Redesigning a Performance Practice: Synergising Woodwind Improvisation with Bespoke Software Technology.

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I hereby certify that this material, which I now submit for assessment on the programme of study leading to the award of PhD, is entirely my own work and has not been submitted for assessment for any academic purpose other than in partial fulfillment for that stated above.

Signature _____

Date _____

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Guide to Notation

This dissertation uses a number of unconventional notional devices, chief among these is a loose interpretation of rhythmic subdivisions. Where a more complex arrangement of rhythmic notation would, arguably, portray a more accurate representation, I have opted for clarity of reading with the use of simplified sub-divisions. This choice is in keeping with the elastic nature of the musical phrasing heard in the recordings and the interest in non-summative rhythmic groupings. Other extended techniques and microtonal tunings are represented as follows.

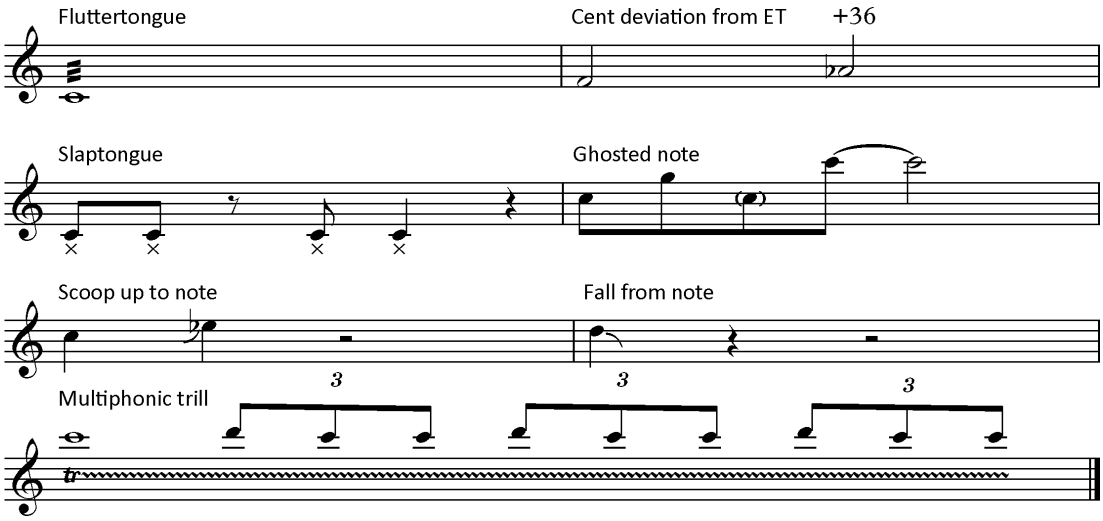


Figure G.1 Overview of non-standard notation used in dissertation.

Abstract

This research examines how the designing of a new performance practice based on the incorporation of custom digital signal processing software impacts on solo improvised woodwind performance. Through the development of bespoke software, I investigate how these new technologies can be integrated into solo woodwind performance practice. This research presents a new improvised music practice as well as a suite of new software tools and performance techniques.

Through a workshop and performance-based research process, a suite of software processors are developed which respond, and are complementary, to a personalised style of improvised performance. This electronic augmentation of the woodwind instrument (clarinet, bass clarinet, alto saxophone and xaphoon) is tested over the course of thirty solo improvised performances. These performances are documented as audio files and analysed using methods derived from electroacoustic music practice.

This research represents an important development in the emerging field of improvised music performance engaging with new digital technologies. The research is practice-led from the viewpoint of an experienced performer and tested in real-world situations, resulting in a useful research outputs embedded in the peer community.

Examining the history of live electronic performance practice, this research situates itself within the field of expert performers who use digital processing in free improvisation contexts. A critical understanding of the processes involved allows this researcher to design a new performance practice more effectively. While research necessarily draws on my own performance practice, the knowledge generated will have broad relevance in the field and much of this work is applicable to non-woodwind instrumentalists and singers. The research outputs include freely distributable software created during this project.

Introduction

The technical extension of woodwind instrumental capabilities has a long history from ancient times with the simplest of flutes, through to the nineteenth century innovations of Boehm and continues today with further refinements of instrument design.[1] This research extends this tradition through the addition and customisation of tools from electroacoustic performance practice to the instrument. The instruments used include B-flat clarinet, bass clarinet, alto saxophone and xaphoon.[2] This research is undertaken from the viewpoint of a performer and is predominately carried out in the arena of performance. While acknowledging the impact that specific tools can have on an artistic practice, it is the musical processes and outputs which remain the core focus of this work. In this light, the programming work necessary to design these new software tools remains a secondary concern, a means to an end.

The research question asks how the designing of a new performance practice based on the addition of custom digital signal processing software impacts on solo improvised woodwind practice. Through the practical development and use of new software, I examine how these new technologies can be integrated into solo woodwind performance practice. This research presents a new improvised music practice as well as a suite of new software tools and performance techniques. While this work necessarily draws on my own specific performance practice, the knowledge generated will have broad relevance in the field, indeed much will apply to non-woodwind instrumentalists and singers.

A scholarly 'emic' account of the process behind electronic augmentation for live performance within this specific field is timely as this is an expanding field with

[1] Theobald Boehm (1794-1881) is credited as the inventor of the modern flute, Boehm's fingering system was also adapted for saxophones and clarinets. See Theobald Boehm, Dayton C. Miller (trans.), *The Flute and Flute-Playing* (New York: Dover, 2011).

[2] The Maui xaphoon Bamboo Sax and Pocket Sax (http://xaphoon.com, accessed 29 January 2013).

new work being created regularly.[3] A critical understanding of the processes involved allows this researcher to design a new performance practice more effectively and efficiently.

Methodology

Rather than setting out a global methodological approach at the start, this dissertation responds to the multifaceted nature of the undertaking.[4] Each chapter starts with a discussion of the methods adopted appropriate to the task at hand. This research uses four dominant methodologies – performance, historical analysis, autoethnography, and musical analysis – each serving a distinct portion of the work.

Coupled with the commentary, drawing on over thirty research performances, is the aim to define a methodology through performance. Taking Christopher Frayling's three-part model of practice-led research as being either research *into* art, *through* art or *for* art, this inquiry situates its research *through* practice, in the main.[5] As a researcher/practitioner who maintains a professional performing career, I consider performance as a site of embodied knowledge and of ongoing learning. Practice-led research is a transfer (and further understanding) of this approach into an academic setting.

> The professional disciplines of art, design and architecture have many differences but all share a tradition of situating learning and scholarship in a professional practice setting. 'Practice-led research' can be thought of as a natural extension of

[3] American linguistic anthropologist Kenneth Pike (1954) coined the terms 'emic' and its counterpart 'etic.' Emic (from the term *phonemic*) signifies a viewpoint from inside the cultural framework referred to. See Gary Ferraro and Susan Andreatta, *Cultural Anthropology: An Applied Perspective* (Stamford: Cengage, 2009), 17. The New York City Electroacoustic Music Festival, San Francisco Electronic Music Festival and SONAR: International Festival of Advanced Music and New Media Art are among the leading electronic music festivals who also programme live instrumentation meets electronica.

[4] "As a result of this reflexive process, methodologies in artistic research are *necessarily* emergent and subject to repeated adjustments, rather than remaining fixed throughout the process of enquiry." Estelle Barrett in *Practice as Research: Approaches to Creative Arts Enquiry*, Estelle Barrett and Barbara Bolt (eds.), (London: I.B. Tauris, 2010), 6.

[5] Christopher Frayling, 'Research in Art and Design,' *Royal College of Art Research Papers* 1/1 (1993/1994): 1-5.

> this principle since many academics in these fields see practice as the natural arena for inquiry and the methods of practice as methods of inquiry.[6]

The tacit knowledge of an improvising instrumentalist will always be fundamentally bound up in performance. Bruce Archer writes:

> There are circumstances where the best or only way to shed light on a proposition, a principle, a material, a process or a function is to attempt to construct something, or to enact something, calculated to explore, embody or test it.[7]

The rationale for using performance as a tool for developing new knowledge is an extension of my previous study and knowledge gained through practice. The ongoing debate surrounding practice-led methodologies still causes obstacles for the practitioner/researcher and, in particular, for those researchers working in music. Much of the literature pertinent to this field is biased towards visual arts, design and architecture. Artists in general are obliged to borrow and adapt working models from unrelated disciplines including science and social sciences with varying degrees of compatibility.

Throughout this dissertation I will use Carole Gray's definition of practice-led research translating Gray's background in the visual tradition to the musical performing arts:

> By 'practice-led' I mean, firstly, research which is initiated in practice, where questions, problems, challenges are identified and formed by the needs of practice and practitioners; and secondly, that the research strategy is carried out through practice, using predominantly methodologies and specific methods familiar to us as practitioners in the visual arts.[8]

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[6] Chris Rust, Judith Mottram and Jeremy Till, *AHRC Research Review: Practice-Led Research in Art, Design and Architecture* (Sheffield, 2007). (http://arts.brighton.ac.uk/__data/assets/pdf_file/0018/43065/Practice-Led_Review_Nov07.pdf, accessed 12 May 2011).

[7] Bruce Archer, 'The Nature of Research,' *Co-design, Interdisciplinary Journal of Design* (January 1995): 6-13.

[8] Carole Gray, 'Inquiry through Practice: Developing Appropriate Research Strategies,' in *No Guru, No Method: Discussion on Art & Design Research*, Pia Strandman (ed.), (Helsinki: University of Art & Design, UIAH, 1998), 82-95 (88).

The practice component allows me to develop the most efficient techniques to extend the parameters of the acoustic instrument to be useful in solo improvised music. The research includes

i) New software programming, designed to develop an interactive situation between performer and computer. This element culminates in the development of a software 'instrument' which can be manipulated by the performer in real time.

ii) Designing a workflow/method for controlling parameters in a performance situation (midi controllers, OSC, and how to program Max/MSP to deal with these most effectively).

iii) A series of solo improvised concerts, each looking, systematically, to work with issues raised through the research.

These activities unfold co-dependently over the four year period, with each strand informing the overall process. The written element of this research serves to situate the practice within a specific field, to provide background and insight into my performance practice and to illuminate and comment upon the musical outputs.

Chapter One relies on an historical analysis to contextualise the author's practice within two distinct yet interwoven cultural practices: jazz improvisation and live electronics in performance. The research is broadly situated within the context of jazz improvisation and, more specifically, is allied to particular practices within subgenres of the field. Concurrent to the history of jazz becoming an appropriated musical form outside of North America in the 1970s is the evolution of electroacoustic music, the emergence of live electronics as a musical performance practice and the new contemporary uses of digital processes in today's improvised music. Chapter One asks whether there is a new approach to music making as a result of new technologies employed.

Chapter Two uses an autoethnographic method to closely examine the practice of the author, who has trained as a jazz musician yet who works across the fields of improvised music, folk and contemporary classical music. An overview of

the practice's aesthetic concerns, historical evolution and technical concerns is included.

Chapter Three discusses the development and designing of the electronic processes used in the new performance practice. The use of technological tools is unpicked here, as are the visual, gestural, ergonomic and performative practicalities. The question of interactive computer music is examined here as a means to create a viable improvisation system.

Chapter Four seeks to codify a suitable form of musicological analysis which serves an improvised music which strays outside of traditional rhythmic, harmonic and tempered systems. A brief overview of the limitations of traditional notation and analysis to illuminate improvised, non score-based, electronically augmented performance leads on to the consideration of some recent innovations in the field. The analysis of electroacoustic music provides a framework for discussing the audio recordings of the performances.

The final chapter, Chapter Five, presents a commentary on the performances. Grouped thematically according to texture, time, movement, pitch and space, these headings are used to leverage a discussion salient to the intention behind the music's creation. Short audio extracts are used to illuminate specific concerns with longer performance documentation serving to fully communicate the outcomes of the new practice.

Chapter One: New Tools in Improvised Music Performance.

Introduction

> "A lot of people ask me where music is going today […] Music is always changing. It changes because of the times and the technology that's available, the material that things are made of […] Musicians pick up sounds and incorporate that into their playing, so the music that they make will be different." – Miles Davis.[9]

This research starts by looking at the nature of the use of electronic technology in artistic practice. More specifically, Chapter One concerns itself with the emerging field of musicians working in improvised music using electronic and computer technology in real time situations. I present the argument that this new field is producing music, which could not exist without the addition of new digital tools and that digital technology plays a powerful role in shaping a new approach to creating music.

This chapter asks if there is a new approach to music making as a result of new technologies, how does it differ? What are the salient differences in terms of

a) the means of production,

b) a changing sense of aesthetics and

c) the influence on performance practice?

There is an understanding, in the field of computer music (and digital technology applications more generally), that we are still in the embryonic stage of development.[10] This, of course, engenders a sense of the unknown, of excitement

[9] Miles Davis, *Miles: The Autobiography* (London: Picador, 1990), 393.

