

Bangor University

DOCTOR OF PHILOSOPHY

Perception and Structure in Electroacoustic Music: A Portfolio of Compositions

Tunncliffe, Steven

Award date:
2019

Awarding institution:
Bangor University

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal ?

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Download date: 17. Apr. 2024

**Perception and Structure in Electroacoustic Music: A
Portfolio of Compositions**

2018

Steven Tunnicliffe

Submitted to Bangor University for the degree of Doctor of Philosophy

Abstract

Following Pierre Schaeffer's proclamation of the primacy of the ear, the composition of acousmatic music has remained a practice based on aural perception. Consequently, the relationships on which acousmatic musical structures are based may not be easily described in terms of their formal logic. Rather, perceived relationships in acousmatic works are likely rooted in complex psychological schemas based on the cultural experiences of individual listeners. Where abstract sounds are concerned, timbral or morphological similarities may form the basis of such relationships. Conversely, symbolic meanings attributed to referential sounds may engender extra-musical relationships in predictable or unpredictable ways. Thus, structural organisation in acousmatic music is inextricably linked to material.

The purpose of this project was to explore structural organisation in acousmatic music through practical research in composition. The accompanying portfolio contains eleven pieces that chart the development of my compositional practice during the period 2012 to 2018, and particularly my approach to musical structure.

Contents

List of Diagrams and Figures	4
Loudspeaker Plans	6
List of Accompanying Media Files	9
Acknowledgements	11
Declaration	12
1. Introduction	13
2. Structural Relationships in Acousmatic Music	15
3. Portfolio Overview	23
4. Commentaries	
4.1 <i>Bouba-Kiki</i>	25
4.2 <i>Ring of Bells</i>	29
4.3 <i>Phases</i>	33
4.4 <i>Sandy</i>	36
4.5 <i>Gramarye</i>	39
4.6 <i>Dreadnought</i>	42
4.7 <i>Dark Skies</i>	46
4.8 <i>Reel Musique</i>	51
4.9 <i>Vivisekt</i>	54
4.10 <i>A Breath of Air</i>	58
4.11 <i>Jeux d'eau</i>	61
5. Conclusions	64
Appendices	
Appendix A: Programme Notes	68
Appendix B: Performances	79
References	80
Discography	86

List of Diagrams and Figures

Diagram 1.	Loudspeaker plan for stereophonic works	6
Diagram 2.	Loudspeaker plan for quadraphonic works	7
Diagram 3.	Loudspeaker plan for surround works	7
Diagram 4.	Loudspeaker plan for hexaphonic works	8
Figure 1.	Simon Emmerson's language grid	17
Figure 2.	Waveform and spectrogram of an excerpt from <i>Bouba-Kiki</i>	27
Figure 3.	Spectrogram showing the inharmonic partials of an attack-decay Morphology based on layered bells records in <i>Ring of Bells</i>	30
Figure 4.	A phase diagram depicting states of matter and their transition thresholds in terms of temperature and pressure	34
Figure 5.	Waveform and spectrogram of an excerpt from <i>Dreadnought</i>	44
Figure 6.	Waveform and spectrogram of an excerpt from <i>Dark Skies</i>	49
Figure 7.	Waveform and spectrogram of an excerpt from <i>Dark Skies</i>	50
Figure 8.	Waveform and spectrogram of an excerpt from <i>Reel Musique</i>	52
Figure 9.	Waveform and spectrogram of an excerpt from <i>Reel Musique</i>	53

Figure 10. Screenshot of the Audiomulch Metasurface 56

Figure 11. Waveform and spectrogram of an excerpt from *Vivisekt* 57

Loudspeaker Plans

The following loudspeaker plans are recommended for studio playback of the pieces presented in this portfolio. For live performance, they represent starting positions that may be expanded or developed at the discretion of the diffusion artist. Indeed, I extend full creative liberty to the diffusion artist to interpret the spatial dimensions of these works as deemed appropriate.

An additional binaural mix has been provided for each of the multichannel works that may be useful for previewing the multichannel arrangements outside of the studio or performance environment. While I do not intend the binaural mixes to replace their true multichannel counterparts, I anticipate a situation in the future when such mixes serve to improve access to my multichannel music.

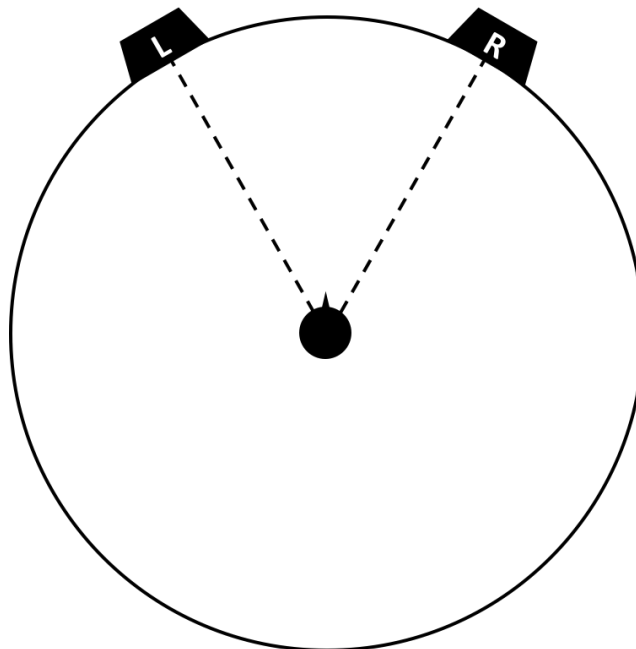


Diagram 1. Loudspeaker plan for stereophonic works

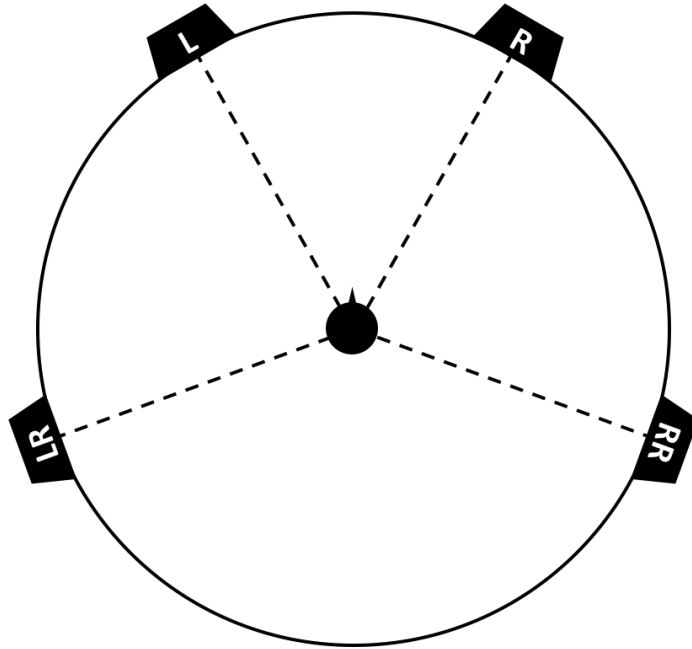


Diagram 2. Loudspeaker plan for quadraphonic works

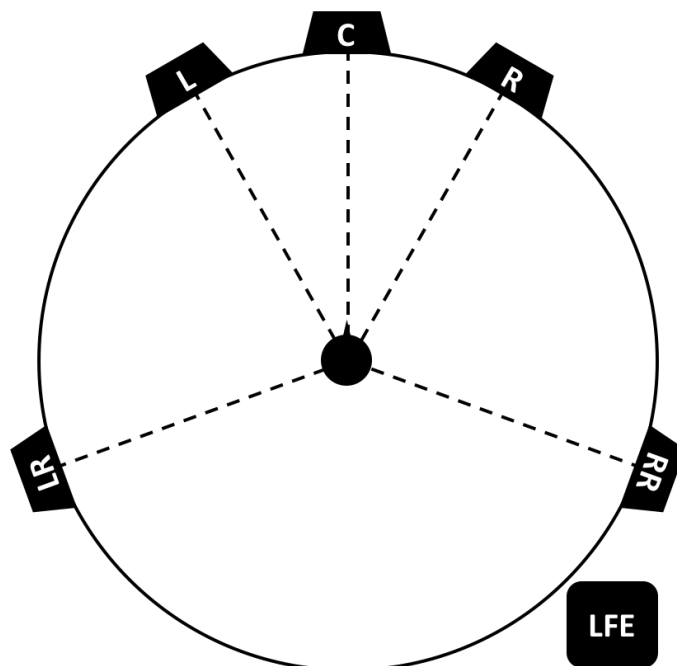


Diagram 3. Loudspeaker plan for surround works

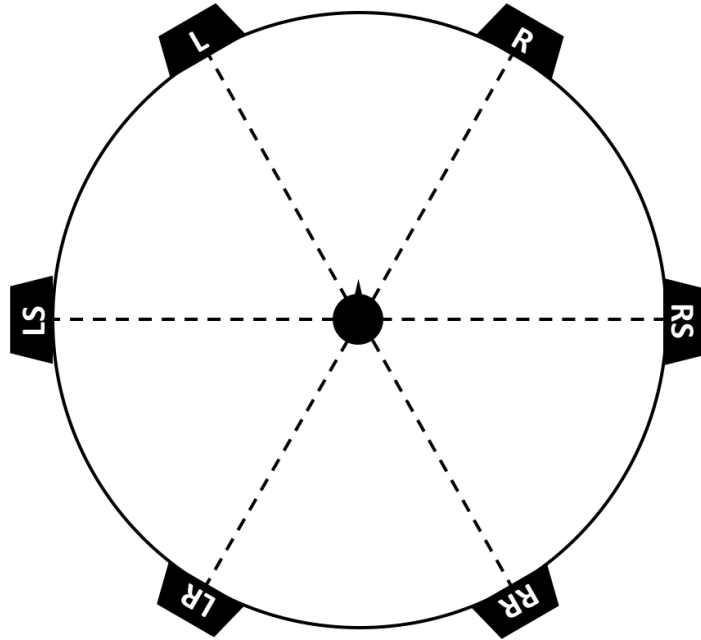


Diagram 4. Loudspeaker plan for hexaphonic works

List of Accompanying Media Files

Stereo (audio files, 24 bit, 44.1 kHz)

Tunncliffe_A Breath of Air_Stereo.aif
Tunncliffe_Bouba-Kiki_Stereo.aif
Tunncliffe_Dark Skies_Stereo.aif
Tunncliffe_Dreadnought_Stereo.aif
Tunncliffe_Gramarye_Stereo.aif
Tunncliffe_Jeux d'eau_Stereo.aif
Tunncliffe_Phases_Stereo.aif
Tunncliffe_Reel Musique_Stereo.aif
Tunncliffe_Ring of Bells_Stereo.aif
Tunncliffe_Sandy_Stereo.aif
Tunncliffe_Vivisekt_Stereo.aif

Quadraphonic (audio files, 24 bit, 44.1 kHz)

Tunncliffe_Sandy_Mono (Left Surround).aif
Tunncliffe_Sandy_Mono (Left).aif
Tunncliffe_Sandy_Mono (Right Surround).aif
Tunncliffe_Sandy_Mono (Right).aif

5.1 Surround (audio files, 24 bit, 44.1 kHz)

Tunncliffe_Dark Skies_Mono (Center).aif
Tunncliffe_Dark Skies_Mono (Left Surround).aif
Tunncliffe_Dark Skies_Mono (Left).aif
Tunncliffe_Dark Skies_Mono (Lfe).aif
Tunncliffe_Dark Skies_Mono (Right Surround).aif

Tunnickliffe_Dark Skies_Mono (Right).aif

Tunnickliffe_Vivisekt_Mono (Center).aif

Tunnickliffe_Vivisekt_Mono (Left Surround).aif

Tunnickliffe_Vivisekt_Mono (Left).aif

Tunnickliffe_Vivisekt_Mono (Lfe).aif

Tunnickliffe_Vivisekt_Mono (Right Surround).aif

Tunnickliffe_Vivisekt_Mono (Right).aif

Hexaphonic (audio files, 24 bit, 44.1 kHz)

Tunnickliffe_Jeux d'eau_Mono (Left Surround).aif

Tunnickliffe_Jeux d'eau_Mono (Left).aif

Tunnickliffe_Jeux d'eau_Mono (Right Surround).aif

Tunnickliffe_Jeux d'eau_Mono (Right).aif

Tunnickliffe_Jeux d'eau_Mono (Side Left).aif

Tunnickliffe_Jeux d'eau_Mono (Side Right).aif

Binaural (audio files, 24 bit, 44.1 kHz)

Tunnickliffe_Dark Skies_Binaural.aif

Tunnickliffe_Jeux d'eau_Binaural.aif

Tunnickliffe_Sandy_Binaural.aif

Tunnickliffe_Vivisekt_Binaural.aif

Acknowledgements

I would like to acknowledge the invaluable contributions of my research supervisor, Professor Andrew Lewis, without which this submission would not have been possible. Professor Lewis's guidance and insightful feedback have aided me greatly in refining my compositional practice over the course of this project.

I would also like to thank my wife, Victoria Tunnicliffe, for her patience and untiring support.

Declaration

I hereby declare that this thesis is the results of my own investigations, except where otherwise stated. All other sources are acknowledged by bibliographic references. This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree unless, as agreed by the University, for approved dual awards.

Yr wyf drwy hyn yn datgan mai canlyniad fy ymchwil fy hun yw'r thesis hwn, ac eithrio lle nodir yn wahanol. Caiff ffynonellau eraill eu cydnabod gan droednodiadau yn rhoi cyfeiriadau eglur. Nid yw sylwedd y gwaith hwn wedi cael ei dderbyn o'r blaen ar gyfer unrhyw radd, ac nid yw'n cael ei gyflwyno ar yr un pryd mewn ymgeisiaeth am unrhyw radd oni bai ei fod, fel y cytunwyd gan y Brifysgol, am gymwysterau deuol cymeradwy.

A handwritten signature in dark ink, appearing to read 'Stuart Hill'.

1. Introduction

The unprecedented array of tools and techniques available to today's electroacoustic music composer offers seemingly unlimited sound-making possibilities. Yet, as electroacoustic music evolves it is the issue of structural organisation that remains central. As Curtis Roads (2015, p.109) writes, "The challenge posed by new sounds is always how to organize them compositionally."

This issue is particularly germane to the development of my compositional practice. Prior to beginning this project, I devoted several years to designing musical sound effects for use in commercial media projects; an endeavour that encouraged sonic experimentation but rarely the realisation of complete compositions. It is hardly surprising, then, that my initial attempts at electroacoustic composition fail to achieve high-level coherence despite their low-level intricacies. What these pieces lack are strong, perceivable structural relationships that engage the listener in unique and rewarding listening experiences.

The imposition of pre-compositional restrictions and formal plans consistently failed to yield more satisfying results: rarely have I succeeded in eliciting cooperation from sound materials without the intuitive guidance of aural perception. As such, I find myself a proponent of the school of composition pioneered by Pierre Schaeffer and the many subsequent artists who advocate for the primacy of the ear.

Throughout this text I detail my exploration of structural organisation through practical research in electroacoustic music composition. The accompanying portfolio contains eleven pieces that chart the development of my compositional practice during the period 2012 to 2018, and particularly my approach to musical structure. In chapter two I briefly summarise select theoretical work in the areas of aesthetics, music psychology, and music theory, as applicable to the composition of electroacoustic music. In chapter three I present an overview of the portfolio followed by commentaries in chapter four

elaborating on the specifics of each piece in chronological order. Structuring processes are highlighted throughout in addition to more general concerns such as the generation of sound material and the articulation of space. In chapter five I engage critically with the works of the portfolio to identify a number of developmental 'themes' and comment on how these may inform the future direction of my work.

