however, as the source to build a sound that reflected (the memory of) that original experience; a fast rush as the wall sped upward and several meters of rope snapping taut, reverberating the room with deep bass. (00:53)

Studio recordings of the climbing gear; nuts, friends, harness, rope, boots, and chalk, were made at the Music, Technology and Innovation recording studios.

The ascent

Metal climbing gear swinging off a harness opens the piece, then after an exploration of gear against rock, it moves quickly into the sound of rope that has been spectrally mixed (cross-synthesized) with those same rock and metal scrapings. That sound of rope is 'slung' more and more into the distance and then rushes forward (see 00:53, above). Except for the underlying bass pulse, the rhythmic section starting there is built of unprocessed recordings of the gear sampled in the studio. Climbing nuts, friends, and cams were hit against rock, other gear, rope, and themselves. The lack of context keeps the sounds abstract and acts as foreshadowing for when the same sounds appear later interwoven and processed with the field climb edits.

At 02:15 an ascent begins with the climber entering the scene surrounded by clatters of gear against rock and intimations of falling matter with the constant tug of gravity. There are periodic downward and upward glissando made of granular crackles to contrast with the climber's struggle upward. This alternates between more and less processed versions of the climbs. Breath is reintroduced in an altered form having been combined with the metal and stone scrapings. (03:15) Sometimes the breath is also crossfaded with the pulses from the samples of wind in order to refer to the piece's opening prior to the 'rope-attack event' at 00:53.

Several 'verité' recordings of different climbs were combined to create one ideal sequence which was used as the majority of the source event. All of the actual recorded events were strained and tense. My climbing is tenuous and edgy work. Relaxation is rare. The visceral aspect of the climbing scene is accentuated by using the sound of the climber pulling up the cliff face and labored breathing as a template against which different processed and natural sounds are matched and contrasted. Although much of that template is

removed or mixed into the background, the physical and emotional tension of the climb remains.

At 04:30 the climber appears clearer and more separated from the background sound. However the nervousness in his breathing is much more apparent. The breath traverses between clear and filtered sound from here, but mostly the climber remains in the foreground until 05:40. The more processed sounds reappear and the climbing scene is enveloped in cross-synthesized breath, metal, and wind.

The piece closes as a simplified rhythmic gear play reappears, rises in pitch into silence and the climber is heard finishing at the top of the peak.

Summary

This research's concentration on music as a plastic art provided both freedom and constraint by which I could explore several types of work under one rubric. While some might be related to 'soundscape' such as *MasterSplasher* or parts of *Cross Country Runner,* others like *Glint*, *Gravity's*, or *Taut* used acousmatic tension (the separation of a sound from its source) as a large part of their structural and-or poetic devices. Still, these variants of form remain plastic art. Materials were manipulated "by ear" and "by hand." Just like the other plastic arts, the sense in question (auditory) guides the muscles that shape the gesture.

The ineluctable result of the modality

While a great amount of freedom was available within this large umbrella term it did force at least one decision. *Parables*, *Analogies of Control* and *K,* the instrumental works, required a completely new way to create and deliver instructions to the performer in order to stay within the framework of plastic sound.

The solution, an aural model, allowed me to compose for an instrumental performer using concrete methods. This meant, in addition to the solo studies, I was also able to create pieces for fixed sounds and performer without resorting to mixed media, that is, plastic sound and graphic notation.

The cello and trumpet applications of plastic sound and plastic music are the first of their kind and provide one answer to closing the schism between studio composition and instrumental writing. These pieces hopefully open some doors to new possibilities for performers and composers to work together in a unified way.

Future practice

For this practice to be fully exploited, instrumental pedagogy must be addressed. Listening to an aural model and simultaneously imitating that sound is alien to instrumental practice, at least in the world of common

practice. This kind of training needs to start early. Training young performers to hear and push the limits of what can be expected of their instruments can only improve their long term understanding of sound, both for plastic and written music.

Historical context

For myself it helped to think of this outside the restrictions of soundscape, concrete sound, electroacoustics, and acousmatics. While these terms are valid for different parts of this project, each carries with it historical and contextual implications that might not fit the portfolio as a whole. It is true, however, that all of the work herein deals with sound as a concrete material, as opposed to an abstract one. But *musique concrète* was named in opposition to another form popular at the time of its discovery, while the term 'plastic music' merely connects music to a longer history of the arts in which direct, physical manipulation of the material is a primary part of their processes. I also consider that by drawing music and the plastic arts together, as a gesture of unification rather than opposition, it stands as encouragement to other artists, plastic, architectonic and any others, to learn about the structure of sound, endeavor to create with it, and continue to extend and explore the possibilities of art as a whole.

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