[10] Nick Collins, *Introduction to Computer Music* (Chichester: John Wiley and Sons Ltd, 2010), 36.

and exploration in this new musical pursuit. Yet another persistent pattern is the fascination and fetishisation of technology as an end in itself – this will be sidestepped throughout this dissertation with the emphasis firmly on applicable uses of new technologies and the resulting musical outcome.[11]

It is the nature of the new to attract a wide cross-section of practitioners working in many diverse fields. This chapter will necessarily narrow its focus on instrumentalists working in improvised music who use digital technologies as an extension of an existing instrumental practice and whose use of these tools radically reshapes their creative work. The tendency toward experimentalism, genre stretching and on-going exploration is not, I will argue, a matter of coincidence among improvising musicians working with these new processing tools.

Musicians and composers working with new electronic and digital processes are faced with a discrete set of challenges in addition to the usual traditional concerns of musical organisation. The traditionally specialised role of *musician,* removed from the understanding of how his/her tools work, is at a distinct disadvantage.

> Early practitioners of electronic music usually had to compensate not only for primitive equipment but for a nearly complete lack of knowledge of the physical and psychological characteristics of musical sound, as well as a nearly complete ignorance of electronics. This is not to imply that these pioneers were anything other than intelligent, dedicated and creative – only that comparatively little was known at the time about the psycho-physics of musical sound – particularly in relation to electronic devices – and the little that was known was not known by most musicians. When suddenly confronted with the capability to design musical sounds from scratch, musicians suddenly need to know a great deal more about sound, hearing and electronics than most music training provides.[12]

[11] A secondary reason to omit extensive technical detail is the rapid progress of this vibrant field. "The cutting edge becomes blunt history, and does so very quickly. It is a sombre lesson in both biological and ideological mortality, that our diligent work today may barely raise eyebrows in the not-so-distant future." Sam Hamm, 'Computers and Live Performance: Interactive, or Interference?' (http://samhamm.com/papers.html, accessed 8 August 2013).

[12] F. Richard Moore, 'A Technological Approach to Music' in *Companion to Contemporary Musical Thought: Volume 1*, John Paytner, Tim Howell, Richard Orton and Peter Seymour (eds.), (London: Routledge, 1992), 332.

Fifty years after the initial forays into electroacoustic music, today's exploratory musicians are often adept in the disciplines of acoustics, psychoacoustics, software programming, sound synthesis or music production depending on their area of interest.[13]

Shaping Technology

> "Technology precedes artistic invention (as much as we artists would like to think it's the other way around!). First came the electric guitar and *then* came rock and roll." – John Adams.[14]

The binary choice underlying John Adams's assertion above as to which comes first, new technology or artistic invention, does not accommodate the co-dependent nature of the relationship between these two forces.[15] 'Correlation does not imply causation' is an apt truism here, identifying a circular relationship between advances in engineering and the adoption of new technologies by artists.

> The concert grand piano as we know it today really depended on the state of iron-casting technology. Prior to the pianos of the mid-19th century, frames were wooden, so the pianos could only be put under a certain amount of tension and therefore could never really be that loud. The first iron-framed pianos were called pianofortes: the important part of that word is "forte". The pianoforte could be used against a full orchestra and still be heard. That led directly to new forms of music which would not have been conceivable before. So it's that kind of process that is going on all the time in music. Music always co-opts whatever is the state-of-the-art technology at any given time, so it's quite consistent that in the Forties and Fifties, people started looking at electronics.[16]

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[13] I will use Keane's definition of electroacoustic music throughout this work as "a form of musical invention that exploits the potentials of electronic circuits and transducers to create and/or modify sound." David Keane, 'At the Threshold of an Aesthetic', in *The Language of Electroacoustic Music,* Simon Emmerson (ed.), (London: Macmillan Press, 1986), 115.

[14] John Adams quoted in Christoph Cox and Daniel Warner (eds.), *Audio Culture: Readings in Modern Music* (London: Continuum, 2004), 111.

[15] This is analogous to the chicken and egg problem, where the cause and effect model doesn't represent the complex, self-evolving relationships at play.

[16] Brian Eno, 'On bizarre instruments' (www.telegraph.co.uk/culture/music/rockandpopfeatures/8825418/Brian-Eno-on-bizarre-instruments.html, 31 October 2012).

This points to a fluid and evolving relationship between musicians and the technologies which they employ to create their work. At times, their output is dependent on the available tools and at other times they are instrumental in driving forward change and development of these same tools. This is a complex transaction where "we shape our tools, and afterwards our tools shape us."[17]

By the turn of the twentieth century, a handful of instrument makers began experimenting with the use of electronics in instrument design.[18] The combination of traditional instrument design and the new electronic technologies was refined throughout the twentieth century resulting in new instruments such as ondes Martenot, the Theremin, the Hammond organ, the electric guitar and the synthesiser. These developments were adopted by generations of musicians who creatively used these new technologies to rework and expand existing aesthetic sensibilities. Musician David Byrne conveys the importance of these new electrified instruments:

> I first heard "Purple Haze" over a transistor radio when I was a kid, and I remember telling my dad that something new had happened. I excitedly explained to him that electronic music (the weird sounds of Stockhausen and Xenakis that I was vaguely aware of, to say nothing of the theremin) was, via the amplified guitar in Hendrix's hands, now being melded and shaped by an acoustic instrument. The sounds Hendrix (and others I didn't yet know about) were getting were nothing like what an acoustic instrument sounded like. That unwritten law of staying true to the sound of a traditional instrument had been violently broken, and the amplifier and signal-processing devices (pedals mostly) had become an integral part of the sound of the instrument. As with Theremin and his instrument, the electric guitars were breaking free of history. Their available range of sounds wasn't constrained by any specific cultural trajectory.[19]

[17] Marshall McLuhan, *Understanding Media: The Extensions of Man* (London: Routledge, 2001), xxi.

[18] Thaddeus Cahill's Telharmonium is credited as one of the very first musical applications of the advances in electronics. Cahill built three versions of his electromechanical keyboard instrument between 1892 and 1914, which broadcast live performances of Bach and Chopin along telephone wires. For a complete history see Reynold Weidenar, *Magic Music from the Telharmonium* (Lanham: Scarecrow Press, 1995).

[19] David Byrne, *How Music Works* (Edinburgh: Cannongate, 2012), 104.

These inventions opened up new expressive possibilities in utilising powerful advances in electrical engineering for musical means. With the exception of the Theremin and the ondes Martenot, these new instruments used the same user interface (most often the keyboard) as traditional instruments and were designed to draw on existing skills of performers. While these instruments did offer a new or extended sonic palette, they ultimately "did nothing to change the nature of musical composition or performance."[20]

The advent of tape recording technology at the end of the 1940s signalled one of the most fundamental changes in music practice of the twentieth century.[21] The irreversible shifts in music consumption, composition and performance following the developments of the recording and playback of music are well documented, but the use of tape technologies also heralded a very new relationship between technology and musicians.[22] These technologies found initial meaningful expression in post-war Europe of 1948 through the work of the profoundly influential Pierre Schaeffer. Schaeffer's contribution is significant, not in terms of simply reproducing compositions through the new medium of tape, but rather Schaeffer's self-titled *musique concrète* saw the creative potential of a new medium and used the technology to alter sounds in entirely new ways.[23]

In this context, this initial step in the evolution of tape music points to a more seismic departure from the conventional modes of music production. The advent of tape recording and editing technologies represented a radical change

[20] Nicolas Collins, 'Live Electronic Music,' in *The Cambridge Companion to Electronic Music,* Nicholas Collins and Julio d'Escriván (eds.), (Cambridge: Cambridge University Press, 2007), 39.

[21] "Sound recording on tape coated with powdered magnetized material was developed in the 1930s in Germany, but did not reach the rest of the world until after World War II. The German Magnetophon tape recorders were a great advance over previous wire and steel band recorders, which required soldering or welding to make a splice." Curtis Roads, *The Computer Music Tutorial* (Cambridge: MIT Press, 1996), 7.

[22] These are explored further by Katz in Mark Katz, *Capturing Sound: How Technology Has Changed Music* (Berkeley: University of California Press, 2005).

[23] Richard Taruskin, *The Oxford History of Western Music: Music in the Late Twentieth Century* (Oxford: Oxford University Press, 2009), 188.

which, in contrast to the inventions of new electrical musical instruments, "*did* represent a fundamental rupture with older modes of composition."[24]

The development of tape as a compositional tool proved to be an expensive and time consuming endeavour, open to those only with access to one of the studios equipped with the state-of-the-art machines. The compositional act itself now became enmeshed in technology in a new way, requiring the composer's skill set to include mastery of this emergent technology. Early tape music pioneers faced many frustrations with these working conditions:

> [Stockhausen] edited without being able to listen to the result, calculating the length of his leader insertions down to the millimeter. This was done on two separate reels of tape. Back in the studio, he synchronized the start of the tapes and played them back so that he could mix the result onto a third tape to create the final mix. The result was not what he had expected. As he listened to the juxtaposed tracks, Stockhausen became "increasingly pale and helpless. I had imagined something completely different! On the following day, the sorcery despairingly continued. I changed my series, chose other sequences, cut other lengths, spliced different progressions, and hoped afresh for a miracle in sound."[25]

The extremely time-intensive nature of this activity necessarily ruled it out as a tool of interest to improvising musicians. Tape did, however, become widely used as a fixed medium with the development of compositions for tape and musicians: Edgard Varèse premiered a new work *Déserts* for chamber ensemble and tape sounds in 1954, composing the tape part in Schaeffer's Paris studio. The same year also saw premières of new pieces for orchestra and tape by collaborators Otto Luening and Vladimir Ussachevsky such as *A Poem in Cycles and Bells* and *Rhapsodic Variations*.[26]

Compositional activity involving tape technology and the emerging field of electroacoustic music garnered official recognition, funding and development

[24] Collins, 'Live Electronic Music,' 39. My emphasis.

[25] Thom Holmes, Electronic and experimental music: technology, music, and culture, (London: Routledge, 2008), 62.

[26] Nicole V. Gagne, *Historical Dictionary of Modern and Contemporary Classical Music* (Lanham: Scarecrow Press, 2011), 162.

through the creation of several key education and research centres such as The Columbia-Princeton Electronic Music Center, San Francisco Tape Music Center, Institut de Recherche et Coordination Acoustique/Musique (IRCAM) and later, The Studio for Electro-Instrumental Music (STEIM). These institutions ensured the survival and establishment of electroacoustic music and its musicians.[27]

The 1960s saw the conception of tape as a fixed, time-intensive medium change through the pioneering work of California-based composers Pauline Oliveros and Terry Riley. Riley's innovation was in his use of tape loops, essentially a circular closed circuit piece of magnetic tape. In 1963, an uncredited engineer created Riley's Time Lag Accumulator:

> He got it by stringing the tape between two tape recorders and feeding the signal from the second machine back to the first to recycle along with the new incoming signals. By varying the intensity of the feedback you could form the sound either into a single image without any delay or increase the intensity until it became a dense chaotic kind of sound […] This engineer was the first to create this technique that I know of. This began my obsession with time-lag accumulation feed-back.[28]

The significance of this innovation stretched beyond the immediate musical phenomena of long delay lines which slowly morphed over time, but rather, that the medium of tape itself "was reinvented as a performance instrument."[29] In working with tape delay, both Riley and accordionist Pauline Oliveros created music far removed from either the angular avant-garde or the nascent rock music of the time. The process of recording and re-recording in a circular fashion dictated many parameters of the music leading to a situation where the technology heavily shaped both the outcome of the work as well as the artist's working practice.[30] Riley

[27] See David W. Bernstein, *The San Francisco Tape Music Center: 1960s Counterculture and the Avant-Garde* (Berkeley: University of California Press, 2008).

[28] Riley quoted in Thom Holmes, *Electronic and Experimental Music: Technology, Music, and Culture* (London: Routledge, 2008), 132.

[29] Collins, 'Live Electronic Music,' 45.

[30] Terry Riley, *A Rainbow In Curved Air,* vinyl long player Columbia Masterworks MS 7315, 1969.

himself, in a revealing statement, asserted that "tape was always part of the process and structure of the music."[31]

David Behrman, the composer and performer who produced Riley's recording *A Rainbow In Curved Air,* is an important figure in the then emerging discipline of live electronics. Behrman's early work with simple homemade electronics, in an era where access to mainframe computers and studio technology was the preserve of select radio studios and university research centres, presaged much of the musical applications of the technological revolution of the 1980s. His seminal piece *Wave Train* (1966) is an important work in terms of blending new technologies with established instrumentation in new ways which, crucially, worked in real-time performance.