2. Structural Relationships in Acousmatic Music

The rapid expansion of musical sound material that characterised the Twentieth Century challenged composers to develop new and innovative methods of structural organisation. The modernist composer who failed in this respect typically garnered harsh criticism. Take, for example, Aaron Copland's disparaging remarks on Alexander Scriabin's piano sonatas (2009, p.153):

One of the most extraordinary mistakes in music is the example supplied us by Scriabin, the Russian composer of amazing gifts, who died in 1915. The quality of his thematic material was truly individual, truly inspired. But Scriabin, who wrote ten piano sonatas, had the fantastic idea of attempting to put this really new body of feeling into the straitjacket of the old classical sonata form, recapitulation and all. Few modern composers make that error any longer.

Such a view is perhaps understandable given historical context: the modernist drive for newness was reinvigorated by the conclusion of the Second World War leading to a period of great innovation and fierce rejection of traditional compositional practices (Griffiths, 2010). Pierre Boulez, a leading figure in European post-war contemporary music, confesses "I wanted to blot out every trace of the traditional in my vocabulary, whether it concerned figures, or phrases, or developments, or form" (Boulez, 1963, cited in Bandur, 2001, p.39).

Boulez and his contemporaries sought to reinvent music through rigorous formalism¹. Serial organisation, as conceived by Arnold Schoenberg, was extended from pitch to a

1. Leonard Meyer defines formalism as the primarily intellectual aesthetic position in which musical meaning "lies in the perception and understanding of musical relationships set forth in the work of art" (1956, p.3).

myriad of musical parameters including, in some cases, those of electronic sound generation. Despite undoubtedly meeting the need for a radically new music, Twentieth Century formalism has been criticised for “stressing concept at the expense of percept” (Smalley, 1986, p.63). The danger, according to Trevor Wishart, is “a situation where there is no longer any experiential verification of our theories about how to compose music” (1996, p.11), leading to what Paul Griffiths describes as the “paradox of rational, purposeful process and irrational, haphazard effect” (2010, p.43).

The music and theoretical work of Pierre Schaeffer offer an antithetical view that privileges aural perception as the prime discriminator in compositional decision making. In his *Treatise on Musical Objects*, Schaeffer makes the case for ‘musique concrète’ as a preferable solution to the problem of redefining music in the post-war period and in doing so paves the way for contemporary acousmatic music (2017). Schaeffer (2017, p.7) recalls:

When in 1948 I suggested the term *musique concrète*, I intended, by this adjective, to express a *reversal* of the way musical work is done. Instead of notating musical ideas in the symbols of traditional music theory, and entrusting their realization to known musical instruments, I wanted to gather concrete sound material, wherever it came from, and extract from it the sonorous musical values which it potentially contained.

The concept of ‘reduced listening’ – a listening behaviour that emphasises “sound for its own sake... independently of its causes or its meaning” (Chion, 1994, p.29) – is key to appreciating Schaeffer’s position. From a poetic perspective, reduced listening may be considered a tool for ‘abstracting’ musicality from recorded sound. This typically involves engaging with a sound over multiple repetitions until awareness of source or extra-musical meaning dissolves and some aspect of abstract musical interest emerges (or not as the case may be).

Simon Emmerson (1986) provides useful terminology for describing the dichotomous relationship between the formalist and Schaefferian approaches to musical organisation. In Emmerson's view, musical syntax exists on a continuum between that which is *abstract* and that which is *abstracted* from the sound material itself. As such, *abstract syntax* involves the organisation of sounds around pre-conceived higher-level structures in top-down fashion (the aforementioned serial methods are an obvious example of this approach). *Abstracted syntax*, on the other hand, involves bottom-up construction as prescribed by Schaeffer.

Emmerson also defines two modes of musical discourse: *aural discourse*, referring to music based on purely abstract sound material; and *mimetic discourse*, based on sounds that refer outside of the work to imitate nature or some non-musical aspect of human culture. These two dimensions are combined in Emmerson's now well-known language grid (figure 1) (1986, p.24) on which electroacoustic works may be placed.

Abstract syntax	1	4	7
Combination of abstract and abstracted syntax	2	5	8
Abstracted syntax	3	6	9
	Aural discourse dominant	Combination of aural and mimetic discourse	Mimetic discourse dominant

Figure 1. Simon Emmerson's language grid

The diversity of sound material featured in contemporary acousmatic music easily spans the full breadth of Emmerson's discourse dimension in the sense that it encompasses a wide range of both abstract and referential sounds. However, the organisation of acousmatic music remains strongly inclined towards the *abstracted* end

of the syntax dimension as musical relationships tend to result from perceptual judgements made during sound selection and development rather than preconceived formal plans. Similarly, the aesthetic value of a given relationship is verified through the listening experience.

It would be naïve, of course, to assume that this approach is in any respect anarchic. As Emerson writes, “There lies, above the process of aural choice... a set of beliefs as to what it is that ‘sounds right’ in any given situation” (1986, p.21). Psychologist David Huron concurs: “The more we rely on our intuitions, the more our behaviors may be dictated by unacknowledged social norms or biological predispositions” (2007, p.x). In his book, *Sweet Anticipation*, Huron discusses at length the role of expectation in musical meaning. Based on a body of empirical evidence, Huron proposes a neurophysiological theory of musical meaning rooted in the psychology of expectation (2007).

Huron claims that music evokes pleasurable feelings by (1) leading the listener to make successful predictions about future events (the prediction effect), and (2) through ‘pleasant surprises’ (contrastive valence), “where initially negative responses are supplanted by neutral or positive responses, with limbic contrast leading to an overall positive affect” (2007, p.239). Familiar structuring methods in Western music, including tonal cadential phrasing and metric rhythmic organisation, are cited as examples of how composers have intuitively applied these principles to create predictability, tension, and surprise.

Huron further states that, through enculturation in a musical style, the listener forms statistically based perceptual models (schemas) specific to that style (2007). Environmental markers learned through exposure to the style (such as a familiar cadential form or instrumental arrangement) may trigger associated schemas. Failure of an applied schema to yield accurate predictions, though, leads to inductive failure and subsequent rejection of the schema (2007). Thus, as Emerson writes, “communication

between composer and audience rests to some extent on a common code or at least common expectations and assumptions” (1989, p.135).

Contemporary acousmatic music, of course, remains largely obscure to the general music consuming public. Nevertheless, appreciation of acousmatic music, even by those without extensive exposure to the style, may be understood in terms of Huron’s theory. Composer Denis Smalley offers insight into the ‘expectations and assumptions’ that underpin the experience of acousmatic music. Smalley asserts that expectation associated with spectral change in instrumental note-based music extends to the domain of electroacoustic sounds (1997). Nested within his theory of spectromorphology² is the assumption that the listener expects electroacoustic sounds to behave similarly to those produced by acoustic instruments in that “spectral richness is assumed to be congruent with the dynamic shape of the morphology - the louder, the more spectral energy, the brighter and / or richer the sound” (1997, p.113). Therefore, the degree to which electroacoustic sounds adhere to expected patterns of spectral change influences their perceived physicality.

Furthermore, Smalley claims that the archetypical sound shape of the instrumental note-gesture “trains us in *spectromorphological expectation*” (1997, p.113) such that causality may be implied even in the absence of a clearly identifiable source. Smalley’s use of the term ‘gesture’ here refers to the physical gesture of a human agent applying energy (the *cause*) to, and consequently exciting, a sounding body (the *source*) such as the action of plucking a guitar string. However, given that in electroacoustic music no actual real world action is required to produce sound, the term is frequently used to describe electroacoustic sounds with energy motion trajectories that imply some physical gesture (1997).

2. Smalley (1997, p.16) defines spectromorphology as “the interaction between sound spectra (*spectro-*) and the ways they change and are shaped through time (*-morphology*).”

In Smalley's view, the gesture holds a central role as a unit of musical structure, being "concerned with action directed away from a previous goal or towards a new goal; it is concerned with the application of energy and its consequences; it is synonymous with intervention, growth and progress, and is married to causality" (1986, p.82). *Texture*, by contrast, describes the "internal behaviour patterning, energy directed inwards or reinjected, self-propagating; once instigated it is seemingly left to its own devices; instead of being provoked to act it merely continues behaving" (Smalley, 1986, p.82).

The relationship between gesture and texture is integral to Smalley's concept of musical organisation. When an energy motion trajectory is the dominant perceptual feature of a given structure, the structure is said to be *gesture carried*. It is not uncommon for such a structure to have a textural interior which is framed by gestural motions (*gesture framing*). In other cases, a texture may provide a canvas on which more proximate gestures materialise (*texture setting*) (1997).

Smalley (1997) further details a myriad of growth and motion patterns and behaviours that open a world of creative potential for structural relationships that affirm or transgress underlying perceptual schemas:

During listening we attempt to predict the directionality implied in spectral change. We might ask ourselves, for example, where a gesture might be leading, whether a texture is going to continue behaving the same way, whether change is likely or not, whether change is likely to be concerned with gradual merging or sudden interruption, and so on (Smalley, 1997, pp.114-15).

Thus, the theory of spectromorphology is primarily concerned with describing the shapes and behaviours of sounds as they exist within aural contexts. However, Smalley's theoretical work also accounts for the referential qualities of electroacoustic sounds and is therefore applicable to mimetic discourse. Smalley's term *source bonding*

describes the “*natural* tendency to relate sounds to supposed sources and causes, and to relate sounds to each other because they appear to have shared or associated origins” (1997, p.110). Smalley’s theory of *indicative fields* provides a more comprehensive analytical model for describing indicative relationships between electroacoustic sounds and the extra-musical world (1996).

By recognising the potential of electroacoustic sounds to establish both intra- and extra-musical relationships, the complexity of electroacoustic musical perception becomes apparent. John Young accounts for this complexity through the unifying concept of the *sound image*: “a conceptual tool which unites those sounds which are distinctly referential and those with a remote relationship to reality, allowing them to be investigated for the properties of presence and physicality they project” (2008, p.34).

According to Young:

The concept of the sound image is more than simply one of presenting ‘realistic’ or literal ‘torn from reality’ field recordings... Imagery may be more generally regarded as part of the response mechanism that listeners may bring to sounds of uncertain or abstract origin - the imagination’s response to that which is fantastical or remote from known physical sources” (Young, 2008, p.25).

Furthermore:

The act of ‘imagining’ in this broad sense can allow the composer to conceive structural relationships and transformational pathways that call on indicative relationships in consideration of factors such as the materiality of sound, spatial presence, colour balance, inflection or the sense of tension and its release (2008, p.34).

Thus, structural organisation in acousmatic music is inextricably linked to material. Abstract sounds may be best characterised in terms of their spectromorphological profiles (Seddon, 2006). When this is the case, aural discourse based on spectromorphological relationships will likely prevail. Conversely, sounds with strong links to source or place will likely evoke extra-musical ideas and therefore extend into the realm of mimetic discourse. Transformational processing may provide a means of bridging between these two contexts as sounds become increasingly remote from their causes and sources.

3. Portfolio Overview

My approach to acousmatic composition strongly aligns with the ideas discussed above in so much as it involves a mindful engagement with sound that facilitates the discovery of aesthetically valuable musical relationships. The nature of these relationships depends on the defining features of the sounds in question and particularly the dominance of aural or mimetic discourse. When effective, the aural and mimetic aspects converge to synergistically support the work's larger meaning.

Sounds with strong links to source or place are generally used cautiously with the intention of evoking real-world sound images. The potential of environmental recordings, for instance, to generate such images and cultivate overarching macrostructural narrativity is explored in pieces such as *Sandy*. There are moments, admittedly, when referential sounds may distract from an otherwise aural focus in a way that renders their inclusion counterproductive. Developing the sensitivity to identify these instances has constituted a significant part of my growth over the course of this project.

Due to their weaker connections with the extra-musical world, abstract sounds are more likely to form intra-musical relationships based on spectromorphological characteristics. Take, for example, the powerful sweeping gestures that appear towards the end of *Gramarye*: I expect that the spectromorphological features of these sounds will supersede any vague extra-musical allusions for most listeners. This informed my decision to establish a context (through recurrence of the sound shape and responsiveness to its implied physicality) within which the sounds participate in meaningful aural discourse. For some listeners, however, allusory images (perhaps representing magic or shards of light) may be unavoidable, demonstrating the potential for abstract sounds to form connections with non-musical aspects of human culture. This appears to be an important factor in the reception of my music and is addressed in the piece *Dark Skies*.

Despite my growing awareness of the structural relationships present in my music, many stemmed from serendipitous meetings of sounds that just happen to ‘work’ in the given context. The process of trial and error that Roads has termed multiscale organisation (2015) has proven integral in this respect. The multiscale approach to composition is essentially a flexible and intuitive hybrid of both bottom-up and top-down strategies. Roads writes:

The core virtue of multiscale planning is flexibility; it mediates between abstract high-level concepts and unanticipated opportunities and imperatives emerging from the lower levels of sound structure... Certain objects and phrases cannot be neatly packaged with precut form boxes... Instead, they mandate a container (mesoform) that conforms to their unique morphology and moment.

Multiscale awareness offers liberty to shift between timescales, adding, editing, reorganising, and discarding material at any point in the compositional process. The exact implementation of multiscale organisation varies from piece to piece. In *Bouba-Kiki*, for example, a bottom-up strategy predominated until a rudimentary formal sketch was assembled. As the work progressed I began jumping between timescales to refine low-level details while continuously assessing the larger-scale implications. In *Sandy*, however, I was cognizant of how the piece’s macrostructural narrative might play out even during the initial stages of composition. In this case, the creation of lower-level structures was influenced by a conceptual outline of the piece’s macrostructure.

Written Commentaries

4.1 Bouba-Kiki

Stereo (2.0), 8'54"

Bouba-Kiki is an acousmatic piece arranged for stereo speakers. The piece's concept stemmed from a growing interest in using descriptive vocabulary to select and organise electroacoustic sounds. Despite being arguably contrary to the acousmatic doctrine of aural primacy, the use of visual and text-based sound representations to inform compositional decision-making is not without precedent: Manuella Blackburn explores such an approach in both her doctoral and post-doctoral research (2009, 2010, 2011). Blackburn claims that the word sets of spectromorphology (Smalley, 1997), originally conceived as esthetic tools, could have poetic applications in acousmatic composition.

Blackburn further suggests that visualisations of sound-shapes might be “useful in the early stages of a new work... for generating sound materials” (2011, p.13). The utility of this method likely rests on the phenomenon of synaesthesia and particularly the bouba-kiki effect³ which describes the “non-arbitrary synaesthetic link between shapes and sound contours” (Ramachandran and Hubbard, 2001, p.27). *Bouba-Kiki* represents an attempt to utilise these ideas in my own acousmatic practice.

The compositional process began with the compilation of a somewhat arbitrary set of tactile adjectives such as bubbly, grainy, slick, gritty, prickly, screechy, airy, etc. This

3. The bouba-kiki effect was first demonstrated experimentally in 1929 by Wolfgang Kohler and later by Vilayanur Ramachandran and Edward Hubbard. The experiment involves presenting participants with two shapes - one round and bulbous, the other spiky and sharp - and asking them to assign either the name Bouba or Kiki to each. Participants consistently name the curved shape Bouba and the jagged shape Kiki. These findings support theories of protolanguages based on synaesthetic vowel / consonant mapping (Ramachandran and Hubbard, 2001).

word set informed the selection of raw sound materials, including recordings of bubbles blown into a glass of water, rubber soled shoes on a sports hall floor, and the skin of a bongo drum. I had originally intended to pre-plan structural relationships based on similarities and contrasts within the word set. In actuality, the bouba-kiki concept served only as a starting point; once the collection and processing of sounds was underway my perceptual awareness spontaneously shifted to the listening experience. The organisation of sounds in *Bouba-Kiki* was, therefore, guided predominantly by aural intuition, with the macrostructure emerging in a bottom-up manner without any reference to the adjective word set or any other pre-compositional plan.