> Wave Train linked an old thing – the resonant characteristics of a grand piano – and a new thing, feedback. The score consisted of a description, with diagrams, of how to set up and do the piece. In performance one places guitar microphones at various locations on a piano's strings, then slowly raises the gain on the microphones' amplification systems until feedback growls forth and excites the strings […] By modulating gain controls and repositioning the microphones in intervals when the gain is off one tries to shape the raw feedback force into large, resonant, overlapping waves.[32]

Behrman, along with fellow composers Alvin Lucier, Robert Ashley and Gordon Mumma, formed the Sonic Arts Union in 1966. This small cell of experimental American composers dedicated itself to the performance of new compositions which used live electronics. These electronics were often built by the composers themselves for specific compositions. This employment of specific homemade technology redefined the nature of the compositional process and many of these compositions were open-ended and relied heavily on the improvisational skills of the performer combining with the inherent properties of the tools created for the specific performance.

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[31] M. Prendergast, *The Ambient Century: From Mahler to Trance - The Evolution of Sound in the Electronic Age* (London: Bloomsbury Publishing, 2000), 102.

[32] David Behrman, sleeve notes for *Wave Train (music from 1959 to 1968),* vinyl long player Alga Marghen 5NMN.020, 1988.

> David Behrman and Gordon Mumma, implicitly advanced the radical idea of a musical composition that could exist purely and entirely in hardware. In this period, scores by the two composers, where they existed at all, often consisted only of a circuit diagram, accompanied by a set of sketchy instructions.[33]

The Sonic Arts Union's existence spanned the decade between 1966 and 1976, a period which witnessed a marked increase in the use of live electronics in performance across both the USA and Europe. Within this dynamic new area of performance practice, the Sonic Arts Union produced many innovative compositions such as Behrman's *Cello With Melody Driven Electronics* (1975) which,

> was a harbinger of the interactive computer music of the next decade. For the cellist and audience alike it was utterly unexpected to hear electronic sounds react so directly to acoustic ones in an era when a fixed tape was the default method for adding electronics to a solo instrumental composition.[34]

The Studio

The originally intended function of studio technology (which also migrated from tape to digital technologies) for recording and reproducing musical performance remains an important means of dissemination for improvising musicians. Yet even this role as a tool of music reproduction, became enlarged as new techniques bestowed an unforeseen creative role to studio engineers and producers.

The rapid establishment of home record players in the 1950s meant that commercial pop music was put in a position in which it could engage with the emerging studio technologies of the time. The concept of using the music studio as a compositional tool, through the use of creative editing and post-production effects, was introduced in the early development of rock and roll music. Popular guitarist Les Paul devised new means of overdubbing, releasing records such as *Lover* in 1948 which layered eight simultaneous electric guitar parts creating a

[33] George E. Lewis, 'Live Algorithms and The Future of Music,' *Cyberinfrastructure Technology Watch* May 2007. (http://www.ctwatch.org/quarterly/print.php%3Fp=74.html, accessed 30 December 2011).

[34] Collins, 'Live Electronic Music,' 42.

soundworld impossible to achieve (or, arguably, to conceive of) without the available technology of the time.[35]

Brian Eno, the English producer, composer and musician, points to Elvis Presley's unusual slapback echo effect on the vocals in *Heartbreak Hotel* as "the first synthetic use of the studio" and proposes that, by the late 1960s, the producer "becomes a re-composer of the piece." [36] The 1960s saw high level studio production values continuing to move into popular music recordings as much of the drive of the music technology sector came from the pop and rock markets which remains the case today.[37] Influential rock performers like Jimi Hendrix, Pink Floyd and The Beatles used both electric instrumentation and live processing on stage, while their studio releases used sophisticated editing techniques, expanding the concept of the recorded artefact.

In the field of improvised music, the jazz mainstream continued to use recording strictly as a means to represent actual performance throughout the 1950s and 60s. In fact, the advent and consuming popularity of rock music in the 1960s was seen by many jazz commentators as a threat to the continuation of jazz as a viable art form, an opinion which arguably retarded the jazz community's adaptation of new studio techniques. This viewpoint contained the tacit implication that jazz was an acoustic improvised music and that tampering with the musicians' work was anathema to the core values which constitute jazz.

Although at odds with the by-then solidified jazz aesthetic, Miles Davis's release of the long player *Bitches Brew* in 1970, brought about a new public awareness of the integration of new technologies with experimental jazz music. Although Davis, and others, had released earlier electric experiments, *Bitches Brew*

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[35] Albin Zak, *I Don't Sound Like Nobody: Remaking Music in 1950s America* (Ann Arbor: The University of Michigan Press, 2010), 67. Les Paul, *The New Sound,* vinyl long player Capitol Records T-226, 1955.

[36] Brian Eno interviewed by Charles Amirkhanian on KPFA's Ode to Gravity, 1980. (www.archive.org/details/BrianEno, accessed 26 January 2011).

[37] Peter Tschmuck, *Creativity and Innovation in the Music Industry* (New York: Springer-Verlag, 2006), 209.

became an iconic and controversial release, selling over half a million units.[38] While the use of signal processing was sparse (predominantly some echo effects on the trumpet), the use of electric instruments, including Fender Rhodes Piano and John McLaughlin's electric guitar, saw the sounds of 1960s rock music being introduced into an improvised setting.

However, the more subtle post-production techniques are what, ultimately, prove to be the innovative legacy of this work. Producer Teo Macero, heavily influenced by Schaeffer's *musique concrète* work, made liberal editing decisions far beyond the accepted norms of jazz production values, which up to that point held as sacrosanct the notions of authenticity and accurate portrayal of the performance.[39] Macero used tape loops and editing techniques, which transformed the recorded performance into a product of the studio. Speaking of his previous collaboration with Davis for *In A Silent Way,* Macero states: "There must have been hundreds of edits, if you listen to it very carefully you will hear the repeats. It was very creative for me because I had *carte blanche* to do whatever I wanted to do with Miles's tapes."[40]

The Digital Revolution

As the electronic technologies became integrated into performance practice in a number of contemporary genres throughout the 1960s and 1970s, the advent of integrated circuit boards and the rise of microprocessors initiated radical changes in music production both on the stage and in the studio. Behrman asserts that, by 1977, the availability of the relatively cheap and vastly more powerful micro-

[38] Eddie Harris's 1968 release *The Electrifying Eddie Harris* is an important document in the saxophonist's oeuvre. This recording features his use of the short-lived Selmer Varitone Saxophone, an internally amplified instrument with basic tone controls and sub-octave pitch shift designed in 1965. Miles Davis's releases *Filles de Kilimanjaro* (1969) and *In a Silent Way* (1969) both make use of electric instruments and advanced use of studio post-production technology.

[39] For an in-depth analysis of Macero's production work with Davis in this period see Jeremy Allen Smith, 'Sound, Meditation and Meaning in Miles Davis's *A Tribute to Jack Johnson'* (Ph.D. diss., Duke University, 2008).

[40] In interview with Olana Digirolamo for *Play That, Teo* Film Documentary. www.playthatteo.com

computers re-invented live electronic performance practice.[41] However, the concept of customising tools for particular compositions and the DIY approach of pioneers such as Behrman was side-lined by the rushing advances of the digital revolution in the 1980s. When digital technologies were married to the emerging electronic music field, the landscape of computer music was fundamentally altered with lasting implications. This evolution brought many of the developments in computer music since the 1950s into the realm of consumer electronics and software. The working limitations and financial demands of earlier tape technologies were overcome through their emulation in digital environments, which proved extremely labour-saving and more cost effective.[42]

The work of pre-digital electro-acoustic improviser/composer/performers such as AMM, David Behrman, Terry Riley and David Tudor provided a wealth of influential music and approaches to music making for the subsequent digital generations of musicians to draw upon. Where this initial generation of pioneers laboured with circuit boards and soldering irons, today's electronic musicians are more likely to engage with commercial software programmes running on laptop computers tailored for digital music production. Perhaps in response to these earlier experimentalists, many contemporary musicians working with digital means favour open-ended software languages, which are non-prescriptive in terms of style or sound sources, offering the composer a *tabula rasa* of sorts, upon which to work.

Aesthetics of Change

The aesthetic viewpoint of improvising musicians who engage with electronic technology is inextricably bound up in the tools they employ. An often overlooked

[41] David Behrman: Interview by Jason Gross (August 1997) (http://www.furious.com/perfect/behrman.html, accessed 12 September 2011).

[42] Since their introduction in the 1980s, digital audio technologies have attracted much controversy over audio quality of analogue versus digital systems. Audio engineer Glen Ballou writes "In spite of the rapid growth of digital technologies in audio, analog recording is by no means dead… Digital emulation *plug-ins* do not fully duplicate the original, regardless of what the marketing hype may tell you." G. M. Ballou, *Handbook for Sound Engineers* (Oxford: Elsevier Science & Technology, 2005), 903.

question, particularly in contemporary use of computers in music, as practitioners are today influenced by the legacy of fifty years of electronics in music is: are musicians choosing to use computers as a tool to realize their compositional intent or are they choosing to use the digital medium for its own set of aesthetic qualities? I suggest that the use of computers in music involves an inevitable combination of these two forces: a realisation of an aesthetic conception and a drawing on the rich legacy of electronic music which carries its own aesthetic vocabulary. The adoption of a particular tool carries with it a set of consequences, aesthetic and practical.

It will prove impossible to entirely divorce the influence of electronic music aesthetics from the tools of its creation. On one extreme, for a determined composer or performer, computer technology provides resources not commonly seen among human performers. But to suggest that a musician chooses a computer as a neutral tool with which to create music, without taking into account the aesthetic traditions of electroacoustic music, electronica, techno or *musique concrète* could occur only in specialized circumstances.

This claim differs from the notion that, simply put, a musician's soundworld is bound and contained by the instrument she chooses to use, i.e. a trombonist will produce sounds which are indicative of a trombone. Computer software technology offers the musician a limitless palette of colour, opening up "a musical exploration not previously possible."[43] Moreover, digital technology reframes how a musician approaches their material, offering many more options in terms of form, structure and dissemination.

This leads us to a situation where the specific technology used and its mode of employment clearly contribute to the aesthetic aims of the musician. This interaction between a piece of technology and the musician has resulted in countless fertile, serendipitous new musical enterprises. Vocalist Pamela Z provides one specific example:

[43] Denis Smalley, 'Spectro-morphology and Structuring Processes', in *The Language of Electroacoustic Music,* Simon Emmerson (ed.), (London: The Macmillan Press, 1986), 61.

> I had been trying to do more experimental work, and I somehow couldn't break through with the tools that I was using. I couldn't break through my old habits, and I couldn't find a new voice to do something different. When I started working with the delays, that was totally it for me. And delays have remained the mainstay of my gear, although now I'm doing it with Max/MSP.[44]

On the other hand, for musicians who use electronic tools to give expression to an identifiable, creative imagination, this has often meant crafting new tools specific to their practice, the composition at hand or a particular performance situation. Composer Laurie Spiegel is equally well recognised as both a software designer and a musician:

> Because much of what I have felt and seen in my mind and imagination is difficult to mash into conventional media, I have spent astronomical amounts of time on the design and creation of tools, mostly electronic and computer-based, to create what previously could not be made or to do so by methods not tried before. I love this work almost as much as the music itself. Each tool (instrument, medium, technique) is like a language, able to express some things inexpressible by others of its kind, and yet full of commonality with them.[45]

Both paths present the use of digital technology as a liberating force, delivering a previously unobtainable aesthetic result to the artist. The relative novelty of the field means that, as yet, very few musicians are schooled in the use of these new technologies leading to a vast array of homemade techniques and routes of navigating this technology. This tendency is further encouraged by the modular design of early synthesizers (Moog, Buchla and their software-based counterparts) which allowed for a huge range of combination and individualisation within the system. This lack of a dominant pedagogical model and an absence of a 'correct' technique, lead to a situation where experimentation, accidents and happenstance often played a defining role in aesthetic development.

> There were no rules for playing synthesizers, so nobody could tell me I couldn't play one. Nobody else could play one either. It was an instrument you made up

[44] Pamela Z quoted in Tara Rodgers, *Pink Noises: Women on Electronic Music and Sound* (London: Duke University Press, 2010), 217.

[45] Laurie Spiegel, 'Artists' Statements I,' in *The Language of Electroacoustic Music,* Simon Emmerson (ed.), (London: The Macmillan Press, 1986), 73.

> yourself […] its role was waiting to be invented. […] The VCS3 preceded, or maybe was even simultaneous with, the Moog. But what was interesting about it was that it wasn't really a keyboard instrument. There was a keyboard with it, but it was impossible to get it in tune, so most of the people who used it abandoned the keyboard. That was a big step, because prior to that synthesizers had been thought of as electronic organs with a few stranger sounds. Abandoning the keyboard took you into a new musical territory. I'm sure Peter Zinovieff, who invented the VCS3, would have been very pleased if he could have made a good keyboard. But the fact that he failed to was what made that instrument special, and what started the different forms of electronic music you hear everywhere now. It came out of an inadequacy of that particular instrument.[46]

The lack of a defining model allowed the early pioneers of electronic music technology to unveil their personal and disparate aesthetic concerns as well as allowing new accidental interactions to delineate their evolving work practices.

Performing Electronics

Bringing computers, electronic hardware and the associated equipment into the arena of live performance raises a raft of considerations. Fundamentally, we can ask how is performance affected by these new tools?