Sounds with strong physical implications generally serve to initiate goal-oriented gestural structures or function as points of attraction. For example, a long crescendo beginning at 1'01" finally terminates with an energetic sweeping gesture at 1'51" (see figure 2). The slowly descending high texture might, at first, be expected to decay away with the textural background, but instead gains in perceived energy through gravitational attraction towards its ultimate goal.

Given the high degree of anticipatory tension generated, considerable care and attention was needed to create a satisfying resolution. I experimented with a number of abrupt terminations designed to surprise the listener, but in many cases, these failed to sufficiently dissipate the accumulated energy in a convincing manner (i.e. in a fashion consistent with the expectation patterns prepared earlier in the piece). In the final version of the piece I decided on a longer decaying termination that dissipates the energy more satisfactorily and smooths the transition to the following section. This point of arrival is reinforced by the inclusion of a subtle but clearly identifiable train pass-by, providing an example of how referential material can support meaning in an otherwise aural context through the evocation of pertinent extra-musical ideas. A similar example occurs at 6'01" where the sound of a solid object falling into a bucket of water terminates a descending trajectory.

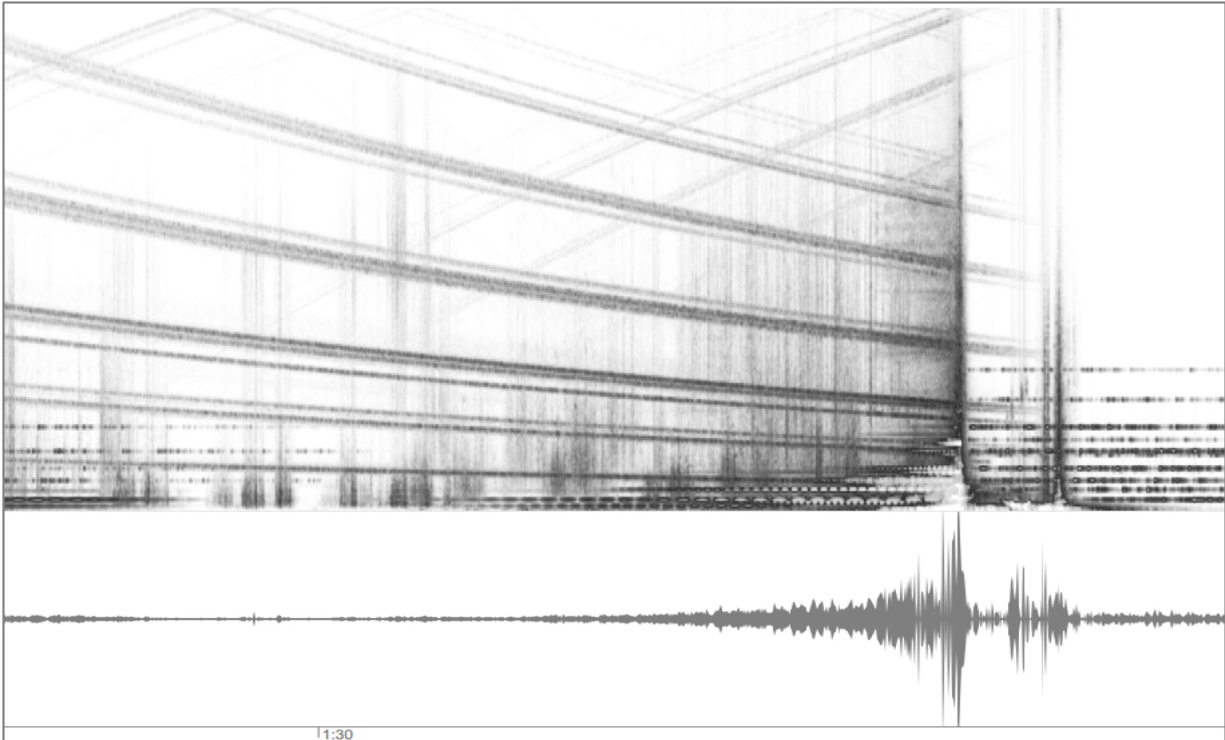


Figure 2. Waveform and spectrogram of an excerpt from *Bouba-Kiki*

Bouba-Kiki presents other referential sounds such as relatively unprocessed recordings of gravel and slate, although in these cases source associations were not intended to be meaningful. I acknowledge that it may be unreasonable to expect the listener, having been prepared for meaningful mimetic discourse, to accept such strongly source-bonded sounds in an aural context. Furthermore, the strong identities of these sounds could make frequent recurrence tiresome for some listeners, particularly given that their transformations are rarely sufficient to establish a significant transformational discourse. Although this material does add a certain dry grit, its inclusion to satisfy the piece's original 'theme' demonstrates the potential for incoherence when extra-musical ideas supersede aural judgement.

Variation in pace in *Bouba-Kiki* is achieved by alternating between gesture- and texture-carried settings. At 7'01", for example, flurries of short gestures draw the listener's attention away from the relatively static textural background and propel the music forward towards the next point of attraction at 7'15". Rapid gestural chains are used

here to focus the listener's attention on low-level details and therefore tend to be short-lived when compared with the more prolonged texture-carried sections.

As the first piece of the portfolio *Bouba-Kiki* represents a starting point for my investigation into structuring processes and acousmatic composition more broadly. My failure to adhere to the initial pre-compositional plan was significant in so much as it re-oriented me towards a compositional ethos grounded in aural perception. The rather free, impromptu approach taken in this piece successfully elucidated a number of intuitive structuring processes that are developed in subsequent pieces, including (1) the use of prolonged, goal-oriented trajectories with strong physical implications, (2) the inclusion of mimetic identities in otherwise aural passages at important points of structural articulation, and (3) the use of gesture- and texture-carried structures to control pace and guide the listener's temporal focus.

4.2 *Ring of Bells*

Stereo (2.0), 10'27"

Ring of Bells is a stereo acousmatic work, the composition of which began immediately after the completion of *Bouba-Kiki*. The piece marks an important point in the development of my practice as several new techniques emerged during its composition: (1) the introduction of aleatoric processes into mesostructural organisation, (2) second-order structuring processes, and (3) the consideration of space in macrostructural organisation.

The initial plan for *Ring of Bells* involved exploring two distinct sound groups with the intention of creating a more coherent macroform than achieved in previous works. The first group is defined by vertically organised structures derived from recordings of bells and found metallophonic objects. These structures are characterised by complex, inharmonic spectra (see figure 3). The second group, by contrast, comprises horizontally organised gestural mesostructures based on studio recordings of improvisational object-play with various types of paper such as magazine covers, wallpaper, and cardboard. Even prior to any processing these recordings were full of interesting movement and low-level detail, making them well suited to time-based transformations such as granulation and pitch modulation.

Randomisation of certain parameters, such as sample selection, playback speed, and spatial position, facilitated the creation of large numbers of mesostructural elements with relative ease and efficiency. Peter Batchelor's Max/MSP patch Clatter⁴ and similar tools proved invaluable as they provided a convenient means of auditioning effectively random combinations of sounds within pre-defined limits. This led to a shift in emphasis away from sound editing to assessing relative aesthetic value amongst the many similar mesostructures. The result was a set of diverse structures, many of which would have been unlikely if constructed entirely by hand.

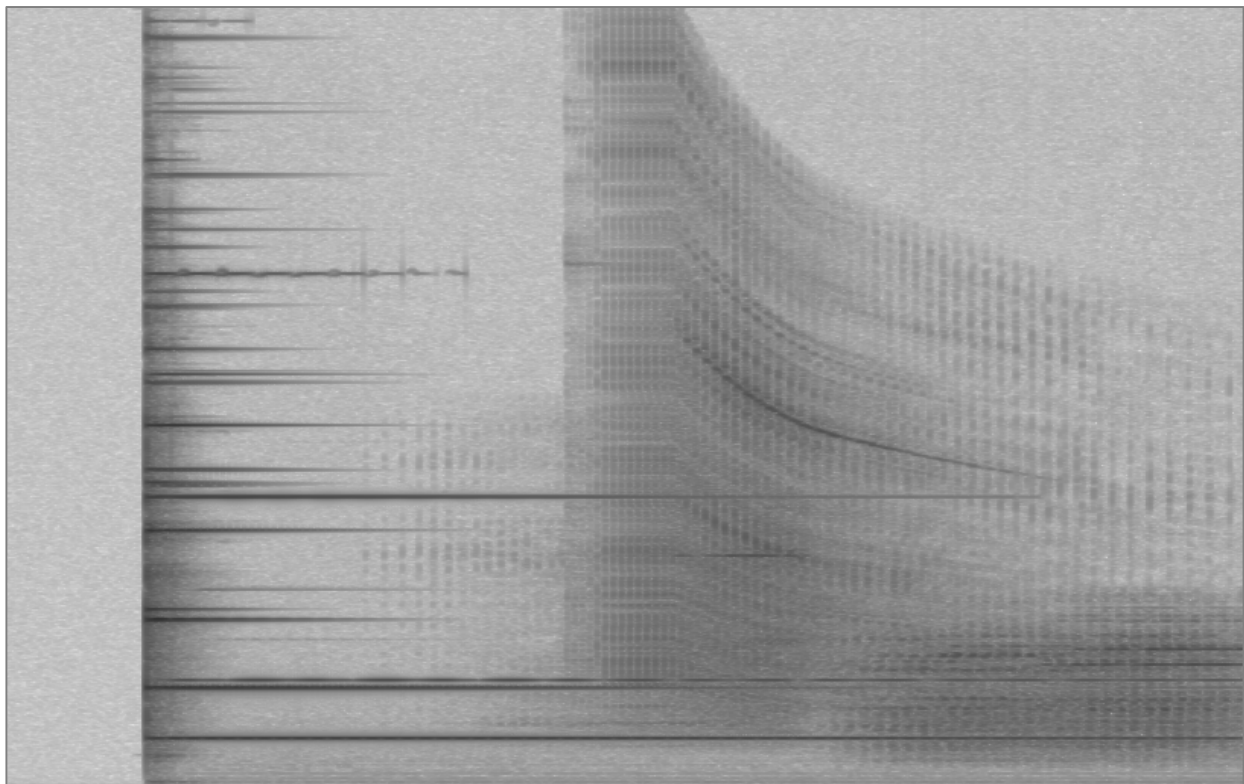


Figure 3. Spectrogram showing the inharmonic partials of an attack-decay morphology based on layered bell recordings in *Ring of Bells*

What I refer to as second-order structuring processes were developed in *Ring of Bells*. By this, I mean that certain structures within the piece were generated by rendering whole sections, subjecting them to further transformational treatments, then re-introducing them back into the original arrangement as new structural elements. An example of this technique occurs between 1'32" and 2'10" where the main mid-ground morphology was created by applying frequency domain processing to a mix down of a later section of the work.

-
4. Clatter is a sampler for Max/MSP created to "translate physical into musical gesture through the triggering of a (theoretically unlimited) series of user-defined samples in quick succession and at random (within limits) transpositions. Users draw gestures onto a two-dimensional 'scrubscreen', each graphical tile of which triggers a new sample. More extravagant movements trigger a greater number of samples, in turn producing more elaborate gestures" (Batchelor, P).

My approach to space advanced significantly during the composition of *Ring of Bells*. Space-form in *Ring of Bells* is inextricably linked to structure, with each of the two sound groups having its own distinct spatial setting. The first sound group occupies a spectrally broad spatial setting with considerable perspectival depth. As the bells decay at 2'20" a texture is introduced that occupies the most distal regions of perspectival space and reinforces the spatial identity of the sound group. The spatial setting of the second sound group is far more intimate, occupying predominantly central proximal space. This was achieved through 'close-miking' techniques, equalisation, and avoidance of natural or artificial reverberation. Other sounds are later introduced in a more distal setting creating spatial simultaneity⁵.

While I was not initially aware of the fact, the influence of traditional classical sonata form on the macroform of *Ring of Bells* is undeniable. It seems likely that schemas associated with sonata-type macroform were evoked by the presence of the two distinct sound groups and subconsciously influenced my decision making. Whether this is satisfying to the listener will likely depend upon his or her individual preferences, although I expect that some may recoil from the similarities with traditional Western musical forms. This approach to form has, however, been successfully utilised in canonical acousmatic works such as Francis Dhomont's *Novars* (Lewis, 1998).

Several pieces were identified as influences on the sound world of *Ring of Bells*. Much is owed to Åke Parmerud's *Crystal Counterpoint* (2009), particularly the sustained high-pitches that feature throughout. These sounds were derived from transformations of the original bell recordings and function in much the same way as the sustained pitches at the beginning of *Crystal Counterpoint*. Diana Salazar's *Papyrus* (2009) was also

5. Spatial simultaneity is a term used by Smalley to describe a spatial style in which two spatial settings are simultaneously represented: "Imagine a very present granular texture directly in front of you as if actually within your listening space, while in the distance a door closes in a large reverberant space. You are aware of simultaneous spaces" (Smalley, 1997, p.124).

influential for its creative use of paper as a sound source.

4.3 *Phases*

Stereo (2.0), 9'17"

As a composer of acousmatic music it is hard to avoid fascination with the physical nature of matter. It is, after all, the physical makeup of different substances that determines their acoustic properties. Chemistry teaches us that matter exists in distinct physical states or phases (solid, liquid, gas) at specific temperatures and pressures. Transitions between phases occur when temperatures or pressures cross substance-specific thresholds, such as when a liquid's temperature exceeds its boiling point leading to evaporation (Flowers et al, 2018). The phase diagram presented in figure 4 provides a visual representation of the physical phases and their transitions (Flowers et al, 2018, p.548).

Phases is a stereo acousmatic piece that explores real and imaginary sonic qualities of physical matter and its phases. I began composing the piece after a period of intensive sound gathering that comprised several field and studio recording sessions. During these sessions, I became concerned with emphasising the 'material' identities of found objects and consequently opted to categorise the recordings by their material characteristics (such as those with strong 'metallic' or 'watery' qualities) rather than their explicit sources. These recordings ultimately formed the palette from which the sound material of *Phases* was drawn.

Solid sounds were derived primarily from recordings of metal and porcelain objects. Recordings of metal banisters in the stair well of a nearby parking garage, for instance, served as raw material for many of the attack-decay morphologies heard throughout the piece. The strong resonant qualities of these sounds along with the 'hardness' of their attacks make them appropriate for representing the solid phase. Techniques such as manually softening hard attacks, filtering out noisy spectral content, and convolution

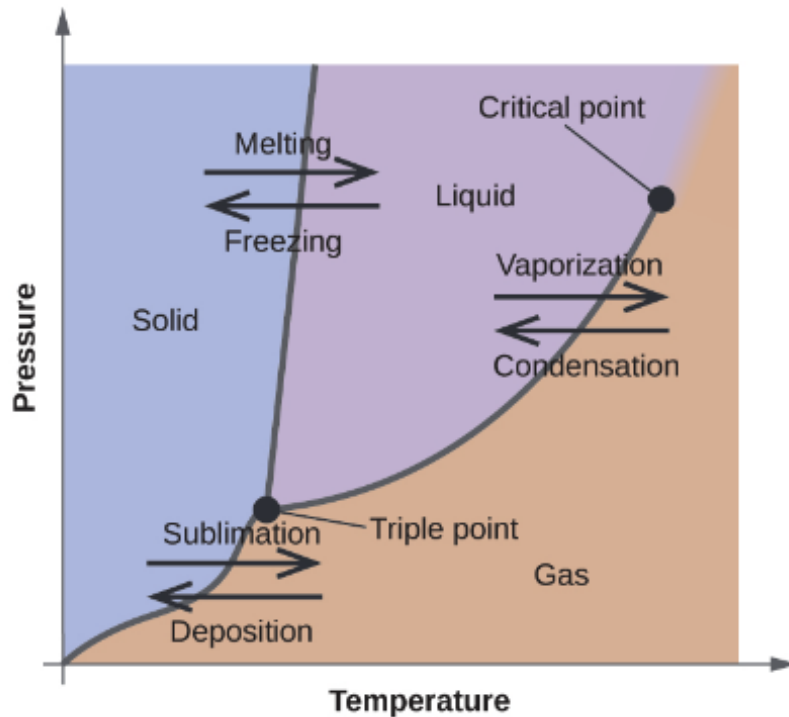


Figure 4. A phase diagram depicting states of matter and their transition thresholds in terms of temperature and pressure

were used to create a sense of fluidity from these same sounds. To represent the gaseous phase, recordings of fizzy carbonated beverages were layered and treated to various forms of electroacoustic manipulation. At certain points in the piece these sounds coalesce into great clouds of gaseous vapour. From an aural perspective, their grainy texture and noisy spectra contrast well with those of the more resonant ‘solid’ sounds.