Despite the calls from the supporters of an acousmatic approach towards a purely sonic environment where "we should perceive and respond to the sounds – the music – through listening alone," the visual element in all music performance retains a central importance.[47] New digital tools have sometimes engendered a situation where the breakdown in visual communication between performer and audience can be clearly seen as the disembodiment of the power and causality of human gesture. Previous to the implementation of electronic technology, the audience could immediately connect a performer's gesture to the resultant sound. The vast array of sounds which can be triggered through digital technology with a

[46] Brian Eno, 15 Oct 2011 www.telegraph.co.uk/culture/music/rockandpopfeatures/8825418/Brian-Eno-on-bizarre-instruments.html

[47] Denis Smalley, 'Artists' Statements I,' in *The Language of Electroacoustic Music,* Simon Emmerson (ed.), (London: The Macmillan Press, 1986), 79.

computer mouse leaves us in a situation where "the age-old relationship between gesture and result became so blurred as to be often imperceptible."[48] In the case of musicians choosing to retain the use of 'traditional instruments' and using digital processing to augment the sonic field of the instrument, the problem can be much less acute. In fact, the mere presence of a recognisable musical instrument, regardless of the techniques used to perform with it, provides a connection point for an audience.

The synthesis of an acoustic instrument with digital technology might also represent a more rewarding format for improvised music. The acoustic improvised music tradition, from the performer's perspective, relies on detailed listening, rapid accommodation, appropriate response and a keen instrumental malleability. While advances are being made in computer interfaces which aim to replicate the immediacy of traditional musical instruments, it is much more common to find instrumentalists who have studied and mastered their chosen instrument than to find musicians who have readily accepted new interfaces, practiced for a number of years with these and display an analogous level of instrumental mastery. Musicians who have benefitted from a traditional instrumental training can arguably approach live electronics while drawing on this background as Kaffe Mathews explains

> One of the things I find is that a lot of people who play with electronics, they don't improvise. It can be very hard to improvise with electronics, because electronics are not nearly as much of an instrument as a traditional instrument can be. They're not as immediate. It's a different thing. In a way, I have an acoustic background to improvising, so I've come through all that, the way of improvising that acoustic instrumentalists have – which is about complete control of your instrument and being able to produce a particular sound from a particular gesture.[49]

Musicians, engineers and computer programmers have continuously sought out imaginative ways to harness the potential of digital technology in performance

[48] Andrew W. Schloss, 'Using Contemporary Technology in Live Performance: The Dilemma of the Performer,' in *Journal of New Music Research* 32/3 (2003): 239-242 (240).

[49] Kaffe Matthews quoted in Tara Rodgers, *Pink Noises: Women on Electronic Music and Sound,* (London: Duke University Press, 2010), 40.

situations since the availability of real-time digital audio in the 1980s.[50] The question of gesture is a recurring theme in this discourse. One avenue of exploration has been in the development of hyperinstruments: acoustic instruments which are fitted with electronic sensors and controls onto the body of the instrument.[51] The core concept here is to retain the acoustic instrument (with its acoustic properties as well as its traditional playing technique) and to build a sympathetic set of sensors which can measure proprioception, touch pressure or lip pressure and accelerometers.[52] Examples of such hyperinstruments include flutes, trumpets, guitars, pianos, saxophones and the hypercello.

> Enhanced human expressivity is the most important goal of any technological research in the arts. To achieve this, it is necessary to augment the sophistication of the particular tools available to the artist. These tools must transcend the traditional limits of amplifying human gestuality, and become stimulants and facilitators to the creative process itself.[53]

Musicians working with digital sound processing who are concerned with overcoming the problematic of gesture have frequently looked to attaching sensor technology directly onto the performer's body. Vocalist Pamela Z has worked extensively in this area using Max/MSP computer software to map body sensors onto a range of effects for live processing. Using loops, delays lines, movement and theatrics, Z has synergised live vocals and real-time processing in an engaging manner. Her use of customised software and computer controllers which serve to

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[50] See Hugh Davies, 'New Musical Instruments in the Computer Age', in *Companion to Contemporary Musical Thought: Volume 1*, John Paytner, Tim Howell, Richard Orton and Peter Seymour (eds.), (London: Routledge, 1992), 500-513.

[51] This term was coined by Tod Machover, these creations are also known as augmented instruments or hybrid instruments.

[52] Eduardo Reck Miranda and Marcelo M. Wanderley, *New Digital Musical Instruments: Control and Interaction Beyond the Keyboard* (Middleton: A-R Editions, 2006), 21.

[53] Tod Machover, Hyperinstruments: A Progress Report 1987-1991, (Boston: MIT Media Laboratory, 1992), 3. (http://opera.media.mit.edu/hyper_rprt.pdf, accessed 4 November, 2012). While the approach behind the hyperinstrument endevour is laudable and would, indeed, preserve the gestural integrity of the performance, the project initialised in 1987 has not yet achieved its ambition that these new hybrids will "become the musical instruments of the future." The specialised approach carried out at The Massachusetts Institute of Technology relies on a great deal of commercial interest before these hyperinstruments become an obtainable resource for the wider field.

communicate to, rather than alienate, an audience serve as a useful benchmark for this research.

> It's very important for me, in performance, that I'm not buried with my face in the computer. Because I'm performing physically and having some kind of a rapport with the audience and with the work. So I needed things that I can just reach out and feel the state that it's in.[54]

The practice of musicians working with live electronics was an important influence on my journey from jazz to improvised music to learning to work with new digital technologies.

[54] Pamela Z, Max Expo '74 Presentation. (http://cycling74.com/2009/09/30/pamela-zs-presentation-from-expo-74/, accessed 5 November, 2012).

Chapter Two: Autoethnography

Introduction

This chapter situates my work in the dual contexts of contemporary improvised music practice and live electronics practice, which have been more generally outlined in Chapter One. Relevant historical episodes of my practice are discussed in order to illuminate my current work and approaches. I endeavour here, through historical and self-reflective analysis, to describe and contextualise an aesthetic framework and an overview of compositional interests. This chapter uses an autoethnographic method to closely examine and provide a critical analysis of my performance practice. This is a practice which originated through formal training as a jazz musician yet which now operates across the fields of improvised music, folk and contemporary classical music.

The gradual growing independence of arts and humanities research from the model originally adopted from the hard sciences has, over the course of the last thirty years, led to a number of contentious research approaches. The notion of the neutral observer/researcher in relation to arts practice has lost traction within contemporary arts criticism circles. Ethnographer Arthur P. Bockner writes that in the academic world

> we are taught to master methods that exclude the capriciousness of immediate experience […] In the objective world, the goal is to speak nature's language without the intrusions of human subjectivity. In some quarters, this kind of world is the only rational world and the only world that can produce knowledge that makes a difference.[1]

Bochner goes on to chart the developments whereby

[1] Arthur P. Bochner, 'It's About Time: Narrative and the Divided Self,' *Qualitative Inquiry* 3/4 (1997): 418-438 (433).

> gradually, scholars across a wide spectrum of disciplines began to consider what social sciences would become if they were closer to literature than to physics, if they proffered stories rather than theories, and if they were self-consciously value-centred rather than pretending to be value free.[2]

Throughout this research I am drawing on experience I have accumulated as a practitioner in the field for over a dozen years. This research is undertaken with the importance of the subjective view firmly to the fore. However throughout these twelve years of practice, self-reflection, critical awareness and self-understanding have necessarily come in and out of daily focus. This autoethnography is an opportunity to reflect on past decisions and current beliefs – not simply in the sense of examining what these were and are but rather understanding where these beliefs were inherited from and what their implications are. In this regard the autoethnographic method becomes a tool of empowerment for constructive change.

> It is not self-indulgence and it is certainly not self-absorption; rather, it is about being accountable to the journey that has brought me to a critical moment […] In other words, I believe that tracing one's past is a key way to understand what you believe and how those beliefs were formed […] We tend to focus more in the academy on what we believe, considering less on how what we believe got to be that way.[3]

Routine accusations against this research method of biased data and self-indulgence fail to engage with the process of autoethnography as openly being an account of lived experience and a communication concerning tacit knowledge. This method provides a transparent and accurate portrayal of how the author understands his position within his discipline. Bochner argues that it is socialisation within the academy which is responsible for the division of personal and professional domains of experience in research writing: "So, we learn to hide our

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[2] Carolyn Ellis, Tony E. Adams and Arthur P. Bochner, 'Autoethnography: An Overview,' *Forum: Qualitative Social Research*, 12/10 (2010), (http://nbn-resolving.de/urn:nbn:de:0114-fqs1101108, accessed 18 November 2011).

[3] John T. Warren, 'Reflexive Teaching: Toward Critical Autoethnographic Practices of/in/on Pedagogy,' *Cultural Studies <=> Critical Methodologies* 11/139 (2011): 3.

personal self behind a veneer of academic and theoretical detachment, fostering the misconception that it has no influence, no place, no significance in our work."[4]

While this autoethnographic model is a useful approach in many research scenarios, I have adopted here an altered model in which the aligning of the personal experience to relevant research and progress in the field further contextualises the author's experiences. Anderson coins the term *analytical autoethnography* where the researcher is "committed to an analytic research agenda focused on improving theoretical understandings of broader social phenomena."[5] Analytical autoethnography seeks to embed the research within the literature in the field rather than *evocative* or *emotional autoethnography,* which uses a more indirect path to uncover the experiences of the writer.[6] In this chapter, the autoethnographic process is accompanied by an ongoing critical evaluation and referencing of the events described.

Examining a Practice: Moving Beyond Jazz

During my formative years my musical experiences were confined to classical piano lessons, popular radio music and recordings of rock and folk music from the 1960s and 70s.[7] As a teenager in Dublin, a continuing interest in music was expressed through teaching myself guitar and exploring basic harmony. When I first encountered jazz (through recordings of Miles Davis, John Coltrane, Cannonball Adderley and others) at the age of sixteen, I decided to learn saxophone at a local music school. My musical endeavours over the following six years focused on guitar

[4] Bochner, 'It's About Time,' 435.

[5] Leon Anderson, 'Analytic Autoethnography,' *Journal of Contemporary Ethnography* 35/4 (August 2006): 373-395 (375).

[6] Ellis and Bochner typify evocative autoethnography as "the mode of story-telling is akin to the novel or biography and thus fractures the boundaries that normally separate social science from literature […] the narrative text refuses to abstract and explain." Carolyn Ellis and Arthur P. Bochner, 'Autoethnography, Personal Narrative, Reflexivity,' in *Handbook of Qualitative Research*, Norman K. Denzin and Yvonna S. Lincoln (eds.), (Thousand Oaks: Sage, 2000): 733-768 (744).

[7] I was born in 1976.

and vocals with the saxophone acting as an additional colour in a folk-rock based aesthetic. Parallel to this activity was an expanding interest in (and compact disc collection of) work by American jazz saxophonists from the 1950s and 60s.

My subsequent fulltime studies in jazz music were modelled on a now standardised system of jazz education, which was developed in the USA during the 1970s.[8] This jazz doctrine, which is dominant in university jazz performance programmes throughout the world, has a clearly overt aesthetic agenda. Primary focus is placed on the developments of American jazz from the period between 1940 and 1960, with secondary attention, at best, paid to earlier swing styles and today's contemporary jazz practice or jazz music performed outside of North America. The stylistic concerns of figures such as Charlie Parker, Miles Davis, John Coltrane, Bill Evans, Sonny Rollins, Elvin Jones and Wynton Kelly are treated as an educational blueprint with which a student navigates his path through a jazz program. In effect, this process creates a canon of classic jazz with the recordings of selected artists becoming celebrated documents of the mainstream of the jazz tradition. This reiteration of a particular narrative removed from all social, geographical and political contexts has lead to a taming of the music, where by the 1990s,

> experimental free jazz styles – originally pioneered by in the late 1950s and 1960s by the likes of Ornette Coleman, Albert Ayler, John Coltrane in his final period, Cecil Taylor, and others – had become marginalized. Acoustic jazz had become the standard […] Somehow a remarkable reversal of values had taken place. Where once it had been possible to characterize jazz as a flight from the status quo, it could now be defined as a flight back to it.[9]

After an immersive number of years studying and performing jazz, it became clear to me that I was becoming frustrated with a set of sedimented aesthetic principles associated with mainstream jazz practice. My attentions, at first, moved

[8] Berklee College of Music, Boston first produced graduates in 1966 (baccalaureate degree in popular music) and has since continued to provide courses in jazz, rock, hip-hop and popular musics. (http://www.berklee.edu/about/history.html, accessed 19 June 2012).

[9] Stuart Nicholson, *Is Jazz Dead?: (or has it moved to a new address?)* (New York: Routledge, 2005), 3.

to musicians closely related to the acknowledged masters so that, to take an example, Lee Konitz become a much more important touchstone than his contemporary Charlie Parker, while the timbral sophistication of Joe Henderson spoke more to my aesthetic sensibilities than the 'sheets of sound' period of John Coltrane.

Ultimately, this educational emphasis on stylistic considerations seemed to sideline what I saw as the core message of jazz. An improvised music system doesn't necessarily benefit from a vocabulary or a prescriptive style and the insistence of defining a set of identifiable norms closes up the potential for actual improvisation and genuine expression. It wasn't until much later that I began to consider the over-arching importance of the *process* of music making as a social and expressive activity. My interpretation of jazz became a much wider topic than a style associated with any group of particular musicians. This line of thought dispenses with the problematic, circular arguments, which plague discussions of style and jazz:

> I feel that jazz is not so much a style as a process of making music. It's the process of making one minute's music in one minute's time. Whereas when you compose you can make one minute's music and take three months. And that's the one basic difference […] We tend to think of jazz as a stylistic medium, but we must remember that in an absolute sense, jazz is more of a certain creative process of spontaneity than a style.[10]

As a product of the quest to develop a personal instrumental voice I moved further and further away from the aesthetic of mainstream jazz, initially by composing and performing contemporary jazz, a field, which, by the late 1990s was heavily influenced by contemporary classical music.[11] Increasingly, I moved towards music (often clearly outside of the jazz tradition) which valued slower tempi, timbral

[10] Bill Evans, *The Universal Mind of Bill Evans*, digital versatile disc Rhapsody Films B0002475P2, 2005.

[11] New York's Downtown scene was a focal point for much of this activity with albums such as Greg Osby, *Symbols of Light (A Solution),* compact disc Blue Note 31395, 2001; Dave Douglas, *Convergence,* compact disc Soul Note 883366, 1999; Uri Caine, *Gustav Mahler Primal Light,* compact disc Winter & Winter 910 004-2, 1998 clearly reflecting a working absorption of contemporary classical language among jazz musicians.

detail and non-patterned improvisation. In my compositional and performance practice I endeavoured to reflect these broader influences and to perform with likeminded musicians. Producer and composer Brian Eno, writing of experimental music in the 1970s, quite accurately mirrors my own aesthetic tendencies twenty years later:

> A new mass audience was quietly starting to coalesce around a new way of listening. These were people who wanted something other than the old categories of rock, jazz and classical. They wanted a music of space, texture, and atmosphere – and they found it in film soundtracks, in environmental recordings, in slow movements, in meditative works from other cultures, and, happily, in some of the work of the 'experimental' composers.[12]

I took much inspiration from jazz musicians who had moved outside mainstream jazz aesthetics to develop practices, which favoured a slower harmonic language, an avoidance of the solo/accompaniment format and, crucially, sought to develop a highly personalised language towards composition and improvisation. Norwegian trumpeter Arve Henriksen, New Zealand saxophonist Hayden Chisholm, American saxophonist Peter Epstein, trumpeter Jon Hassell and pianists Christian Wallumrød and Benoit Delbecq are all important references in this regard. Much of the impetus of this aesthetic direction among the musicians mentioned here comes from an exploration of regional folk musics, free improvisation, electronic processing or a combination of these elements.

Folk Influences[13]

The globalised nature of the twenty-first century cultural landscape means that more musicians look beyond their local environments for musical inspiration. With

[12] Brian Eno, foreword to M. Nyman, *Experimental Music: Cage and Beyond* (Cambridge: Cambridge University Press, 1974), xii.

[13] Throughout this dissertation I will use the term 'folk music' to loosely denote a range of regional musical styles which have come to seen as in 'opposition' to art music. This construct is extremely problematic (and increasingly seen as out-dated) but falls outside of the remit of this research. See Matthew Gelbart, *The Invention of "Folk Music" and "Art Music"* (Cambridge: Cambridge University Press, 2007).

today's easy availability of a bewildering variety of recorded music, an increasing number of jazz musicians look towards indigenous folk music for inspiration.[14] This has been a pronounced feature of Scandinavian jazz practice since the 1950s, readily apparent in Scandinavian jazz musicians' acquisition of folk materials collected from Norway, Sweden and the Nordic countries.[15] Important releases from the 1970s onwards on the ECM record label brought about a wide recognition of a new European jazz model, fusing the vernacular of American jazz with the regional accents and sensibilities of Northern Europe. The interest in the harmonically and rhythmically simplified structures of regional folk musics can be seen as a direct reaction against the ever-growing complexity of modern jazz's dictum. The same can be said for the melodic line, where post-bebop angular, chromatic melodies have been supplanted by an unusual combination of diatonic, microtonal and non-pitched materials.

Archival folk recordings have been a rich source for contemporary European jazz musicians. Arve Henriksen's obvious debt to the Japanese shakuhachi tradition is a clear example of a jazz musician adopting the aesthetics and philosophies of an isolated and ancient music tradition:

> "An interest in sound-making was there from the beginning of my work with the trumpet. I have spent many hours on developing a warm sound, for instance, but not only that. In my opinion, the trumpet has vast potential for tone and sound variations that we still have not heard. At one point, I think it was in 1988, Nils Petter Molvær lent me a cassette of shakuhachi playing. Then things changed." Arve Henriksen began collecting recordings of Japanese music, with koto, biwa, shakuhachi and other instruments: "I let the music 'ring' and develop in my head. I was astonished by the sound of this flute..." The shakuhachi's roots in the tradition of Zen Buddhism fascinated the trumpeter, as did its "meditative and minimalistic

[14] There is an obvious precedent to this activity among twentieth-century composers such as Béla Bartók, Igor Stravinsky and Ralph Vaughan Williams who actively sought out and incorporated folk elements in their work.

[15] Swedish jazz musicians such as Rolf Billberg, Lars Gullins and Arne Domnérus worked within the American tradition, in particular the west coast 'cool school' and brought, what today is often referred to as, a particular 'Nordic sensibility' to their music which continues to influence jazz in these countries.

> expressive quality. This has made me work with tone and sound making in a new direction." [16]

New Zealand saxophonist Hayden Chisholm is another key influence on my own aesthetic conception. Chisholm's interest in Armenian duduk, Japanese shakuhachi and gamelan as well as quarter-tone saxophone technique is another example of a jazz musician who has drawn on various folk traditions to realise a deeply personal and expressive voice.[17] Chisholm's interest in pitch bends and microtonality developed into a systemised approach of working with the twenty-four-note quarter-tone scale, which he uses as a tool in both improvisation and composition. The quarter-tone scale greatly increases Chisholm's melodic potential, giving him access to a range of new scales, which hadn't previously been used in the jazz saxophone lexicon.[18] The mastery of quarter-tone harmony also suggests an aesthetic link to folk musics, which employ microtonality to colour melodic material. Chisholm points to the saxophone's relatively young history and resultant lack of a restrictive tradition, which absolves the musician from the need to adhere to rules or conventions, which might otherwise curtail a folk musician's means of creativity.

> In the shakuhachi tradition the use of microtonality, slurs, very modern techniques such as flutter tonguing is, of course, an integral sound of the actual instrument. It is sometimes difficult to separate an instrument from its tradition and shakuhachi is very closely connected to the ancient works that were written for it and continue to be performed on it, whereas the saxophone is, perhaps, more of a tabula rasa – something which you can write your own signature on. There are as many different saxophone sounds as there are players. The microtonal part of the saxophone is a

[16] Rune Grammofon album notes: Arve Henriksen *Sakuteiki,* compact disc Rune Grammofon RCD 2021, 2001. Shakuhachi is a traditional flute which has origins in medieval Japanese Zen practice. Shakuhachi music uses much microtonality and has very detailed embellishments.

[17] The duduk is a simple double-reed instrument without any keys. The traditional repertoire consists of slow instrumentals and songs often accompanied with a drone. Much of this music is improvised.

[18] Root 70, *Fahrvergnugen*, compact disc Intuition Records INT3397 2, 2006.

way for me to broaden the tonal possibilities of the instrument, not just the harmonic possibilities but actually the timbre and the nuance.[19]

Free Improvisation

My introduction to European Free Improvisation in the early 2000s opened many pathways into the fields of improvised, avant-garde and electro-acoustic musics along with the host of splinter groups, which may fall under the umbrella term contemporary improvised music.[20] Reassuringly, for a neophyte, many musicians working as free improvisers came from an orthodox jazz lineage. As a saxophonist, I was uncomfortable with the received notion that in a typical jazz performance, my role would be to play the melodic material (perhaps in unison with another instrument) and at some point to improvise a solo within the song structure and no further input would be necessary or welcomed. These roles of course are much less delineated in more contemporary trends in jazz and free improvisation, which is one of the reasons I was subsequently drawn to these more open forms.

Situating my work within the genre of free improvisation allowed me to give increasing attention to textural and dynamic variety within the music (an oft-levelled criticism is that these qualities are missing in the mainstream jazz aesthetic). However, my background also equipped me to work with propulsive rhythmic elements, odd-time signatures and chromatic improvisation. Sympathetic to both camps, I sought out musicians who either transcended or amalgamated this debate. Initially, I began to work in mixed groups of jazz musicians and free improvisers in order to create a symbiotic approach with these related and compatible musics. I began to compose for group situations where a personal vocabulary of jazz improvisation met the open structures of free improvisation and

[19] Author's interview 21 May 2009. Full transcript available from http://arrow.dit.ie/aaconmusdiss/1/

[20] The loose term European Free Improvisation refers to the work of improvising musicians including Derek Bailey, Evan Parker, Han Bennink, Axel Dörner, Misha Mengelberg and others.

attended to considerations of avant-garde and electroacoustic musics.[21] By 2002, in the spirit of expanding my aesthetic appetite, the work of established artists as well as my peers working in the realm of free improvisation encouraged me to introduce live audio processing to my work. This was the point where I introduced effect pedals and other electronics as an extension of my saxophone work.

Electrifying The Acoustic – Extending The Instrument

My use of alto and soprano saxophones, clarinet and bass clarinet points to a tendency toward a broad tonal palette.[22] I spent several years concentrating on working with extended woodwind techniques to acquire a working command of non-pitched material, microtonality, multiphonics, circular breathing and special effects to further widen the acoustic properties of my chosen instruments. In a continuation of that trajectory, the subsequent use of live signal processing serves to widen that palette in a manner well beyond the normal acoustic expectations of the instrument. To contextualise my work with audio technology, we need to first understand the development of my practice as a home studio engineer and producer.

My first meaningful encounters with audio processing were in the mid-1990s with a Tascam Portastudio 414.[23] The Tascam was an analogue four-track audiocassette tape recorder produced for the home consumer market.[24] Although this machine had no ostensible effects, it was possible to produce pitch-shifting and reversed playback. Almost simultaneous to this was the purchase of my first saxophone. My initial work with primitive home studio technology in the 1990s had

[21] A CD of my work in this field is available: Trihornophone, *Breathing Time,* compact disc Diatribe DIACD004, 2008.

[22] Earlier performance instrumentation included flutes, prepared piano and homemade woodwind instruments.

[23] I had experimented previously with crude multitracking using domestic cassette decks.

[24] A number of artists did use the Portastudio with the professional sphere, Bruce Springsteen providing one of the most celebrated examples with the Portastudio 144. See David Burke, *Heart of Darkness: Bruce Springsteen's Nebraska* (London: Cherry Red Books, 2011).

a number of immediate emancipatory results. As an individual musician, the ability to, in effect, carry out the roles of several musicians was very attractive. This concept translates to my practice today where in a live performance I can (as a monophonic instrumentalist) create rhythmic, contrapuntal and melodic parts simultaneously in real time.

By the early 2000s I was using a personal computer with an analogue-to-digital converter, which enabled me to record and process acoustic instruments in real time. This advancement in technology (although still relatively unstable and unpredictable) encouraged me to perform live with a bulky desktop computer processing a guitarist and myself on tenor saxophone. In part due to the restrictive logistics of this set up and also partly because I was concentrating on acoustic jazz music during this period I didn't continue to use live digital signal processing for a number of years. However, the desktop computer, and subsequently, when prices became more affordable, the laptop personal computer were important tools in my practice as a music producer to document my own and others' work.

The experience of working in a home studio provided me with a basic understanding in audio production and signal processing and eventually led me to performing live with electronic processes. Digital editing techniques, the progeny of Schaeffer's tape editing work, allowed me to configure recordings in ways far removed from their original acoustic performance, while this, in turn, informed musical decisions during performance. This spiral of influence was the start of my instrumental practice negotiating a new aesthetic sense derived from the orbit of electroacoustic music.