Transformational processing facilitated exploration of transitional states. The liquid-metal textures heard between 2’00” and 3’50”, for example, were created by applying filtering to predominantly noise-based sounds with the goal of emulating the resonant qualities of metals in a continuous fluid texture. Cross-synthesis and convolution techniques were also utilised for this purpose.

Sound organisation on the mesostructural level was based on the now familiar bottom-up strategy employed in previous pieces. Most mesostructures adhere to spectromorphological expectation patterns in that their energy motion trajectories resolve in physically convincing ways. This is of particular importance given the work's allusions to thermodynamic behaviour in the material world. However, there are examples throughout *Phases* of more artificial, spectromorphologically 'non-adherent' behaviours that foreshadow the types explored later in the portfolio. An example of such occurs between 4'16" and 4'22" where trajectories are suddenly interrupted without regard for perceptions of energy motion.

From a macrostructural perspective, *Phases* differs from previous pieces in that it encourages the listener to track a narrative idea across the full duration of the piece. The opening of a pressurised can at the very beginning of the piece symbolises energy being released into a yet undefined composed space⁶, catalysing the many subsequent gestural structures prior to the 'system' reaching its final equilibrium. The piece ends with a reference back to the beginning as the carbonated fizz finally settles. This idea provides an obvious metaphor for notions of gesture and spectral energy motion, and demonstrates my growing awareness of multiscale perception.

6. Smalley defines the composed space as "the space as composed on to the recorded media" (1997, p.122).

4.4 *Sandy*

Quadraphonic (4.0), 10'29"

Sandy is a quadraphonic electroacoustic piece that presents a sonic narrative based on the course of hurricane Sandy⁷. The piece was composed during the wake of *Sandy* while I was traveling the eastern United States. Inspiration for the piece was drawn not only from the sounds of the storm but also from the palpable tension within the effected communities that, in many cases, were anticipating catastrophe. My aim, therefore, was to represent both the destructive force of the storm and the emotional burden shouldered by its victims. This provided an opportunity to explore narrative structuring using a combination of real-world and imaginary sound images.

Many of the sounds presented in *Sandy* fit into one of three categories: abstract, environmental, and instrumental. Each sound category plays a distinct role within the overall narrative. For instance, abstract sounds were called upon to represent the inner, emotional world of the individuals impacted by the storm. The descending morphologies that appear at 1'11" and recur throughout are inherently unstable and were selected to create a sense of unease and anticipatory anxiety. Whether this meaning is fully apprehended will likely depend on the listener's familiarity with the piece's extra-musical theme as well as the effectiveness of access tools (Landy, 2007) such as the accompanying programme notes.

The environmental material includes several relatively unprocessed ocean and weather recordings, taken around the time of the storm. These sounds were chosen first and foremost for their obvious mimetic qualities. The crashing waves and howling winds

7. Hurricane Sandy was a category 2 hurricane that devastated the northeastern United States in late 2012, costing billions in survivor assistance, emergency protection, and infrastructure replacement (FEMA, 2013).

at 2'14", for example, are intended to evoke real-world sound images that carry the brutality of the storm. The soft, rolling waves that appear at the beginning and end of the piece, by contrast, are particularly soothing and provide no hint of the unconstrained, destructive power within. These sounds are intended to convey the stark contrast between the intensity of the storm and the relative calm at its periphery.

Instrumental sounds based on recordings of a prepared piano and a waterphone serve entirely different structural roles, often functioning as sectional 'scaffolding'⁸. A prominent member of this category is the low register piano note that first appears at 0'54" and undergoes subtle pitch-based transformations throughout the piece, as if bending in compliance with the force of the storm. The instrumental identities of these sounds are important in that they clearly differentiate the material from that carrying the larger narrative.

Sandy also features a range of miscellaneous 'found sounds' derived from studio recordings of frying pans, balloons, and boiling kettles. Of interest are the passages of active gestural material around 3'30" and beyond that create unexpected shifts in pace and direction. These passages narrow the listener's perceptual focus from the macroscopic events of the storm to the lower-level details of gestural behaviour on the meso timescale.

Natasha Barrett's *Trade Winds* (2004-06) was influential on the composition of *Sandy*. Amongst its many accomplishments, *Trade Winds* successfully evokes what Adrian Moore describes as "emotions of the power and enormity of the sea" in a way that I hoped to achieve in *Sandy* (2016, p.123). Like Barrett, I opted for recordings of large crashing waves to access the environmental field (Smalley, 1996). However, my use of

8. David Hirst uses the term 'scaffolding' to refer to distinctive sounds that appear "at periodic junctures throughout the work" and "are generally used as structural signposts" (2006, p.198). Hirst suggests that "Loud percussive sounds (like foot-stomps, struck piano frames, and bass drums)" may be "used to provide punctuation points and mark sections" (2006, p.197).

these sounds deviates from Barrett's in its relative potential for transcontextual⁹ interpretation: the environmental material in *Sandy* is presented in a programmatic way intended to depict actual events in a more or less chronological fashion. By contrast, naturally and culturally indicative sounds in *Trade Winds* are frequently recontextualised by the composer through transformational processing or references to literary works such as Jules Verne's *Twenty Thousand Leagues Under the Sea* (Barrett, 2007).

9. Transcontextuality describes situations where recordings of nature or cultural events are incorporated into a work and "the composer intends that the listeners be aware of the dual meanings of a source. The first meaning derives from the original, natural or cultural context of the event; the second meaning derives from the new, musical context created by the composer" (Smalley, 1996, p.99).

4.5 *Gramarye*

Stereo (2.0), 7'53"

*Gramarye*¹⁰ is a stereo acousmatic piece inspired by notions of magic, enchantment, and occultism as represented in contemporary works of fiction such as David Mitchell's *The Bone Clocks* (2014). The composition of *Gramarye* was aimed at arousing vivid sound imagery strung together into a gripping sonic narrative. Narrative structuring techniques were the focus of my previous work, *Sandy*, in which the strong referential qualities of environmental sound recordings were utilised to stimulate sound images reminiscent of the eponymous hurricane. This time my intention was to create surreal, dreamlike imagery that skirts the borders of reality.

Gramarye challenges the listener to employ multiple simultaneous listening modes¹¹ to perhaps a greater extent than my previous works. For example, throughout the piece vocal utterances suggestive of magical incantations are incorporated into gestural structures, prompting the listener to engage both causally and semantically. Despite the clarity of their source, these vocal fragments are rendered largely incomprehensible, making their semantic interpretation difficult if not impossible. Similar ambiguities are introduced as transformative processes obscure the vocal source. When this occurs spectromorphological roles may take precedence, leading the listener to a reduced listening situation.

10. The term 'gramarye' may be interpreted as an archaic reference to mystical or occult learning (Online Etymology Dictionary).

11. Michael Chion defines three modes of listening: causal, semantic, and reduced. According to Chion, "Causal listening... consists of listening to a sound in order to gather information about its cause (or source)" (1994, p.25). Semantic listening is defined as "that which refers to a code or a language to interpret a message: spoken language, of course, as well as Morse and other such codes" (1994, p.28). Finally, Chion borrows the Schaefferian concept of reduced listening (1994).

A range of structural functions are covered by these morphologies. Relatively raw vocal sounds serve simple onset and termination functions, such as between 0'37" and 1'02". Termination functions often take the form of abrupt interruptions, anticipating the types of behaviours encountered in later works such as *Reel Musique* and *Vivisekt*. Elsewhere, such as at 2'55, layers of heavily processed vocal sounds form texturally complex structures that grow slowly before dissipating. At 1'06" a different but equally ambiguous vocal sound is situated distally to the foreground gesture and provides spatial depth. The remote surrogacy of this last example leaves only a trace of the vocal identity.

The treatment of space further supports *Gramarye's* surrealism. In addition to the types of spatial processes described previously in this text, here I attempt to subvert spatial realism by applying transformative processing (such as dynamic spectral filtering) to reverb signals. The large swells of reverb appearing at 5'00", for example, are treated as discrete spectromorphological entities, creating a type of transcontextual situation in which space possesses its own material characteristics.

Gramarye reaches its most climatic moments between 5'30" and 6'35", during which the narrative alludes to a violent conflict between unknown supernatural agents. The intensity of this section is dependent not only on the perceived gestural energy but also the temporal organisation: the density of gestural events is suddenly increased after a period of relative languor. The events in question, like the vocal sounds, are intended to encourage a range of listening behaviours. While predominantly abstract in nature (and therefore likely to be interpreted reductively), these sounds were modelled on cinematic 'magic spell' sound effects and may, for some listeners, possess mimetic qualities.

The potential for incongruent responses between listeners is an unavoidable product of *Gramarye's* evocative sound material. Anecdotal reports obtained during informal auditions with musically inexperienced listeners confirmed that without preparation many listeners fail to apprehend the piece's extra-musical ideas. However, a brief

preparatory discussion detailing my intentions and aims for the piece appeared to largely rectify this situation, supporting Landy's previously cited endorsement of programme notes and other access tools (2007).

4.6 *Dreadnought*

Stereo (2.0), 5'00"

Dreadnought is a stereo acousmatic piece inspired by the Western musical tradition of the virtuoso concert etude¹². Rather than examining specific instrumental techniques, as would be customary, my goal was to explore the sonic possibilities of an instrument through transformational discourse in the electroacoustic domain. To this end I chose the dreadnought acoustic guitar. Despite being extremely common-place, the dreadnought guitar proved capable of producing a surprisingly wide range of sounds, captured during improvisation sessions and subjected to various forms of digital manipulation.

My improvisations were influenced, to some extent, by the timbral system of Polish sonorist Krzysztof Penderecki. In short, Penderecki views timbre as a function of sounding bodies (vibrators) and their agitators (inciters). By exploring vibrator/inciter combinations based on the materials of the orchestra (metal, wood, leather, hair, and felt) Penderecki creates a palette of both traditional and non-traditional articulations such as tapping the sound board or body of stringed instruments with the nut or finger nail (Mirta, 2001). In *Dreadnought*, I regarded the guitar similarly in terms of its constituent materials and developed a number of extended techniques such as scraping the wound strings with various objects, percussing the body and fret board, strumming above the nut, and sliding glass or metal cylinders (bottlenecks) over the strings.

During sound development I was concerned primarily with maintaining morphological diversity: my previous attempts at composing single-source pieces were lacking in

12. 'Concert etude': "a particularly brilliant instrumental composition evolved from a single technical motive" (2015). Beyond mere fingers studies, the concert etude grants the instrumentalist opportunity to showcase both his/her musical and technical mastery in performance.

this regard and subsequently tended towards rather stagnant listening experiences. *Dreadnought*, on the contrary, features an almost gratuitous assortment of sounds including traditional note articulations (rest strokes, harmonics, muted strums, etc.), percussive attacks, flocking textures, drones, sweeping gestures, and so on.

While transformations range from subtle to extreme, I felt it important to preserve some aspect of the base ‘guitar’ identity at all times. The piece is, after all, a study on the sound-making possibilities of the instrument. Thus, I wanted to avoid blunt juxtaposition of obviously real and abstract sounds in favour of a more nuanced continuum across which transformational discourse could play out. In this respect *Dreadnought* differs from pieces such as Daniel Teruggi’s *The Shining Space* (1997-99) where references to the guitar are fleeting and, for the most part, do not represent the major identities of the work.

The nature of the transformations themselves are of obvious importance here. Due to source-bonding, the raw guitar sounds exhibit strong identities that, given the familiarity of most listeners with the instrument, may be expected to produce reliably consistent interpretations. Simple transformations that leave important morphological or spectral features intact generally maintain strong source bonds. At 0’22”, for instance, two open string rest-stroke sounds are time-stretched far beyond their natural lengths to create a stratified plane that clearly retains the original attack and spectral profiles¹³. This was achieved using IRCAM’s SuperVP algorithm in the audio editing package Audiosculpt.

Temporal organisation is also critical here. The gestural material beginning at 1’06”,

13. This technique is amongst those endorsed by Smalley as appropriate for transformational discourse: “stretching or contracting in time which does not threaten too much the aural, evolutionary integration of spectral components. Compress too much and you destroy identity; stretch too much and you destroy, for example, attack identity” (1994, p.43).

while far more remote in its surrogacy, maintains perceivable identity traces¹⁴ through close temporary proximity with its ‘parent’ material. Between 1’10” and 1’16”, for example, a complex gestural structure containing highly abstract sounds is framed by relatively unprocessed ‘bottleneck’ slides from which the former were derived (see figure 5). The common morphological characteristics provide the listener with important source cues. This is typical of how abstract materials are handled in *Dreadnought*: rarely are these sounds presented in isolation or before their strongly source-bonded parent sounds (which generally serve as behavioural models).

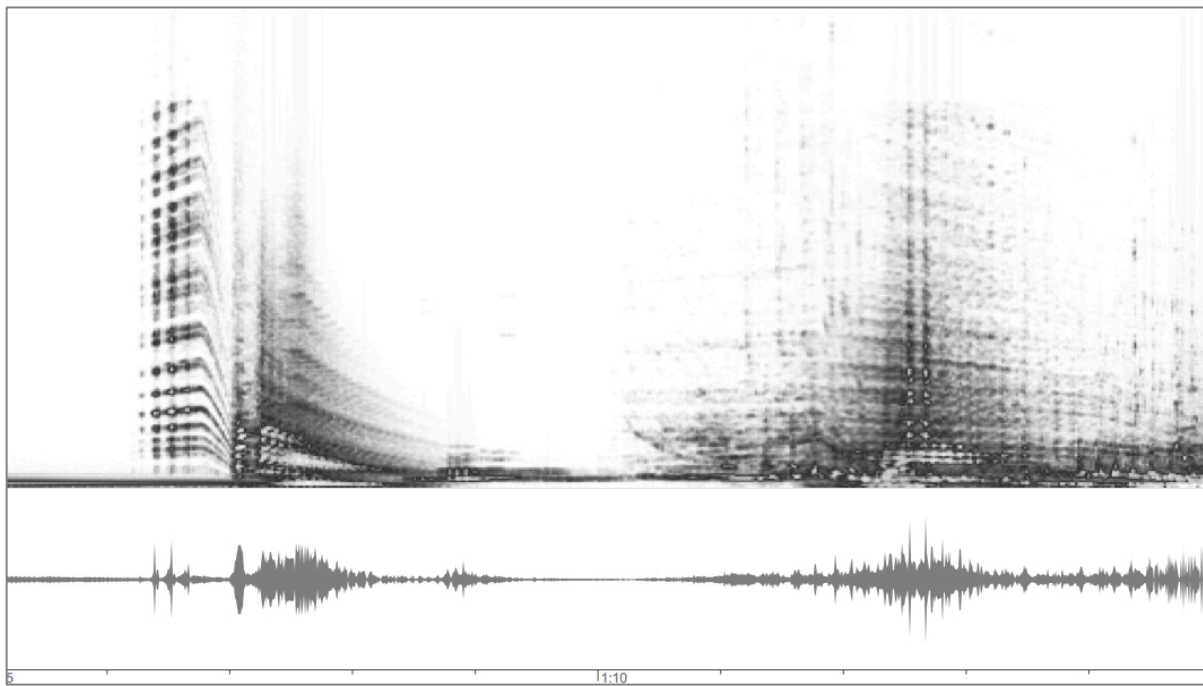


Figure 5. Waveform and spectrogram of an excerpt from *Dreadnought*

Remaining faithful to the genre, my etude is a condensed but dramatic exploration of the acoustic guitar. As the only piece to focus on transformational discourse of a single instrumental source, *Dreadnought* represents an important inclusion in the portfolio.