As I worked to develop an individual musical path, I began to use hardware effect units in performance. Initially in 2002, I began working with a phrase sampler which I used to create long delay lines, live reverse playback, octave displacement and as a looping device.[25] Along with Pauline Oliveros and Terry Riley's deep

[25] The Boomerang Phrase Sampler, which boasted 4 mega-bytes of computer memory, was an advanced machine in its category at the time.

fascination with tape delay, vocalist Pamela Z's enthusiasm for digital delay units resonates with my own work:

> In the early 1980s, there came to be what I consider to be my single most profound artistic change brought about by the acquisition of a new device: I bought my first digital delay unit. And, overnight, my whole way of working with, and listening to, sound changed. If I could pinpoint one single time in my life where I discovered my true voice as an artist, I would say that would be that time.[26]

Delay became a core electronic component of my developing live performance practice. While delay is *de rigueur* for electric guitarists working in pop and rock, usually the delay time is quite short and is used to provide a warmth or widening of the sound. I was interested in much longer delay times, sometimes up to twenty seconds long which allowed me to rapidly build layers of sound and could be repeated *ad infinitum* much like Riley's Time Lag Accumulator (of which I was ignorant at the time). The use of long asynchronous delay lines necessarily ruled out metrically accurate gestures and the music took on a blurry focus with long shapes taking some time to gradually decay, suiting perfectly the slower tempi I was using.

By 2007 my arsenal of effects was beginning to expand and by 2009 it included delays, reverbs, pitch-shifter, harmonizer, ring modulation, overdrive, a multi-effect processor, two volume pedals and a mixing desk. The use of overdrive and ring modulation to excite certain partials displayed a preoccupation with timbral detail, an influence from my exposure to free improvisation. Although these units are designed as foot pedals, acting as a simple on/off function with set parameters, I chose to manipulate the parameter settings on these pedals by hand on a table, giving me access to a complex range of control over many simultaneous processes.

The practicalities of working with so many potentiometers in a live situation while playing saxophone had obvious implications – a repeated unfavourable consequence would be playing one-handed saxophone while tweaking the live

[26] Pamela Z lecture (http://www.archive.org/search.php?query=collection%3Aatc-at-ucb-lecture-series&sort=-publicdate&page=1, accessed 11 November 2011).

electronics. Coupled with this issue was a logistical one of carrying these units, including the necessary wires and power supplies to and from each performance.

> People already playing with laptops showed me that I could do this [effect pedals and drum machines] setup in a laptop. And it was kind of a liberation from schlepping all the equipment. I realized, it's all sampling anyway, even if it's in the laptop. I'm using the same drum machine sounds, and using Max and MSP […] With the laptop you can do even more processing and manipulation.[27]

After working with the hardware effect units for a number of years as an electronic extension to my saxophone performance, I began to seek out a software solution, which would be ergonomically superior as well as musically more expansive and versatile. In 2010, in conjunction with this research, I decided to embark on creating a new set of software tools using the programming language Max/MSP.

Aesthetic Conceptions, A Personal Voice

My study of jazz, folk music, free improvisation and electronic processing has resulted in an overarching aesthetic viewpoint encapsulating these influences and expressing itself in a number of key ways, which I will explain in further detail here.

The debate of the development of an individual voice within a pre-existing musical genre brings a set of considerations into play: influence, imitation, an evolving tradition and experimentation. This coming to terms with a musician's place within a body of recorded music as well as within their immediate community of music makers, audiences and associated structures strikes me as an important component in the development of an artist.

As a developing jazz saxophonist I was strongly influenced by the sound – in the tone-production sense of the word – of a number of saxophonists: Sonny Rollins, Joe Henderson and Lee Konitz. This attention to the timbral detail of a

[27] Ikue Mori quoted in Tara Rodgers, *Pink Noises: Women on Electronic Music and Sound* (London: Duke University Press, 2010), 77.

player (particularly in the case of an instrument as malleable and 'personisable' as the saxophone) is actively encouraged in jazz pedagogy. Indeed, this practice has been in place since the earliest jazz music. "An idol's personal sound is commonly the precise object of imitation for learners. It is a clearly discernible, all-encompassing marker of an individual artist's identity."[28]

The significance of developing a personal sound then becomes a mantric quest for all jazz musicians. Embedded in this endevour is the process of initial imitation and then, after time, transcending the original 'sound' through the addition of one's own musical personality to create something new and identifiably one's own. Added to the studying and modelling of a sound the student jazz musician copies many salient features of the music through repeated study:

> As their level of sophistication advances, students grasp the multitude of attributes comprising each artist's "musical personality," from the most specific features of timbre and melody construction to the most general issues concerning musical texture and tune treatment. They learn, moreover, to interpret such matters within the changing stream of their music's historical conventions and come to value the processes by which individuals establish their own identities through interacting with peers and predecessors alike. "It helps your playing to have some tradition behind you," [Kenny] Washington states. "To understand Tony Williams, you ought to know 'Philly' Joe Jones and Sid Catlett. It's the same with drummers as with other instrumentalists. Unless you understand James P. Johnson and Fats Waller, you don't really understand Ahmad Jamal, or Bud Powell, or Herbie Hancock."[29]

In this regard, my path towards defining an aesthetic conception owes much to jazz instrumentalists and vocalists initially from the swing and be-bop eras and later to contemporary jazz musicians from America and Europe. In tandem with these early sonic conceptions of the instrument are the choice of instrument itself and the playing techniques adopted.

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[28] Paul A. Berliner, *Thinking In Jazz: The Infinite Art of Improvisation* (Chicago: The University of Chicago Press, 1994), 124.

[29] *Ibid.,* 124.

My initial studies began in earnest with the tenor saxophone. Many mouthpiece/reed/ligature set-ups were experimented with in these early years of study spent transcribing recorded solos of musicians such as Sonny Rollins, Dexter Gordon, Miles Davis and Charlie Parker. Before finishing formal jazz studies I also started practicing and performing on soprano saxophone – in equal measure influenced by Coltrane's soprano work and also driven by a search for a more ethereal sound than a typical full-bodied sound of the tenor instrument. Immediately after graduating, I switched to alto saxophone never returning to tenor saxophone since. I continued to work with the soprano instrument, and, some years later, I added bass clarinet and eventually, in 2010, the B flat clarinet.

The saxophone and the clarinet have, like many instruments, dual traditions – classical and jazz – in both education and performance. I was educated by jazz saxophonists (as this was the music I was interested in playing) and so my technique is clearly influenced by this upbringing. However, as part of the practical element of this doctoral research I have undertaken four years of tuition from a classical saxophonist/clarinettist.[30] This reflects my desire to continue to learn and develop my instrumental practice. Foremost among the technical differences between these two traditions is one of embouchure.

> The main difference between a jazz or rock player's embouchure and that of a classical player is the positioning of the lower lip; in classical playing it is more common for the lower lip to be slightly curled over the lower teeth providing the firmness necessary to control pitch and sound in that style, however in general, jazz and rock players turn the lip outwards […] The sound is broadened, allowing many more partials to appear in the tone; the reed vibrates more freely in the mouth, and more of the lower lip comes into contact with the rest of the reed, providing a different quality of damping. This creates a suitably more relaxed feel to the tone.[31]

This use of jazz embouchure allows for more plasticity in tuning, a darker tone, and

[30] I am indebted to Kevin Hanafin of DIT for his patience, expertise and flexibility as a teacher throughout this research.

[31] David Roach, 'Jazz and Rock Techniques,' in *The Cambridge Companion to the Saxophone*, Richard Ingham (ed.), (Melbourne: Cambridge University Press, 1998), 88.

the use of subtone – a particular breathy quality to the sound, made popular by jazz artists such as Lester Young. The conception of tone also takes vibrato, intonation, articulation and breathing into account. All of these elements point to a lengthy period spent consciously developing each of these facets as an instrumentalist in order to match an internal, evolving aesthetic concept to a realized manifestation of sound.

The Vocal in Instrumental Music

A recurring feature of music, throughout the world, is the central importance of the vocalist. Singing, for the obvious reasons of availability and its alignment with spoken language, is situated historically at the centre of human musical expression across all cultures. The voice's flexibility in terms of pitch control and individuality has been a source of inspiration for instrumentalists and instrument builders for thousands of years. To take an example, the Turkish classical music tradition values vocal music as the pinnacle of expression, and instrumentalists are judged "according to the degree in which they imitate or partake of the qualities of vocal music."[32] These qualities in particular refer to the subtleties of tuning as "the ability of the human voice to produce minute pitch differences or 'shades' in intonation is a sublimely expressive feature which Near Eastern instrumentalists strive to attain on most instruments."[33]

The expressive power of instrumental music which draws on vocal inflexions is perhaps allied to the emotional contours of spoken language. It is not an unreasonable conjecture to suggest that the semantic cadences of language attain a musical translation which is imbued with some of the original expressive resonances.

[32] Iannis Zannos, 'Intonation in Theory and Practise of Greek and Turkish Music,' in *Yearbook for Traditional Music* Vol. 22, Dieter Christensen (ed.), (Ljubljana: International Council for Traditional Music, 1990), 42-59 (43).

[33] *Ibid.,* 43.

> Take the meaning away from the utterance, and one thing you *may* still have (though not necessarily) is the utterance's emotional cast. I can, for example, sometimes tell by the tone of voice that someone has said something to me angrily or sadly, even though *what* he or she said may have been lost on the wind. And the musical equivalent of the emotional tone of voice is […] a prime mover in the recognition of what emotions music is expressive of. Thus the tendency of the ear to hear sound linguistically lends support to the claim that part of music's expressive quality is due to the analogy of musical sound to passionate human speech […] And the evidence bears this suggestion out in the twin observations that we can never say what pure instrumental music means (in the semantic sense of that word) but frequently can, within certain limits, say what it is expressive of.[34]

The simple idea that every person has a vocal quality, which is his, or hers alone, is something that I, in my practice, seek to transfer onto the instrument. In the jazz tradition, the saxophone's tendency towards fluid pitching is a quality which many musicians take full advantage of. Jazz woodwind and brass players, in an extension of American blues music, seek to recreate the nuance and emotional range of jazz and blues vocalists. Beyond microtonal nuance, jazz musicians have also used other vocal effects in this attempt to reach beyond the instrument to capture something of the voice.

Ornette Coleman is a jazz saxophonist who fully embraces the notion of playing with a vocalised approach. Drawing inspiration from the field hollers and early blues music of his native Texas, Coleman developed a microtonal aesthetic, "a fascinating and basically inimitable amalgam of blues and modal, atonal and microtonal music", which he uses as a tool in improvisation.[35]

> Coleman himself emphasized the importance of a vocal projection: "You can always reach into the human sound of a voice on your horn if you are actually hearing and trying to express the warmth of a human voice." The trick, he said, was playing in the right pitch [...] So acute is his ability to hear the continuity of alternative pitches that he stays in tune with himself even as he remains at odds

[34] Peter Kivy, *Music Alone: Philosophical Reflections on the Purely Musical Experience* (Ithaca: Cornell University Press, 1991), 9.

[35] Barry Kernfeld (ed.), *The New Grove Dictionary of Jazz, Volume 2* (New York: Macmillan, 1991), 479.

with conventional tuning.[36]

After studying the complexities of be-bop and practicing complex patterns (based on innovations in the work of Charlie Parker, John Coltrane and others) on the saxophone in my early career, I made a firm decision not to rely on the tool of saxophone technique and pre-learnt patterns to improvise. The improvising singer, operating from a much higher level of risk and a position of emotional connectedness fascinated me. A singer must rely solely on the ear rather than leaning on an instrumental aid. The old musicians' adage 'if you can't sing it, you can't play it' became an aesthetic line in the sand for my practice.

This research undertaking places me in the unusual situation where, despite using very sophisticated tools and technology, I am all the time endeavouring to play 'as a singer might.'[37] The effect of this is that the music becomes a reflection of my listening ability not a reflection of pre-learnt muscular pathways. This, in turn, translates audibly to less chromatic modulation, less complexity in melodic line and more detail given to microtonal tuning and embellishments.

Microtonality and the Melodic Line

The nature of my melodic interest has identifiably moved away from earlier tropes of jazz sensibility. Following a period of study into microtonality and alternative tuning systems, I began using more diatonic material, often using the naturally occurring harmonic series to perform in just intonation and to work in detail with microtonal embellishments in broadly diatonic pitch fields.[38] This melodic work

[36] Gary Giddins, *Visions of Jazz: The First Century* (New York and Oxford: Oxford University Press, 1998), 470.

[37] By contrast Sandeep Bhagwati points out that "whole schools of acousmatic and experimental music virtually seem to shun the singing voice altogether (except if hacked into granules and snippets, or otherwise disfigured into unrecognizability)" See Sandeep Bhagwati, 'Imagining the Other's Voice,' in *Vocal Music and Contemporary Identities: Unlimited Voices in East Asia and The West,* Christian Utz and Frederick Lau (eds.), 88.

[38] My initial interest in this field was piqued by the performance of quarter tone music on the saxophone using alternative fingerings, providing twenty-four keys of 'equal temperament.'

stems from a simplification of basic melodic material rather than a direct influence of a particular folk tradition, although many parallels to Irish instrumental music and, more specifically, sean-nós music can be drawn.[39] The Irish sean-nós tradition has a similar approach to microtonal inflexions, which imbue the singer's line with added expressivity:

> Microtonal changes in pitch are a normal part of a good traditional singer's technique and one finds in particular a tendency to slide up to an important note through an interval, which many be greater or less than a semitone. It is the author's experience that some of those who favor the [microtonal] slide have been influenced by traditional instrumentalists – particularly pipers.[40]

My study of microtonality and the questioning of the hegemony of twelve note equal temperament led to a stark re-evaluation of tuning issues and, in particular, my use of harmony. One of the arguments of eighteenth century music theorists in favour of equal temperament was the ability to modulate easily, equally and freely through all twelve keys.[41] Yet the compromises that this has engendered caused me to avoid complex harmonic processes in my music.