14. Ambrose Seddon defines trace identities as those “sound materials whose identity is less distinct, and more generic formulations and properties are perceived” (2006, p.2).

Composing the piece challenged me to develop a more nuanced approach to sound transformation and, furthermore, to gain an appreciation for temporal organisation in maintaining identity traces across multiple levels of gestural surrogacy.

4.7 *Dark Skies*

Surround (5.1), 8'05"

Dark Skies is the first in a series of three pieces that explore the aesthetics of microsound (Roads, 2001), digital failure (Cascone, 2000), and science fiction. The title was taken from my first published sound library¹⁵ which comprises many individual sound elements of a similar style. My growing interest in developing the *Dark Skies* sound world in an acousmatic context led to two specific avenues of enquiry: (1) how extra-musical associations between abstract electroacoustic sounds and science fiction might be evoked and exploited, and (2) how cinematic-type sound design elements might be mixed with more conventional electroacoustic sounds.

Inspiration for the piece was drawn from the music of Curtis Roads, Horacio Vaggione, and Gilles Gobeil, as well as the cinematic sound design of Dane Davis. The third movement of Roads' piece *Volt Air* (2001-03) was particularly influential for its short bursts of frantic activity that erupt out of the slowly evolving textures. At 1'27" Roads presents a brief pitched attack built from synchronous sound grains that, in my opinion, is highly effective in its onset function. This inspired my choice to articulate certain structural transition points in *Dark Skies* with similar pitched granular fragments.

The decision to arrange *Dark Skies* in 5.1 surround was intended to support an immersive cinematic listening experience. As such, I closely followed the conventions of cinematic surround sound mixing with a predominantly frontal image occupying

15. *Dark Skies* is a commercial library of original, royalty-free sound design elements and construction kits published by the Zero-G soundware label (2008). Material from the *Dark Skies* sound library has appeared in numerous media projects such as the BBC television series *Luther* and the video game *The Evil Within*.

prospective and panoramic space. While the subordinate role of the rear pair in generating a circumspatial image is undoubtedly limited, several multi-channel mixing techniques were employed including the use of middle/side processing to isolate the centre and sides of the stereo field to the centre and front stereo speakers respectively.

During auditions of earlier portfolio pieces, I became aware of the tendency of some listeners to associate abstract electroacoustic sounds with science fiction¹⁶. I was initially dissatisfied by these reports as they suggested that a misalignment of poetic and esthetic perspectives (Nattiez, 1990) may have been influencing how audiences understood my music. However, *Dark Skies* presented an opportunity to exploit these tendencies and marked a deviation from my usual approach to mimetic-discourse. Consequently, subtle references to cinematic science fiction pervade the sound world of *Dark Skies* with deep synthetic drones, mechanical and robotic sounds, and glitch techniques appearing throughout.

This strategy emphasises the importance of mimetic relationships in the perception of abstract electroacoustic sounds. As Smalley writes, “mimesis is always at work even in music regarded as abstract” (1986, p.64). Ambrose Seddon, however, takes an alternative stance, claiming that “The strength of identity of sounds that do *not* bear strong source or cause relationships is of particular significance in the acousmatic realm. For these cases, the most dominant spectromorphological features define the identity” (2006, p.2). This claim appears to be predicated on the assumption that the listener’s perceptual behaviour reliably shifts to a state analogous to Schaefferian reduced listening upon failure to identify a clear source or cause.

16. Landy reports similar observations in discussing the results of the Intention / Reception (I/R) project: Landy notes associations drawn by listeners of varying levels of musical experience between Denis Smalley’s *Valley Flow* and science fiction (2007, p.64). Elsewhere, Landy comments on the public’s exposure to works of twentieth-century music through science fiction and horror films, and suggests that this exposure could change the meanings of these pieces in the wider cultural context (2007, p.24).

Based on reports from inexperienced listeners during informal auditions, science fiction associations are the main identifying features of much of the abstract material in *Dark Skies*. In certain cases, a listener could relate their perceptions to specific films or even sound design elements. This supports Smalley's assertion by providing evidence (be it anecdotal) demonstrating the potential of mimetic identities to prevail over spectromorphological identities even with respect to highly abstract sound material. This discovery, while far from conclusive, influenced my sound selection strategies in subsequent pieces.

The sound design of Dane Davis in *The Matrix* series may account to some extent for the reports described above. *The Matrix* features a scene in which the film's protagonist, Neo, is extracted from a digitally simulated reality to the 'real world'. In this scene, Davis utilises microsound techniques to progressively transform an unprocessed scream into a stream of sound grains, giving the impression of the human voice being digitized:

My approach was to start with the apparent high resolution of his Matrix sensory inputs, and then degenerate into more and more quantized, granular bits of his own sound to simulate that transition of virtual sense breaking down, and then resolving into high resolution again once his eyes and ears were sensing directly and not through the wires and software of the Matrix (Davis, 2014).

Throughout the composition of *Dark Skies*, I was acutely aware of timescale. To a greater extent than in previous works, I consciously restricted structuring methods to particular timescales. On the micro timescale, for example, microsounds are frequently organised in contrasting asynchronous / synchronous blocks, leading to glitchy stutter effects and brief pitched sounds. This was achieved largely through manual micro-montage techniques. However, organisation on the meso timescale follows spectromorphological schemas, creating a situation in which physically implausible

microsounds exist within larger structures that adhere to well established expectation patterns.

On occasion, I intentionally break this rule: by allowing structuring processes to escape their respective timescales I present the listener with surprising new behaviours. For example, the hard edits that occur on the micro timescale sound unnaturally abrupt when transposed to the meso timescale, such as at 0'11" (see figure 6). This technique undermines the established expectation patterns in a way that, to me, suggests the fracturing or 'digitization' of reality.

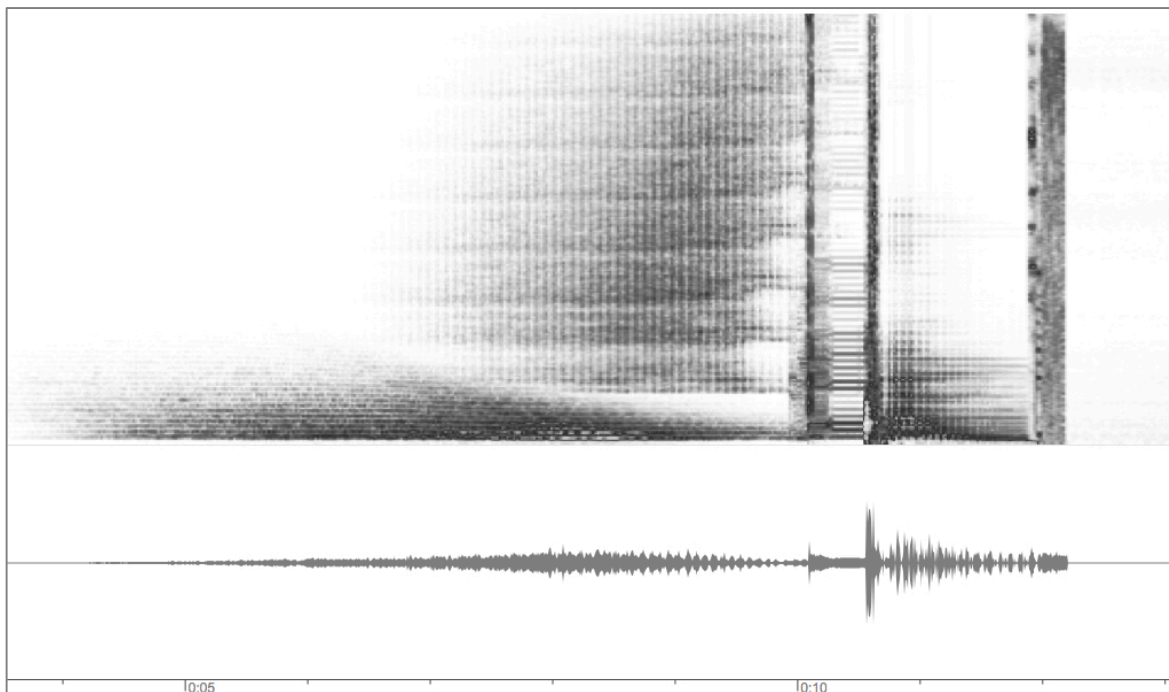


Figure 6. Waveform and spectrogram of an excerpt from *Dark Skies*

The macroform of *Dark Skies* recalls my previous works *Ring of Bells* and *Phases* in that its first two sections constitute an exposition in which all the piece's sound material is presented in respectively texture- and gesture-carried contexts. A relatively long structure beginning at 0'15" builds towards a much-anticipated termination at 1'53". During this section, growing textural complexity combined with multiple directional trajectories push the music forward towards its eventual goal (see figure 7). The

contrasting second section presents gestural material characterised by short forceful trajectories that convey a sense of scale and power. A developmental section unfolds from 4'26" onward before the final crescendo of the piece during which material is recapitulated (6'30" - 8'05").

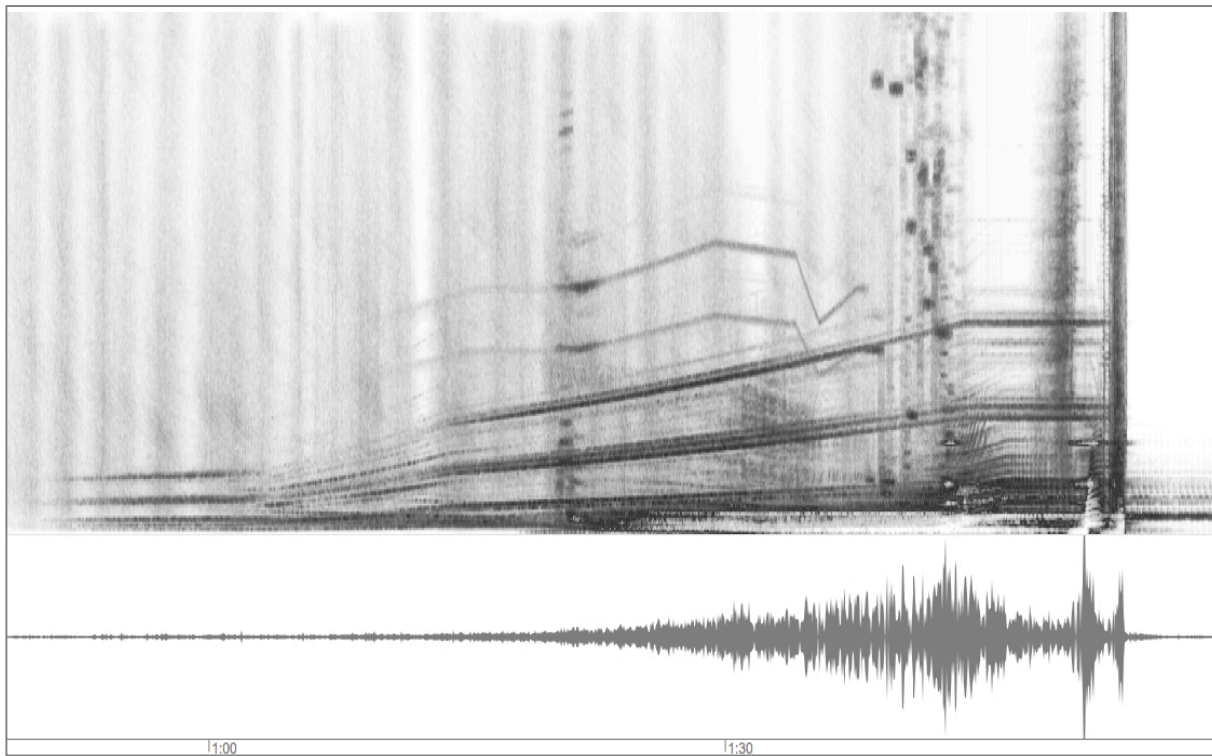


Figure 7. Waveform and spectrogram of an excerpt from *Dark Skies*

As the first of the series, *Dark Skies* opens several new avenues of enquiry that are explored further in the following works *Reel Musique* and *Vivisekt*.

4.8 *Reel Musique*

Stereo (2.0), 7'01"

Reel Musique is a stereo acousmatic piece based on recordings of an old reel to reel film projector. Like *Dark Skies*, *Reel Musique* combines microsound and glitch sounds that exist outside of physical reality with structures that adhere to spectromorphological expectation patterns. The resulting discourse requires the listener to reconcile seemingly incompatible schemas when, for instance, abrupt onsets and terminations reminiscent of tape edits are woven into otherwise conventionally gestural structures.

A unique feature of *Reel Musique* is its somewhat gimmicky 'hook': the periodic blips that open the piece form a memorable 'motif' of sorts that recurs frequently throughout (see figure 8). These sounds possess significant mimetic potential in that they provide referential cues to the opening sync sounds of motion picture film leaders (sounds presumably familiar to most Western listeners regardless of musical experience). Consequently, the blip motif provides context for the film projector sounds that might otherwise be attributed more generally to a non-specific mechanical source.

The blip sounds also contribute to the aural aspects of the work. All the sounds presented between 1'26" and 1'40" as well as the granular textures that follow were derived from a single instance of the blip sound. While the listener may not be acutely aware of these derivations, the shared spectral characteristics of these sounds support a sense of sonic cohesion. The temporal organisation of the blip sounds within the motif represents another, be it more abstract, recurrent event in the piece: the periodic pulsing of the drone texture introduced at 2'17" is derived from this pattern.