> Nothing can change the fact that the major third in ET [equal temperament] is a long way from acoustical purity. When notes are perfectly in tune, the sound of the interval they create is stable and tranquil. When notes are slightly out of tune, even the tiniest amount, there is interference between the vibrations of the harmonic overtones of the two notes and we hear a pulsation […]
>
> No matter how masterful they are as musicians, many performers today don't hear how bad the ET's major third is because it's what they are used to (conditioning) and because they've never heard an acoustically pure major third (ignorance). They're convinced that the ET major third must be the proper sound because it's what modern – and therefore obviously more enlightened – theorists have devised

[39] *Sean-nós* translates as old style. It is an ancient form of highly ornamented unaccompanied singing particular to certain regions in Ireland.

[40] Tomás Ó Canainn, *Traditional Music in Ireland* (London: Routledge, 1978), 74.

[41] Ross W. Duffin, *How Equal Temperament Ruined Harmony (and Why You Should Care)* (New York: W.W. Norton, 2007), 39.

> (delusion), and they wouldn't want to change because it would be too much trouble (convenience). Mostly, they don't want to think about it (oblivion).[42]

It would be disingenuous to suggest that my move towards a simpler harmonic language is solely the result of a consideration of the limitations of equal temperament. The influence of folk idioms is also clear in this case. The slowing of harmonic pace and melodic tempi allows the listener to investigate alternative tunings and microtonal embellishments. This is most clearly illustrated in drone music.

Immersive Music

The concept of the drone is an ancient one permeating musical cultures around the world from the Indian classical system where a tambura creates a hypnotic static field, counter-balancing virtuosic improvisations, to the Irish piping tradition where the drone is built into the instrument and serves as an accompaniment. The use of a sustained drone ensures a lack of real harmonic movement, which explains its absence in the canon of western art music which prized ever more complexity of modulation and chromaticism.[43]

This research employs a broad understanding of the drone concept which also includes "a constantly repeating phrase of one or more pitches."[44] This idea of using repetitive pitch patterns and non-pitched material as a textural drone is readily identified in José Maceda's analysis of Southeast Asian traditional music.

> The pulse and the timbre make up the drone. They are the markers of time, not the pitch. A melody instrument may accompany the drone ensemble, but its pitches move independently of the pitches of the drone instruments. This concept

[42] *Ibid.,* 30.

[43] Some composers have used harmonic movement *over* a constant drone creating a pedal point. This compositional technique is often employed in contemporary jazz: John Coltrane's *Naima* is the most celebrated archetype.

[44] José Maceda, 'A Concept of Time,' in *Arcana II: Musicians on Music*, John Zorn (ed.), (New York: Hips Road, 2007), 150-160 (152).

> of drone differs from drone in Indian music or ostinato in Western music, both of which are centred on pitch, rather than pulse or timbre.[45]

Maceda's suggestion of independent melodic movement, here exactly parallels my own use of melody and tuning concerns, where elements which are traditionally held as functions of harmony or rhythm act as textural elements.

> A bilateral relationship between drone and melody describes not only the music but also the thinking behind the music […] While time may be measured by pulse in a drone, it may also be represented by pitches in a melody, except that, where pulse or beats in a drone are repeated regularly, melodic pitch occurs in time irregularly, often avoiding the regularity of the pulse […] Furthermore, an elasticity of intervals between pitches creates nuances between these intervals comparable to a view of chromaticism in Western culture and music.[46]

The minimalist movement, centred around the work of Steve Reich, La Monte Young, Terry Riley and others, brought music using extreme repetition, loops and drones into the framework of art music.[47] While the influence of repetitive and drone based folk music is well documented on these composers, the influence of modern machinery and recording apparatus is an interesting aspect to reflect on.

Steve Reich's early accidental experimentation with asynchronous tape loops moving in and out of phase (he was attempting to synchronise two separate tape machines), led to the seminal piece *It's Gonna Rain* (1965).[48] Here, the tape technology clearly moulds the composition, illustrated by the composer's statement that the "most interesting music of all was made by simply lining the loops up in unison, and letting them slowly shift out of phase with each other."[49]

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[45] *Ibid.,* 152.

[46] *Ibid.,* 153.

[47] Composer Michael Nyman is credited with borrowing the visual art term 'minimalism' and using it in relation to the work of La Monte Young, Terry Riley, Steve Reich and Philip Glass. Nyman frames minimalism as a reaction to Cage's indeterminism and points to its roots (at least as part of Young's career) in Webern's serialism. See Michael Nyman, *Experimental Music: Cage and Beyond* (Cambridge: Cambridge University Press, 1974), 139.

[48] Keith Potter, *Four Musical Minimalists: La Monte Young, Terry Riley, Steve Reich, Philip Glass* (Cambridge: Cambridge University Press, 2000), 166.

[49] Steve Reich, *Writings About Music, 1965 – 2000* (New York: Oxford University Press, 2004), 50.

A musical loop can be rendered by a machine or it can be performed by musicians. Reich's discovery illustrates how the machine can dictate to the musician, but this can be a two-way communication where musicians reared on mechanised music and software quantisation have changed "the way in which musicians played in live situations. Under economic pressure and changing tastes, humans were learning how to be as accurate as machines."[50]

> Live electronic music has altered our idea of what live music can, and should be. At a deeper level, it also continues to pose questions about the relationship between humans, machines and the values associated with music in a period of rapid and disorientating transition.[51]

Reich later brought these phasing techniques to live instrumentation in pieces such as *Piano Phase* (1967) and *Phase Patterns* (1970), developing an aesthetic unthinkable without the seismic cultural shifts of the industrial revolution and the subsequent advent of new electronic technologies.

Ultimately, though, it is the aesthetic force of this new music's interaction with technology, which interests us here. Minimalism employed an initially highly controversial aesthetic: deliberately seeking to remove the dynamics and momentum of western art music, the Minimalists seemed to reach toward both an older and Other sense of music making, albeit with the veneer of contemporary twentieth century means. Part of the original 'minimal set' of composers, Philip Glass explicitly points to this idea of a static conception of musical materials:

> The chief structuring technique is unceasing repetition […] But in minimalism, repetition is used to create what [composer Philip] Glass has called 'intentionless music', which replaces goal-orientated directionality with absolute stasis. Like so much non-Western music, minimalist pieces do not drive towards climaxes, do not build up patterns of tension and release, and do not provide emotional catharses.[52]

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[50] David Toop, *Haunted Weather* (London: Serpent's Tail, 2004), 222.

[51] *Ibid.,* 221.

[52] K. Robert Schwartz, *Minimalists* (London: Phaidon Press, 1996), 9.

The radical thinking of Iannis Xenakis clearly isolates this notion of retarding the forward motion of euro-centric music making, a concept that, in turn, was adopted by La Monte Young and his peers:

> Reaching back into Byzantine chant, Xenakis drew distinctions between musical structures and categories that he called *outside-time, in-time,* and *temporal.* He felt that by almost exclusively emphasizing music's forward direction in the temporal sphere European musicians had enervated music by too little attention to static, nontemporal aspects of musical architecture […] Xenakis wrote […] "This degradation of the outside-time structures of music since late medieval times is perhaps the most characteristic fact about the evolution of Western European music." […] Much of his [La Monte Young's] music relinquishes forward motion altogether. His sound installations made up of sustained sine tones, tuned to perfect frequency ratios, shimmer in quasi-endless immobility.[53]

Young, starting out as "a phenomenally fluid blues saxophone player in his youth", abandoned his jazz studies to explore early music and music from Japan and India.[54] His synthesis of drone music, electronics, saxophone improvisation, and Indian raga bred a new performance practice featuring highly choreographed, durational events, with concerts often lasting all night. The influence of John Coltrane was clear, with Young improvising on sopranino saxophone over extended modal forms, yet with an identifiably microtonal concern (through the use of alternate fingerings).[55] Young's interest in microtonality was directly connected to his use of long sustained tones over a drone and the use of beating tones and difference tones. Eventually this led to the abandonment of equal temperament: "What I found was that I was deeply and profoundly moved by great modal music, and that I really wasn't by harmonically unstructured music, equal-tempered music

[53] Kyle Gann, 'The Outer Edge of Consonance: Snapshots from the Evolution of La Monte Young's Tuning Installations', in *Sound and Light: La Monte Young and Marian Zazeela,* William Duckworth and Richard Fleming (eds.), (Cranbury: Associated University Presses, 2009), 152-190 (153).

[54] Schwartz, *Minimalists,* 23.

[55] *Ibid.,* 24.

in particular."[56] Subsequent to this was his move away from saxophone to singing giving him the pitch flexibility to "sing anything I could hear."[57]

Young was also explicit in regard to his intention to rid music of forward propulsion and looked to early chant and Asian music for inspiration:

> Young put his finger on the connection between medieval Western music and Asian music – and why both influenced him so profoundly. 'I feel that in most music peculiar to the Western hemisphere since the thirteenth century, climax and directionality have been among the most important guiding factors, whereas music before that time, from the chants through organum and Machaut, used stasis as a point of structure a little bit more the way certain Eastern musical systems have.'[58]

A recurring feature of drone music created in the wake of the American Minimalist scene is long, static sound pieces, which discard the conventional notions of harmony, melody and rhythm. On first appearance this seems to be a music which disregards the basic perceptual notion of figure-ground – where typically a melody acts as figure over a harmonic backing. However, composers such as Phill Niblock use dense microtonal drone recordings, creating beating tones which form layers of rhythmic content, and allowing upper harmonic partials to be interpreted by the listener as having a melodic function.

This music works on a deeply immersive level, often performed – or played back as tape pieces – at extremely high volume over long durations, typically out of the context of concert halls or jazz clubs. This approach to music making has a great deal of influence on my own work. However, as a woodwind player, the tension of relying on melodic invention versus creating more 'monolithic' blocks of sound is a recurring balance to attend to in my work. The quest to find a voice within an electronically sustained soundscape and one, which does not diminish the static qualities of the soundscape, is an ongoing one.

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[56] Quoted in Potter, *Four Musical Minimalists*, 63.

[57] *Ibid.,* 64.

[58] Schwartz, *Minimalists,* 23.

Rhythmic Aesthetics

Musicologist Trevor Wishart argues that our musical notation system limits composers and musicians to thinking only in terms of what can be represented by the limited stave system.[59] In relation to rhythm he claims that this thinking is manifest by summative rhythm where "each note value can be expressed as the sum of smaller equal note values."[60] Wishart argues that this essentially results in music whose rhythmic information is always fixed in terms of simple subdivisions of a pulse (whether this is stated or not), so that musicians only play semibreves, crotchets, quavers, dotted note values and the remaining smaller subdivisions. While Wishart doesn't go into details regarding *accelerandi* and *ritardandi* his point holds.

Folk music has many examples of moving outside this notional rhythmic grid, Norway's *springar* rhythmic form from the Hardanger fiddle tradition providing one of the more formalized and clear examples:

> At first you may have the same experience that I had: I simply couldn't understand the rhythm. The fiddlers were keeping time by stomping their right foot, but how could this stomping help them when the beats were always uneven? Later I discovered that different fiddlers used different beats, and that there were differences from one district to another. Especially in western Norway, the rhythm of the *springar* has become very subtle and complex. The three beats in the measure are of different lengths: the second one is the longest, and the third is quite short and leads into the first beat of the next measure, almost like an upbeat.[61]

The idiosyncrasies of jazz swing feel also defy the boundaries of music notation. Jazz eighth notes phrasing is commonly summarized in textbooks as playing two written eighth notes as a triplet with the first two notes tied. However, in practice, the

[59] Trevor Wishart, *On Sonic Art* (Amsterdam: Harwood Academic Publishers, 1996), 24.

[60] *Ibid.,* 24.

[61] Einar Steen-Nokleberg, William Halverson (trans.), *Onstage with Grieg: Interpreting His Piano Music* (Bloomington: Indiana University Press, 1997), 354.

nuance of swinging eighth notes is a highly personalised matter and remains a flexible approach to rhythmic materials.[62]

In my own practice, when using traditional notation in the past, I have used fermatas, odd time signatures, rubato and cued phrasing to break down the rhythmic expectations described in Wishart's lattice model. In the body of music presented as this research, I have stepped away from notation and have further worked to avoid a dependence on summative rhythmic phrasing.