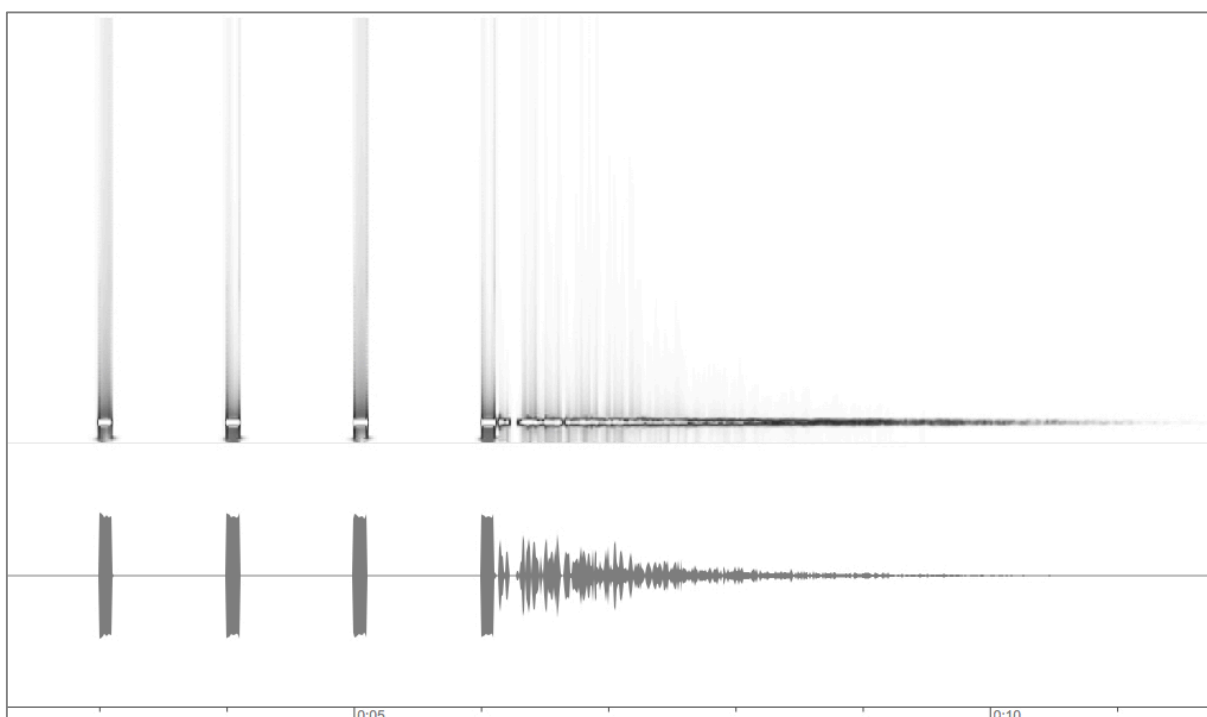


Figure 8. Waveform and spectrogram of an excerpt from *Reel Musique*

Interruption and fragmentation are important behaviours in *Reel Musique*. Indeed, the initial concept of the piece was based around emulating the now antiquated tape editing techniques developed during the early days of musique concrete. Accordingly, many sounds in the piece are crudely spliced together into meso and micro timescale montages (such as between 2'40" and 2'56"). At times these sounds are rapidly juxtaposed with more physically plausible morphologies. At 3'28", for instance, a montage sequence interrupts a slowly decaying spacious texture before suddenly terminating with a large, reverberant attack-decay morphology (see figure 9). This demonstrates how a momentary shift in schema can produce a satisfying surprise without disrupting larger scale structural development.

The macroform of *Reel Musique* is characterised by frequent and often dramatic shifts in temporal focus. For example, after a short but intense micro-montage at 1'24" the pace of the music drops significantly to allow the listener's perceptual focus to adjust in preparation for the next section. As the second major section of the piece begins

(around 1'47") the listener's attention is drawn instead to the growth of larger scale structures by the spectral broadening of a pulsing drone texture. At other times, rapid montage passages constrict the listener's focus on lower-level details. The dynamic listening experience that results calls to mind Smalley's comments: "a work must possess this focal potential if it is to survive repeated hearings during which we seek not only the rewards of the previous hearing, but also fresh revelations" (1986, p.81).

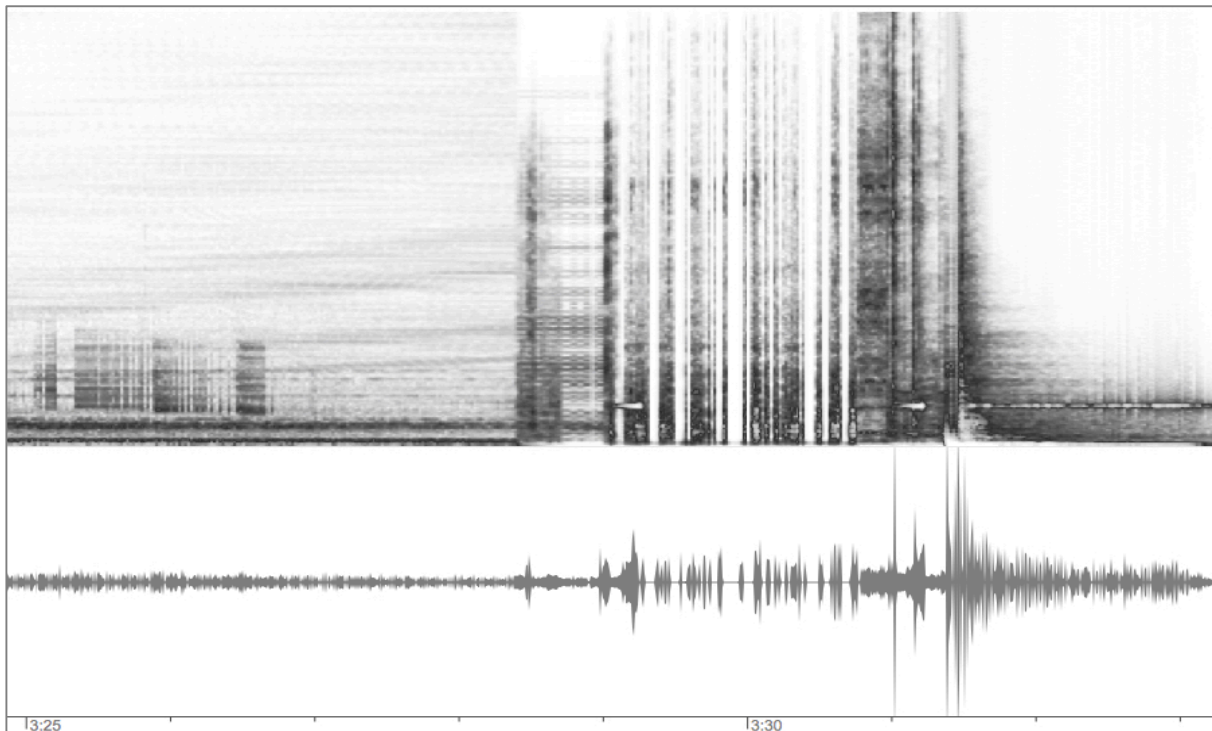


Figure 9. Waveform and spectrogram of an excerpt from *Reel Musique*

4.9 *Vivisekt*

Surround (5.1), 7'13"

Vivisekt is the last in the set of three pieces that includes *Dark Skies* and *Reel Musique*. The title, much like the music, represents several layers of meaning. From one perspective, the title refers to the live granular techniques that generated much of the sound material. From another, the title connotes the rather clinical brutalism¹⁷ that characterises the piece. From yet another, the Germanic style spelling alludes to the Elektronische Musik movement which inspired the piece's synthetic sound world.

Like *Dark Skies*, the aesthetic tone of *Vivisekt* is distinctly post-digital (Cascone, 2000). The low attack-decay morphology that opens the piece, for example, was created by 'abusing' a time-domain time-stretching algorithm to expose typically undesirable artefacts. On the micro timescale, these artefacts produce perceptions of pitch due to the synchronicity of the sound grains (Roads, 2001). The asynchronous fragmentation that occurs throughout the piece recalls the skipping or stuttering of a damaged compact disk. When nested within more 'organic' and phrase-like mesostructures, these digital obscenities are less offensive and may, for some, be suggestive of a kind of artificial intelligence.

My approach to multichannel arrangement builds on that developed during the composition of *Dark Skies*. However, in this instance I was more mindful of the articulation of space. Rather than merely 'filling in' the peripheral channels of an otherwise frontal panoramic arrangement, I consciously allowed my awareness of the morphologies to guide their placement and movement within the composed space. For

17. The term 'brutalism' has been used to describe sound-based artworks that embrace the aesthetics of minimalism, noise, and glitch. Brutalist works may be perceived as being "Cold, stripped-down, monochrome, pixelated, iterative, [and] quantised" (Zareei et al, 2005, p.51).

example, the fragmented material introduced at 0'11" is scattered randomly around the 5.1 array. By contrast, the gaseous grain-clouds that recur throughout the piece move through space in slow trajectories intended to match their dynamic profiles. The 5.1 surround array is hardly ideal for this purpose due to the wide angles between the front and rear pairs. However, this technique is developed in the later piece *Jeux d'eau* using a more appropriate speaker arrangement.

The development of materials for *Vivisekt* relied heavily on live improvisation with simple granulation patches built in Native Instruments Reaktor and 'played' with the Audiomulch Metasurface¹⁸ (see figure 10). The development of sound materials from continuous granulations has been described elsewhere by composers such as Roads (2004) and Moore¹⁹. In my practice, this technique tends to yield lengthy audio files that can serve as raw material for subsequent editing and processing.

Furthermore, the nature of the resulting sounds can vary extensively depending on the parameters involved. This accounts for the diverse range of morphologies present in *Vivisekt*. The sweeping mid-ground gestures that appear at 1'11", for instance, were

-
18. Audiomulch is a modular composition environment that allows users to create complex, interactive instruments by patching together sound-generating and processing modules. The Metasurface is a virtual two-dimensional surface on which 'snapshots' of multiple module parameters are placed and modulated between using the mouse (Bencina, 2005). As such, the Metasurface lends itself to live improvisation as it allows users to interact with multiple parameters simultaneously using gestural movements over the surface.
 19. Motivated by a desire to "make an intervention somewhere between the development of sounds using a diverse range of electroacoustic tools and the mixing process", Moore explores the potential of live granulation for acousmatic composition and performance using an instrument designed in Max/MSP and controlled via a graphics tablet (2008). Moore's instrument permits granulation of multiple sound files as well as the application of transformational processing through physical gestures made using the tablet's pen controller (2007, 2008).

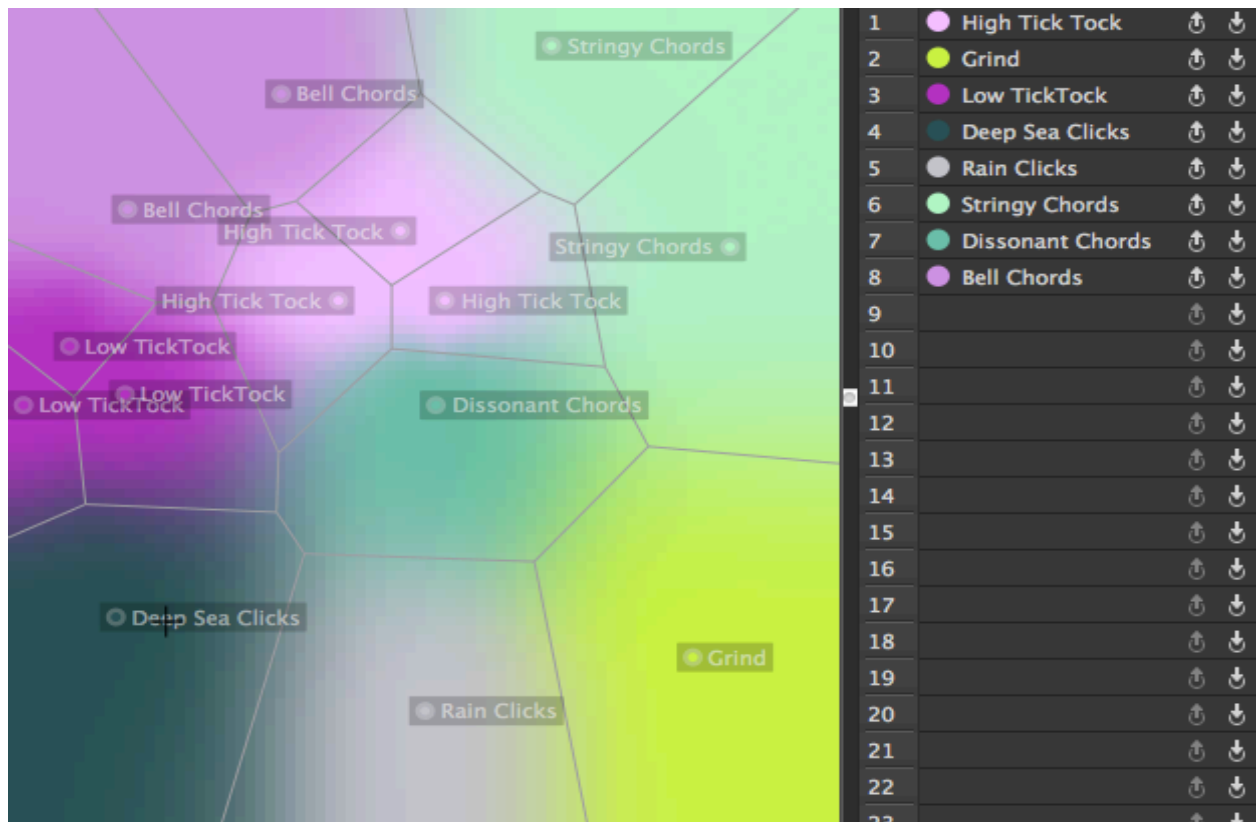


Figure 10. Screenshot of the Audiomulch Metasurface

created by modulating pitch and filter parameters in Audiomulch using finger gestures on the laptop's trackpad. At 3'02", several layers of the granular material are mixed to form a complex mesostructure: a smooth reverberant layer, created by modulating the parameters of spring reverb and tape echo plugins, sits distally in perspectival space to the more dry, proximate material (see figure 11).

Despite the different approach to sound development, *Vivisekt* was constructed using several now familiar organisational methods. For example, the use of attack-decay morphologies as onsets or terminations of larger-scale structures is common throughout the work. Brief fragments of the granular material are at times used as abrupt terminations in a manner reminiscent of the tape-style editing techniques explored in *Reel Musique*. The use of textural material to create spatial depth is also present. Nevertheless, developing sounds in a top-down manner was less familiar to me at the

time and lead to the creation of higher-level structures that would certainly have not been possible otherwise.

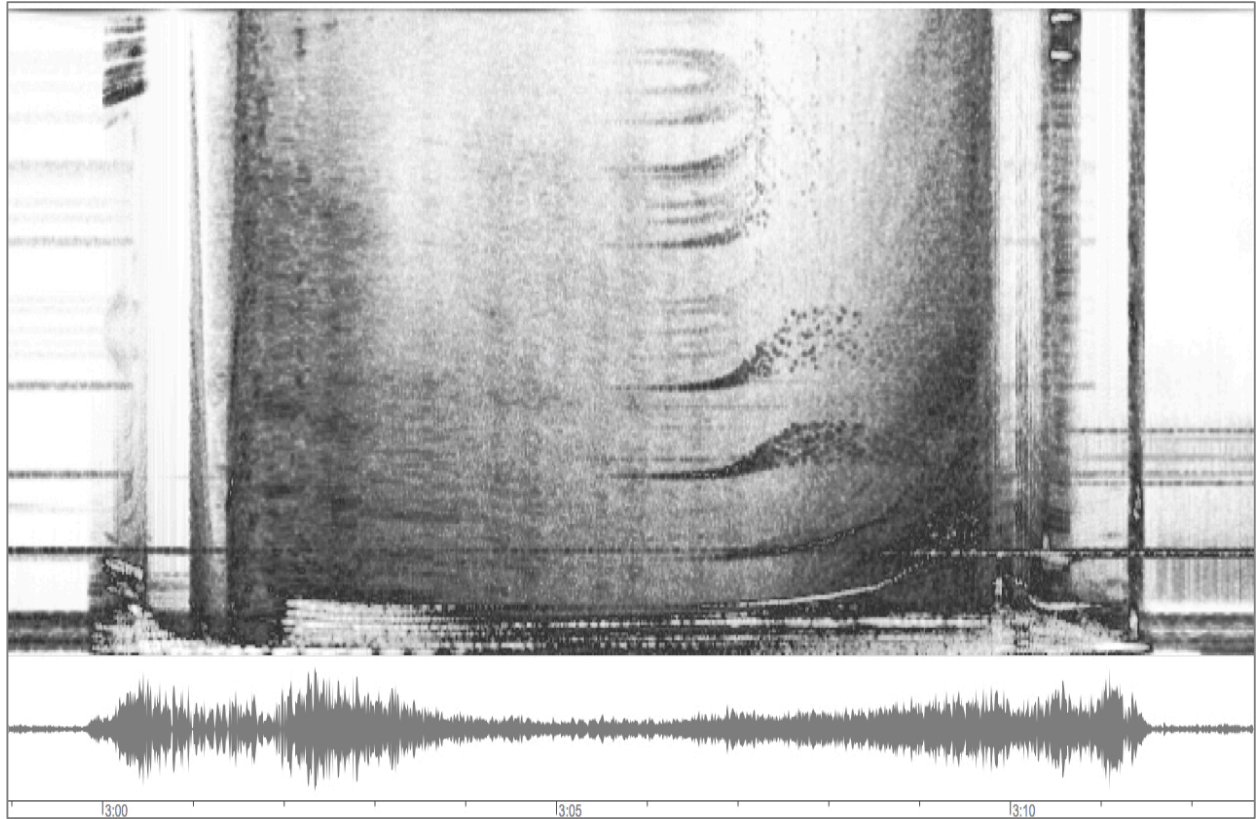


Figure 11. Waveform and spectrogram of an excerpt from *Vivisekt*

4.10 *A Breath of Air*

Stereo (2.0), 10'20"

A Breath of Air is a stereo acousmatic piece that explores sounds associated with 'air'. The impetus for the work stemmed from investigational object-play with balloons in the studio. The potential of balloons as sound-making instruments was evident during the collection of materials for *Phases* and *Sandy*. Improvisation sessions yielded a wealth of material from percussive attacks to airy textures. Transformation of these recordings generated a library of material spanning the entire real-to-abstract spectrum.

Jonty Harrison's piece *Hot Air* (1995) provided further inspiration. Like Harrison, my experimentation with balloons led to a more general interest in notions of air and their compositional possibilities. This, perhaps, is where my path diverges from that of Harrison, for where Harrison appears to have focused more on elaborating a structural model based on physical interactions of gaseous particles (Harrison, 1996), I emphasise the creation of an exciting sonic narrative rooted in mimetic discourse. It follows, then, that despite their common sources, the two pieces share little in terms of their respective listening experiences.

The macrostructure of *A Breath of Air* broadly adheres to simple ternary form. Nevertheless, multi-scale perception played an important role in the structuring of the piece. For the first minute, for instance, the music is constructed of relatively long gestural mesostructures. Here the listener's attention is drawn to the growth and decay of these structures as well as the referential and aural qualities of the material. However, as the section progresses the listener is presented with increasingly low-level detail until the flurry of rapid gestural chains and microsounds climaxes at 2'50".

The construction of this section relied on a new organisational strategy²⁰ that involved rendering effects processes to several copies of an audio file and arranging them in

parallel in the Digital Audio Workstation (DAW) for editing into a composite montage. As each copy exhibits distinctive spectromorphological characteristics, the resulting montage appears to shift rapidly between smooth dynamic swells and stuttering glitches. Some listeners may perceive elastic-like qualities (not dissimilar to those explored in Bernard Parmegiani's *Étude élastique*) that appear to catalyse subsequent gestures only to be interrupted by brief passages of micro-montage.

Like in *Reel Musique*, periods of intense activity are succeeded by complementary periods of relative calm that allow the listener's ears to rest and prepare for the next section. According to Roads, "Compositional processes need a balance between sparsity, relaxation, and repose as well as density, tension, and action" and thus "Composers sometimes deliberately insert sections that stall or freeze the narrative, as preparation for intense fireworks to come" (Roads, 2015, p.323). This aligns well with Smalley's assertions regarding the importance of varying "perceptual focus throughout a range of levels during the listening process" (1986, p.81).

A Breath of Air is unique within the portfolio for its use of rhythmic periodicity. At 4'47", for example, rhythmic layers are introduced that establish an energetic pulse and in doing so contribute to the sense of swift forward motion. This technique was utilised to great effect by Peter Batchelor in his piece *Steamin* (2000), during which periodic rhythmic material mimics the temporal pattern of a speeding steam train. In *Steamin*, the rhythmic pattern is amongst the strongest identities. While more abstract than in Batchelor's piece, the rhythmic periodicity explored in *A Breath of Air* effectively adds to the behavioural diversity of the piece.

20. This method was adapted from the innovative vocal production techniques of the American popular electronic music artist Brian Transeau. Transeau is known for creating complex vocal arrangements by applying numerous effects treatments to vocal tracks and manually editing them to form intricate micro-montages (2004).

A Breath of Air develops spatial techniques introduced in *Gramarye*. Specifically, transformational processing such as filtering and pitch shifting were applied to long decaying reverb tails to create a type of transcontextuality in which the reverberation functions as both indicator of spatial depth and spectromorphological entity. A subtle example occurs during the opening gesture when a long reverb tail falls in pitch as it decays, suggesting expansion of the spatial setting as well as a distinct morphological behaviour. A more dramatic example at 2'24" involves a dense reverb tail taking on the function of a textural morphology.

A Breath of Air refines and integrates several compositional ideas from previous pieces as well as introducing several new ones. Despite receiving favourable reviews during early auditions, I recognise specific areas for improvement that should be addressed in future works. Firstly, the perhaps excessive use of recurrent identities could become tiresome for some listeners. This might be avoided through the introduction of subtle variations into recurrent events that share strong identities. Secondly, my use of heavy reverberation in this piece might be problematic in some performance settings. Nonetheless, *A Breath of Air* marks an important step in the development of my compositional practice.

4.11 *Jeux d'eau*

Hexaphonic (6.0), 8'46"

Jeux d'eau is an acousmatic work for six channels that explores the sound-shapes and behaviours of water. Given its intimate relationship with human life and culture, it is not surprising that water has long received the attention of artists. Composer Maurice Ravel, for instance, was sufficiently captivated by the substance to dedicate at least one piece to its aesthetic possibilities. Ravel cites “the sound of water and musical sounds made by fountains, cascades, and streams” (1990, p.30) as inspiration for his innovative post-Romantic piano piece of the same title.

Of course, Ravel’s musical language, beyond suggestive figuration, was limited in its capacity to evoke such associations. The electroacoustic medium, by contrast, provides a vastly expanded means for establishing extra-musical relationships. Indeed, the acousmatic repertoire offers a diverse selection of pieces that make prominent use of water, such as Denis Smalley’s *Tides* (1984), Jean-Claude Risset’s *Elementa* (1998), Jonty Harrison’s *Streams* (1999), and Natasha Barrett’s *Trade Winds* (2004-06) to name but a few.

My own interest in water began with the composition of an acousmatic piece at Masters level entitled *Hydromorphia*. As its name implies, *Hydromorphia* is primarily a mimetic discourse on water and water-like sound-shapes. While developing material for the piece, the versatility of water as a sound source quickly became apparent; a wide range of morphologies were generated that not only exhibited strong source bonding but were also highly amenable to transformational processing. Water has since pervaded my work, appearing in numerous contexts from the bubbly gestures in *Bouba-Kiki* to the crashing waves of *Sandy*.

In *Jeux d'eau*, I engage in a more comprehensive study of water across various timescales and modes of musical discourse. *Jeux d'eau* opens with the presentation of resonant attack-decay morphologies created by convolving samples of bubbles blown in a glass of water with percussive attacks from a waterphone. This brief expository section serves to define the pitch-space (Smalley, 2007) of the piece as well as subtly alluding to the shortly following referential materials. Certain textures, such as those heard between 2'40" and 3'00", were derived from granulations of these morphologies. My intention here was to reinforce the listener's awareness of these pitches through recurrence of identity traces²¹. During the development section (beginning at 3'00") more spectrally complex derivations appear that could be considered analogous to harmonic development in note-based music.

Jeux d'eau also features abstract material in more complex gesture-carried contexts. However, in most cases these sounds are functionally linked to referential sounds through causality relationships. For instance, between 4'00" and 4'10" a complex structure comprising several morphological strings imply microscale causal interactions as water droplets collide.

Jeux d'eau makes extensive use of extra-musical references. For example, at 1'00" recordings of water draining from a bathtub appear²². These sounds exhibit interesting spectromorphological characteristics that contrast with those of the pitched attack-decay material while remaining strongly source-bound. As this section proceeds towards its climatic point at 2'20" more referential material is introduced that draws the listener's attention to the micro timescale details of individual bubbles and droplets. At 2'13" a recording of a toilet flushing breaks the slowly building crescendo. While this sound may

21. Seddon (2010) comments on the effectiveness of this technique in his analysis of Andrew Lewis' *Penmon Point* (2002-03).

22. Yves Daoust's *Water Music* (1991) features this sound in a similar context, although I was, at the time of composing *Jeux d'eau*, unfamiliar with this piece.

work well from an aural perspective, the associations with source (a toilet) and place (a public bathroom) may provoke undesirable reactions in some listeners.

Environmental sound occurs sparingly in this portfolio. The most notable examples appear in *Sandy*, where strong references to natural phenomena and place contribute to the work's 'real world' imagery. By contrast, the use of environmental material in *Jeux d'eau* is intended to encourage transcontextual interpretation (Smalley, 1996). At 5'33", for example, a second crescendo climaxes with the crashing of ocean waves that soften and decay as the perceived energy dissipates. Within this context the environmental recording is expected to evoke images of the sea in addition to functioning within a goal-oriented spectromorphological structure.

Jeux d'eau is the first piece of the portfolio to be arranged for a true circumspatial multichannel array. As a result, the occupancy of circumspace is more developed than in previous works. Both granulation and spectral diffusion²³ techniques were utilised to distribute textural material across the six channels. Gestural material was typically spatialised in accordance with the spectromorphological characteristics of the sounds in question. However, the technical limitations of my studio prevented a more sophisticated multichannel realisation. Furthermore, I largely ignored the spatial implications of the environmental sounds. In future works I hope to explore these points thoroughly.

23. Daniel Barreiro provides descriptions of granular and spectral diffusion techniques along with practical examples from his own works (2010).

5. Conclusions

The primary objective of this project was to investigate the organisation of electroacoustic sounds based on perceivable musical relationships. This final section is dedicated to briefly discussing the types of relationships on which the works of this portfolio are based, along with describing their influence on the direction of my future work. The portfolio, as a whole, documents my development as a composer over the period 2012 to 2018. Nested within, however, are several sub-projects, each devoted to solving particular aesthetic or technical problems:

- A basic approach to bottom-up organisation was established in *Bouba-Kiki – Phases* (2012 – 2013)
- A number of narrative structuring processes were developed in *Phases – Dreadnought* (2013 – 2017)
- The aesthetics of science fiction and microsound were explored in *Dark Skies – Vivisekt* (2015 – 2017)
- Space-form, including approaches to composing spatial environments, spatial surrealism, and multichannel composition, was examined in *Ring of Bells – Jeux d'eau* (2013-2017)

Earlier I made the distinction between aural and mimetic discourse. Aural discourses based on the exposition and recurrence of strong but disparate sound identities form the basis of my earlier pieces. These identities remain distinct due to their relatively stable spectromorphological, behavioural, and spatial characteristics. Larger scale development in these works is generally a function of variation in terms of the identity combinations as well as the durations and perceived pace of the sections. Despite emphasising mesostructural variety over higher level coherence, this approach offers an effective means of structuring acousmatic music through which interactions between diverse materials can be explored while preserving clear aural sound identities.

Macrostructural narrativity becomes increasingly evident in works such as *Sandy* (2014), *Gramarye* (2016) and *Dreadnought* (2017). A primarily aural narrative plays out in *Dreadnought* that follows a set of instrumental identities along paths of transformation. Maintaining semblance of the original instrumental identities required careful attention to temporal organisation and an awareness of the more salient aural features. The self-referential nature of this discourse permits narrative continuity even across extreme ranges of gestural surrogacy.

This differs from my earlier approach to aural discourse in its emphasis on multiscale perception: the listener is asked to recognise both the meso- and macrostructural implications of transformations rather than merely responding to variations on strong but largely undeveloped identities. My growing awareness of multiscale perception is also manifest in later works such as *Reel Musique* (2017) during which edits on the micro timescale briefly interrupt larger scale gestural development creating moments of surprise without destroying a sense of trajectory. Anticipating the implications of interventions made on one timescale over other timescales becomes an increasingly important aspect of my compositional thinking as the portfolio progresses.

By contrast, *Sandy* and *Gramarye* present extra-musical narratives through the evocation of real and surreal sound images respectively. The issue of esthetic incongruence poses a significant problem here: narrativity in these works is constructed not so much from the perception of intra-musical relationships but rather the apprehension of extra-musical references based on the composer's own cultural experience. The inclusion of access tools such as programme notes represents a common and evidence-based solution to this problem (Landy, 2007). However, I remain dissatisfied depending on ancillary materials and endeavour to pursue compositional strategies that offer closer alignment of the poetic and esthetic within mimetic contexts.

That abstract sounds (those in which source and cause are obscure) are often rich in extra-musical meaning (through associations with various aspects of culture such as

science fiction) further demonstrates the complexity of aligning poetic and esthetic perspectives. This challenges the notion that the primary mode of engagement with abstract sounds is aural and supports claims that even the most abstract sounds have the potential to participate in meaningful mimetic discourse. The use of certain sounds and processing techniques in *Dark Skies* (2016), for example, intentionally encourages the listener to draw associations with science fiction cinema rather than avoid them.

Having abandoned prior aspirations of achieving ‘pure’ aural discourse, I settle into a more relaxed attitude to concept and a renewed commitment to aural perception. By this I mean that adherence to concept cedes to ‘doing what sounds right’ in a given context far more frequently in the latter works of the portfolio. This is evident in my approach to both sound material and organisation in works such as *A Breath of Air* (2016): materials from outside the conceptual sonic palette are included for their behavioural characteristics and result in entirely new mesostructures that would not have occurred otherwise.

The portfolio also demonstrates my growing appreciation for space. This is notable in *Ring of Bells* (2013) where specific sections were devoted to establishing the composed space. *Sandy* was the first work of the portfolio to be arranged for a multi-channel array and therefore posed a new set of challenges. While the frontal-panoramic image remains focal throughout, the additional channels serve to expand textures over circumspace and repeat gestures in a kind of rudimentary imitative counterpoint. This anticipates the type of polyphonic spatial images presented later in *Jeux d'eau* (2017). In *Gramarye*, reverberation was elevated to the generation of discrete sound events. Here the boundary between the sounding event and the response of the composed space is blurred in a manner intended to create ambiguity and compliment the piece’s surreal tone.

I plan to explore the structural significance of interactions between sound material and spatial environment in future pieces. I find the notion of juxtaposing the placement of

stable sound identities in convincingly real and surreal spatial environments quite intriguing. This could easily extend to transforming a spatial environment over time such that its realism breaks down. I also intend to explore the environmentally indicative aspects of space and their implications for real world sound image based narrativity.

Appendices

A1. Bouba-Kiki

Stereo (2.0), 8'54"

First observed in 1929 by German psychologist Wolfgang Kohler, the bouba-kiki effect describes the tendency of human beings to synaesthetically associate the contours of vocal utterances with visual shapes. This principle provided the impetus for *Bouba-Kiki*, a stereo acousmatic piece that explores sound materials selected for their perceived agreement with certain tactile adjectives such as bubbly, gritty, prickly, and slick. The result is a diverse assortment of sounds: some recognisable, some not. The listener is encouraged to focus on the various sonic qualities presented throughout rather than on any perceived links to real world objects or places.

Bouba-Kiki was realised during 2012-2013 at the composer's studio in Boca Raton, Florida.

A2. *Ring of Bells*

Stereo (2.0), 10'27"

Ring of Bells is a stereo acousmatic piece that explores the juxtaposition of two contrasting groups of sounds, one defined by its 'vertical' (spectral) characteristics, the other by its 'horizontal' (time). A variety of bells and found metallophones were recorded and manipulated to create the complex inharmonic spectra of the first sound group. For the second, gestural material was derived from recordings of various papers and plastic sheets. Beyond the exposition and interplay of these materials, the listener may perceive concurrent shifts in spatial setting from the deep and spacious to the intimately proximate.

Ring of Bells was realised during 2013 and revised in 2015 at the composer's studio in Boca Raton, Florida.

A3. *Phases*

Stereo (2.0), 9'17"

As a composer of sound-based music it is difficult to avoid fascination with the physical nature of matter. It is, after all, the physical makeup of substances that determines their acoustic characteristics. The sounds presented in *Phases* were selected and processed with these properties in mind. Sources span a range of gases, liquids, and solids, including cans of carbonated beverage, vocal articulations, and resonant metallic objects. The sounds were subsequently treated either to emphasise their intrinsic physical characteristics or to generate transitional timbres that exhibit mutable physical qualities.

Phases was realised during 2012-2013 and revised in 2016 at the composer's studio in Boca Raton, Florida. The piece was premiered on 15th November 2013 at the Florida International University Electro-Acoustic Student (FEASt) Festival in Miami, USA.

A4. *Sandy*

Quadraphonic (4.0), 10'29"

Sandy is a quadraphonic acousmatic piece composed in the wake of the eponymous hurricane. At the time, I was traveling the eastern United States and was struck by the palpable tension within the effected communities that were, in many cases, anticipating catastrophe. My aim in composing the piece was to represent both the destructive force of the storm and the emotional burden shouldered by its victims.

Sandy was realised during 2012-2014 at the composer's studio in Boca Raton, Florida. The piece was premiered on 12th March 2013 as part of Electroacoustic WALES at the Bangor New Music Festival (Wales, UK).

A5. *Gramarye*

Stereo (2.0), 7'53"

Gramarye is a stereo acousmatic piece inspired by notions of magic, enchantment, and occultism. The piece includes a variety of sounds ranging from cryptic vocal utterances to blasts of abstract sound that, for some, may recall cinematic or literary depictions of magical activity. Others may experience *Gramarye* more through its diverse sonic qualities and the physicality of its sounds. Regardless, the listener is encouraged to embrace any sonic imagery conjured during the listening experience, allowing for a distinctly personal interpretation of the work.

Gramarye was realised during 2016 at the composer's studio in Boca Raton, Florida.

A6. *Dreadnought*

Stereo (2.0), 5'00"

Dreadnought is an acousmatic miniature inspired by the Western musical tradition of the virtuoso concert etude. Rather than examining specific instrumental techniques, my goal was to explore the sonic possibilities of an acoustic guitar in the electroacoustic domain. Despite being extremely common-place, the instrument proved capable of producing a surprisingly broad range of sounds that were captured during improvisation sessions and later subjected to electronic manipulation. The listener may find value in tracking traces of the original guitar identity along the various lines of transformational processing.

Dreadnought was realised during 2013 and revised in 2017 at the composer's studio in Boca Raton, Florida.

A7. *Dark Skies*

Surround (5.1), 8'05''

Dark Skies is the first of three pieces that explore the aesthetics of microsound, digital failure, and science fiction. The title was taken from my first published sound library that comprises many stylistically similar sound elements. Inspiration for the piece was drawn from the music of Curtis Roads, Horacio Vaggione, and Gilles Gobeil, as well as the cinematic sound design of Dane Davis in films such as *The Matrix*. *Dark Skies* is an immersive work intended to evoke vivid sound imagery through pervasive allusions to modern science fiction culture.

Dark Skies was realised during 2015-2016 at the composer's studio in Boca Raton (Florida, USA) and the Electroacoustic Music Studios of Bangor University (Wales, UK).

A8. *Reel Musique*

Stereo (2.0), 7'01''

Reel Musique is an acousmatic piece inspired by the medium of analogue tape. Despite being somewhat antiquated in today's world of sample accurate digital audio editing, tape editing techniques developed during the early days of musique concrete retain a certain aesthetic appeal. Consequently, the sounds in this piece are frequently interrupted, fragmented, and spliced together in a fashion reminiscent of yesterday's tape music. With the use of digital technology, these techniques were extended to function over various timescales, often far beyond what would be possible with manual tape editing.

Reel Musique was realised during 2014 and revised in 2017 at the composer's studio in Boca Raton, Florida.

A9. *Vivisekt*

Surround (5.1), 7'13"

Vivisekt is a multi-channel acousmatic piece that focuses on the typically undesirable artefacts of digital sound processing. *Vivisekt* immerses the listener in a distinctly post-digital sound world through the use (and often abuse) of time-domain granulation and time-stretching techniques. In creating *Vivisekt* I relied heavily on live granulation to generate large quantities of continuous material that was later painstakingly edited and used as raw sound material. The result is a music in which the ugly and the beautiful are sometimes difficult to distinguish.

Vivisekt was realised during 2015-2017 at the composer's studio in Boca Raton, Florida.

A10. *A Breath of Air*

Stereo (2.0), 10'20"

A Breath of Air is a stereo acousmatic piece that explores sounds and behaviours associated with 'air'. The work stemmed from a series of experimental studio recording sessions involving balloons. By physically interacting with the balloons I was able to create a diverse palette of sounds including airy textures, bright squeaks, percussive attacks, and much more. Transformation of these recordings yielded a wealth of material, much of which retained traces of its origins. The result is a dynamic work that hopefully offers the listener an enjoyable and engaging experience.

A Breath of Air was realized during 2016 at the composer's studio in Boca Raton, Florida.

A11. *Jeux d'eau*

Hexaphonic (6.0), 8'46"

Jeux d'eau is an acousmatic work for six channels that explores the sound-shapes and behaviours of water. Given its intimate relationship with human life and culture, it is hardly surprising that water has long received the attention of artists. Indeed, notable examples from leading composers pervade the acousmatic repertoire. My own contribution offers a fresh perspective on this familiar theme. The versatility of water as a source of sonic material is apparent through the inclusion of a diverse body of sounds from sources as disparate as a bathroom sink, bubbles in a glass of water, and the Atlantic Ocean.

Jeux d'eau was realised during 2016-17 at the composer's studio in Boca Raton, Florida.

B. Performances

Sandy

Dedans Dehors

Electroacoustic WALES, 2015

Bangor, Wales, UK

Sandy

Sweet Thunder Listening Room

San Francisco Contemporary Music Players (SFCMP) Electro-Acoustic Festival, 2014

San Francisco, California, USA

Phases

Florida International University Electro-Acoustic Festival (FEAST), 2013

Florida International University

Miami, Florida, USA

Sandy

Electroacoustic WALES

Bangor New Music Festival (BNMF), 2013

Bangor, Wales, UK

References

Bandur, M. 2001. *Aesthetics of total serialism*. Basel: Birkhauser.

Barreiro, D. L. 2010. Considerations on handling of space in multichannel electroacoustic works. *Organised Sound*. 15(3): pp.290-296.

Barrett, N. 2007. [Liner notes]. In: *Trade Winds*. [CD] Oslo: Aurora.

Batchelor, P. Clatter. [Online]. [Accessed 14 August 2018]. Available from: <http://www.peterb.dmu.ac.uk/maxClatter.html>

Bencina, R. 2005. The Metasurface: Applying natural neighbour interpolation to two-to-many mapping. *Proceedings of the 2005 International Conference on New Interfaces for Musical Expression (NIME05)*, Vancouver, BC. [Accessed 12 August 2018]. Available from: <http://www.audiomulch.com/learn>

Blackburn, M. 2009. *Composing from spectromorphological vocabulary: Proposed application, pedagogy and metadata*. [Online]. [Accessed 22 July 2018]. Available from: www.ems-network.org/ems09/papers/blackburn.pdf

Blackburn, M. 2010. *Portfolio of electroacoustic music compositions*. Ph.D. thesis, University of Manchester.

Blackburn, M. 2011. The visual sound-shapes of spectromorphology: An illustrative guide to composition. *Organised Sound*. 16(1), pp.5-13.

Cascone, K. 2000. The aesthetics of failure: "Post-Digital" tendencies in contemporary computer music. *Computer Music Journal*. 24(4), pp.12-18.

Chion, M. 1994. *Audio-vision: Sound on screen*. Translated by C. Gorbman. New York, NY: Columbia University Press.

Copland, A. 2009. *What to listen for in music*. New York, NY: New American Library, 2009.

Davis, D. 2014 In: Kaufman, D. 2014. [Online]. Dane A. Davis on 'The Matrix. Cinemontage. [Accessed 15 August 2018]. Available from: <http://cinemontage.org/2014/11/dane-davis-matrix/>

Emmerson, S. 1986. The relation of language to materials. In: S. Emmerson, ed., *The Language of Electroacoustic Music*, London: Macmillan Press, pp.17-39.

Emmerson, S. 1989. Composing strategies and pedagogy. *Contemporary Music Review*. 3(1), pp.133-144.

Federal Emergency Management Agency (FEMA). 2013. Hurricane Sandy Recovery Efforts One Year Later. [Online]. [Accessed 7th April 2014]. Available from: <http://www.fema.gov/media-library/assets/documents/85068>.

Flowers, P., Theopold, K., Langely, R., Robinson, W. R. 2018. *OpenStax Chemistry*. Houston, TX: Rice University.

Griffiths, P. 2010. *Modern music and after*. 3rd ed. New York NY: Oxford University Press.

Harrison, J. 1996. [Liner notes]. In *Articles indefinis*. [CD] Montreal: empreintes DIGITALes.

- Hirst, D. 2006. *The development of a cognitive framework for the analysis of acousmatic music*. Ph.D. thesis. University of Melbourne.
- Huron, D. 2007. *Sweet anticipation: Music and the psychology of expectation*. Cambridge, MA: The MIT Press.
- Landy, L. 2007. *Understanding the art of sound organization*. Cambridge, MA: The MIT Press.
- Lewis, A. 1998. Francis Dhomont's Novars. *Journal of New Music Research*. **27**(1/2), pp.67-83
- Merriam-Webster Online Dictionary. [Online]. 2015. concert étude. [Accessed 24 July 2018]. Available from: www.merriam-webster.com.
- Meyer, L. B. 1956. *Emotion and meaning in music*. Chicago, IL: The University of Chicago Press.
- Mirka, D. 2001. To cut the Gordian Knot: The timbre system of Krzysztof Penderecki. *Journal of Music Theory*. **45**(2), pp.435-56.
- Mitchell, D. 2014. *The Bone Clocks*. New York, NY: Random House.
- Moore, A. 2007. Making choices in electroacoustic music: Bringing a sense of play back into fixed media works. [Accessed 12 August 2018]. Available from: <http://adrian-moore.staff.shef.ac.uk/music/3pieces-article.pdf>
- Moore, A. 2008. Fracturing the acousmatic: Merging improvisation with disassembled acousmatic music. [Accessed 12 August 2018]. Available from: https://www.sheffield.ac.uk/polopoly_fs/1.26358!/file/ajmlCMCfinalfracture.pdf

Moore, A. 2016. *Sonic art: An introduction to electroacoustic music composition*. New York, NY: Routledge.

Nattiez, J-C. 1990. *Music and discourse: Towards a semiology of music*. Translated by C. Abbate. Princeton, NJ: Princeton University Press.

Online Etymology Dictionary. [Online]. glamour. [Accessed 24 July 2018]. Available from: <https://www.etymonline.com>.

Ramachandran, V.S. and Hubbard, E.M. 2001. Synaesthesia - a window into perception, thought and language. *Journal of Consciousness Studies*. **8**(12), pp.3-34

Ravel, M. 2003. An autobiographical sketch by Maurice Ravel. In: Orenstein, A. *A Ravel reader: Correspondence, articles, interviews*. Mineola, NY: Dover Publications, pp. 29-37.

Roads, C. 2001. *Microsound*. Cambridge, MA: The MIT Press.

Roads, C. 2004. The path to Half-Life. [Accessed 12 August 2018]. Available from: <https://www.curtisroads.net/articles>

Roads, C. 2015. *Composing electronic music: A new aesthetic*. New York, NY: Oxford University Press.

Salazar, D. 2009. *Portfolio of original compositions*. Ph.D. thesis, University of Manchester.

Schaeffer, P. 2017. *Treatise on musical objects: An essay across disciplines*. Translated by C. North and J. Dack. Oakland, CA: University of California Press.

Seddon, A. 2006. Recurrence and sound material identify in acousmatic music composition. *Digital Music Research Network Doctoral Research Conference, 22-23 July 2006, Goldsmiths College, University of London*. [Online]. [Accessed 24 July 2018]. Available from:
<http://doc.gold.ac.uk/~map01ra/dmrn/events/dmrn06/papers/seddon2006recurrence.pdf>

Seddon, A. 2010. Investigating recurrences in Andrew Lewis's Penmon Point. In: Motje Wolf & Andrew Hill (Eds). *Proceedings of Sound, Sight, Space and Play 2010 Postgraduate Symposium for the Creative Sonic Arts, 2-4 June 2010, De Montfort University Leicester*. [Online]. [Accessed 24 July 2018]. Available from:
<http://www.mti.dmu.ac.uk/events-conferences/sssp2010/>

Smalley, D. 1986. Spectro-morphology and structuring processes. In: S. Emmerson, ed., *The Language of Electroacoustic Music*, London: Macmillan Press, pp.61-93.

Smalley, D. 1994. Defining timbre - refining timbre. *Contemporary Music Review*. **10**(2), pp.35-48.

Smalley, D. 1996. The listening imagination: listening in the electroacoustic era. *Contemporary Music Review*. **13**(2). pp.77-107.

Smalley, D. 1997. Spectromorphology: explaining sound-shapes. *Organised Sound*. **2**(2), pp.107-26.

Smalley, D. 2007. Space-form and the acousmatic image. *Organised Sound*. **12**(1): pp.35-58.

Transeau, B. 2004. In: Levine M. Sonic Surgeon. *Electronic Musician*. [Accessed 22 August 2018]. Available from: <https://www.emusician.com/gear/sonic-surgeon>

Wishart, T. 1996. *On sonic art*. New and Rev. ed. Amsterdam: Hardwood Academic Publishers GmbH.

Young, J. 2008. Reflections on sound image design in electroacoustic music. *Organised Sound*. **12**(1). pp.25-33.

Zareei, M. H., McKinnon, D., Carnegie, D. A., Kapur, A. 2016. Sound-based brutalism: An emergent aesthetic. *Organised Sound*. **21**(1), pp.51-60.

Zero-G. 2018. Dark Skies Cinematic Ambiences. [Online]. [Accessed 10 July 2018]. Available from: <https://zero-g.co.uk/products/dark-skies-cinematic-ambiences>

Discography

Barrett, N. 2004-06. *Trade Winds*. [CD] Oslo: Aurora.

Batchelor, P. 2000. *Steamin'. Spike*. [CD] London: Sargasso.

Daoust, Y. 1991. *Water Music. Musiques naïves*. [CD] Montreal: empreintes DIGITALes.

Dhomont, F. 1989. *Novars. Cycle du son*. [CD] Montreal: empreintes DIGITALes.

Harrison, J. 1995. *Hot Air. Articles indefinis*. [CD] Montreal: empreintes DIGITALes.

Harrison, J. 1999. *Streams. Environs*. [CD] Montreal: empreintes DIGITALes.

Lewis, A. 2002-03. *Penmon Point. Miroirs obscurs*. [CD] Montreal: empreintes DIGITALes.

Moore, A. 2006-07. *3Pieces. Contrechamps*. [CD] Montreal: empreintes DIGITALes.

Parmegiani, B. 1975. *De natura sonorum. L'oeuvre musicale en 12 CD*. [CD] Paris: Ina-GRM.

Parmerud, A. 2009. *Crystal Counterpoint. Necropolis*. [CD] Montreal: empreintes DIGITALes.

Risset, J. 1998. *Aqua. Elementa*. [CD] Paris: Ina-GRM.

Roads, C. 2001-03. *Volt Air. Point Line Cloud*. [CD] San Francisco, CA: Asphodel.

Salazar, D. 2009. Papyrus. *Portfolio of original compositions*. [Ph.D. Portfolio]
Manchester: University of Manchester.

Smalley, D. 1984. Tides. *Sources / scenes*. [CD] Montreal: empreintes DIGITales.

Teruggi, D. 1997-99. The Shining Space. *The Shining Space*. [CD] London: Sargasso.