Another important rhythmic approach in this research project is the use of asynchronous loops. Rather than creating grid-like rhythmic patterns with live sampled loops, I often choose to let the software govern the resulting rhythmic patterns. So that, rather than attempting to impose my rhythmic concepts upon the machine, I allow the Max patch to follow its procedures and I follow its outcome. This viewpoint echoes the work of live electronics pioneer David Tudor as discussed here by Nicholas Collins:

> He believed that new, object-specific, intrinsically *electronic,* musical material and forms would emerge as each instrument took shape: 'I try to find out what's there – not to make it do what I want, but to release what's there. The object should teach you what it wants to hear.' This clearly stated ethos of music *implicit* in technology served as a paradigm for much American electronic music of the 1970s.[63]

Improvisation

Improvisation has been the single constant unifier in my musical output over the last decade. It is a vast subject so I will necessarily confine the discussion to questions surrounding academic research in the area and what role improvisation plays in my practice.

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[62] Peter Erskine, *Time Awareness: For All Musicians* (Los Angeles: Alfred Publishing Company, 2005), 20.

[63] Collins, 'Live electronic music,' 46.

Much of the initial reluctance to generate serious discourse around the area of improvisation in music is tied to the tacit assumption that improvisation is a pure form of direct creativity reserved for the slender canon of musical geniuses. The disempowering, Romantic interpretation of creativity – "the belief that creativity bubbles up from an irrational unconscious, and that rational deliberation interferes with the creative process" – allows for the continuing proliferation of the genius trope.[64]

> Because rational explanations of the creative process could not be found, metaphysical reasons filled in the explanatory gap: since antiquity, the ability to create artistically and scientifically has been considered a fortunate gift from God, a daemon, or a muse; since the seventeenth century, a person who has the ability to create has been named a genius. Within the discourse about genius, newness, originality and uniqueness were defined as indispensable criteria of the creative product.[65]

This thinking leads us to a concept of creativity as unpredictable and unteachable. Pursuing this logic, we are left with a problem in terms of using improvisation as a valid musical means as

> In order to produce new, original, and unique sounds, creativity must appear in improvisation. However, because improvisation happens on demand, creativity, a phenomenon that *per definitionem* is unforeseeable and uncontrolled, also must happen on demand.[66]

Kutschke argues that it is through the developments in scientific thought towards a rationalist viewpoint of creativity that avant-garde composers begin to use improvisation on cue in new pieces.

> Creativity lost its image of being the opposite of rationality; it became a mastered aspect of everybody's intelligence. Creativity could be measured and quantified and – in the end – could be instrumentalized and operationalized toward several

[64] R. Keith Sawyer, *Explaining Creativity: The Science of Human Innovation* (New York: Oxford University Press, 2012), 23.

[65] Beate Kutschke, 'Improvisation: An Always-Accessible Instrument of Innovation,' *Perspectives of New Music* 37/2 (Summer 1999): 147-162 (148).

[66] *Ibid.,* 148.

> goals. […] [Creativity research] was applied to the military, to economics, science, art, politics, and the personal sphere.[67]

Kutschke's conclusion that the commodification of creativity is complete and that "this new image of creativity [has] repressed the original characterization of creativity as an irrational and mystifying act," is still, generally speaking, a controversial viewpoint. Mainstream educators, audiences and general media are, by and large, firmly committed to the Romantic model today.

Even within scholarly discourse, research and analysis around improvisation in music has a surprisingly short history. The reluctance to engage with the practice of improvisation points to some deeply held and long-standing biases among research circles:

> The idea, still around in 1950, that improvisation just couldn't be explained, and widespread scepticism that there could even be such a thing, went hand in hand, perhaps, with ideas to the effect that oral transmission of music was a strange and unproductive form of enculturation. By the late twentieth century, the situation had changed enormously, as a large body of ethnomusicological literature had been developed.[68]

While Nettl's point about the increased interest in ethnomusicological research is certainly valid, it is in the realm of jazz that the bulk of today's discourse around improvisation resides.

> In particular, the anointing, since the early 1950s, of various forms of "jazz" the African-American musical constellation most commonly associated with the exploration of improvisation in both Europe and America, as a form of "art" has in all likelihood been a salient stimulating factor in this re-evaluation of the possibilities of improvisation.[69]

The ever-shifting parameters and individualised understanding of the nature of improvisation has meant that theorists in the field have attained very little

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[67] *Ibid.,* 152 and 154.

[68] Bruno Nettl, *The Study of Ethnomusicology: Thirty-one Issues and Concepts* (Baltimore: University of Illinois Press, 2006), 35.

[69] George E. Lewis, 'Improvised Music after 1950: Afrological and Eurological Perspectives,' *Black Music Research Journal* 16/1 (Spring, 1996): 91-122 (91).

consensus as to describing the nature of improvisation in music. So that, while improvisation is a continually expanding component in the praxis of many diverse musical genres it "enjoys the curious distinction of being both the most widely practiced of all musical activities and the least acknowledged and understood."[70]

My intention here is not to put right these historical shortcomings in research but rather to isolate the salient points concerning the nature and role of improvisation in my own practice as well as the relationship between improvisation and composition which has implications to the disclosure of the research findings. This endevour is undertaken while taking heed of Derek Bailey's admonition that

> Any attempt to describe improvisation must be, in some respects, a misrepresentation, for there is something central to the spirit of voluntary improvisation which is opposed to the aims and contradicts the idea of documentation.[71]

As with any jazz musician, improvisation is thoroughly intertwined throughout my practice. In the context of jazz improvisation, this is a learning process which typically starts with learning how to embellish melodies, understanding how rhythmic displacements operate, mastering chord/scale relationships and continues into more specialised territory. Lee Konitz describes this as a continuum ranging from interpretation to improvisation.[72] This approach to improvisation is largely based on listening to recordings and live performances of jazz musicians and analysing these through discussion and transcription. These transcriptions are performed on the instrument, altered, personalised, embellished and transposed, all with the eventual aim of developing a personal approach to improvisation derived from the groundwork of master musicians.

The precise nature of the process of improvisation is variously interpreted by musicians. A recurring motif in these discussions is the analogy with language:

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[70] Derek Bailey, *Improvisation: Its Nature And Practice In Music* (London: Da Capo Press, 1980), ix.

[71] *Ibid.,* ix.

[72] Berliner, *Thinking in Jazz,* 67.

> After you initiate the solo, one phrase determines what the next is going to be. From the first note that you hear, you are responding to what you've just played: you just said this on your instrument, and now that's a constant. What follows from that? And then the next phrase is a constant. What follows from that? And so on and so forth. And finally, let's wrap it up so that everybody understands that that's what you're doing. It's like language: you're talking, you're speaking, you're responding to yourself. When I play, it's like having a conversation with myself.[73]

Roach's explanation of the process resonates readily with my own approach. The concept of an internal conversation is quite apt in the context of unaccompanied improvisation. Lee Konitz echoes Roach's idea of self-generating dialogue:

> The vital part is thinking while you're moving, and once the momentum has been started, I don't like to break it. I'm concerned with the continuity in motion […] If you're not affected and influenced by your own notes when you improvise, then you're missing the whole essential point.[74]

Jazz improvisation (and, indeed, improvisation across multiple musical styles) traditionally holds a number of tacit assumptions regarding the value of the 'new' and the role of spontaneity. Yet clearly, this approach is one, which relies heavily on preparation. The preparation of previously executed material in the practice room, the 're-crafting' of this and the 'creation' of previously unheard material becomes a ongoing balance in jazz performance.

> For the improviser, the performance must feel like a "leap into the unknown", and it will be an inspired one when the hours of preparation connect with the requirements of the moment and help shape a fresh and compelling creation. At the time of performance they must clear their conscious minds of prepared patterns and simply play. Thus it makes sense to talk of preparation for the spontaneous effort."[75]

Another interpretation of this model contains the assumption that improvisation is a musical tool reserved for musicians who have mastered certain

[73] Max Roach quoted in Berliner, *Thinking in Jazz,* 192.

[74] Lee Konitz quoted in Berliner, *Thinking in Jazz,* 193.

[75] Andy Hamilton, 'Jazz as Classical Music,' in *Improvisation: Between Technique and Spontaneity,* Marina Santi (ed.), (Cambridge: Cambridge Scholars Publishing, 2010), 53-76 (57).

more 'fundamental' aspects of music making. Some practitioners in free jazz and free improvisation have challenged these assumptions with performers improvising with a range of instruments which they have no traditional technique or mastery over and attempting to deny the influence of previous musical preparation (or even education) such as Eddie Prévost's suggestion of interacting with your instrument as if for the very first time.[76] The approach of the free improvisation school is often one which negates preparation and adopts a "searching for sounds and for the responses that attach to them, rather than thinking them up, preparing them and producing them."[77]

This fascination with the new seems to call out for re-invention with each improvisation. In my practice, while exploring new terrain and material with each performance, the creation of something new *per se* is not a supreme goal. Contemporary culture's demand for innovation in artistic practice is problem-ridden and can cause musicians to deny their own aesthetic tendencies in favour of producing something which will be seen to be new.

> Innovation is a concept, a value that we borrow from science and technology where it is absolutely crucial […] But the value of science is renewal, renewal, renewal […] But culture has had quite another role; it has had cohesion as one of its main 'purposes' if you can talk about purpose. It's something that we can share, that we can understand and we can move on it. Because innovation takes place anyway. Language changes, but nobody would ever say we need some more innovation in language. Nobody says that. But we talk about that in music, so somehow we have transferred this value from science and technology, uncritically, into the theme of culture.[78]

My experience of working in free jazz and free improvisation has raised these questions concerning preparation and in my own practice I oscillate between both

[76] The AACM's use of 'little instruments' and Ornette Coleman's use of violin and trumpet are examples. See Todd S., Jenkins, *Free Jazz and Free Improvisation: An Encyclopedia* (Westport: Greenwood Press, 2004).

[77] Cornelius Cardew, 'Towards an Ethic of Improvisation,' in *Cornelius Cardew: A Reader*, Edwin Prévost (ed.), (Harlow: Copula, 2006), 127.

[78] Erling Aksdal, The Jazz Summit 2012 (http://www.youtube.com/watch?v=tsgJRuLEnXU, accessed 3 May 2013).

approaches, at times finding unexplored techniques and areas of the instrument and at other times drawing on many years of (continuing) rigorous instrumental preparation and control. Often the most personally rewarding musical experiences for me are when I create music which I respond to aesthetically yet am not fully aware of *how* I am creating it.

So there is a balance then, in my practice, between preparation and surprise. Each informs the other: preparation almost never implies working on specific passages or patterns (as it certainly did earlier in my career), instead, tone production and attention to movement are recurring central concerns. Sound production is a prepared element yet this will not influence the notes chosen, nor, for that matter dictate that I cannot experiment with new techniques of sound production during performance. This toying with prepared elements and surprising myself during performance is a very enticing part of live performance. This is an ongoing concern for the majority of improvising musicians: "There is a fine balance between structure, preparation, and control, and letting things come through […] I play things that I could've never played, that I couldn't imagine."[79]

> I have complete faith in the spontaneous process. I think most people think that can be very naïve, and that you do your improvising at home, and when you go out, you play prepared material, so the paying customers don't get short-changed […] Obviously, playing [prepared material] mechanically suggests a lack of real connection to what you are doing at the moment. We learn to play through things that feel good at the time of discovery. They go into the "muscular memory" and are recalled as a matter of habit […] I think most people who play professionally want to do a good job, and prepare as much as possible to do that. I do in my way, but that's my way of preparation – to not be prepared. And that takes a lot of preparation![80]

[79] La Monte Young quoted in Jnan Ananda Blau, '"The trick was to surrender to the flow:" Phish, the Phish Phenomenon, and Improvisational Performance Across Cultural and Communicative Contexts' (Ph.D.diss., Southern Illinois University Carbondale, 2007), 90.

[80] Lee Konitz quoted in Andy Hamilton, *Lee Konitz: Conversations on the Improviser's Art* (Ann Arbor: The University of Michigan Press, 2007), 110.

This 'game of risk' between preparation and surprise is an essential personal ingredient in my performance practice. It also figures as a key reason that listeners will attentively follow an improvised music performance:

> This situation of the improviser is essentially what holds our attention as audience members, as witnesses, of improvisation. It is one of the prime sources of our fascination and admiration […] The improviser's "plight" is thus improvisation's constitutive feature as well as its nature as an aesthetic text.[81]

Improvisation functions as a means of generating musical material during performance. Yet "even the freest improviser, far from creating *ex nihilo,* improvises against some sort of musical context."[82] In my solo performances this context can be determined by a number of external factors. More importantly though are the aesthetic preferences that I bring to each situation. In practice, quite often I will initiate the performance in response to a sound in the room – a (hopefully) distant car alarm, a dog barking or an audience member coughing.[83] This interaction between my own artistic direction and whatever external factors come into play during a performance is what makes live performance so utterly unlike anything which can be pre-determined, recreated alone, or fully documented.

> We have, then, a complex and productive tension between improvisation as on-the-spot creativity and as something that is also always already contextualised, situated within time and space.[84]

While the vast bulk of the music created for this research was done without any pre-determination on my behalf – that is to say, I had no direct plan other than to use my instruments to create music for a roughly predictable duration – there are external influences on the unfolding of this music. Chief among these are the performance space, the audience numbers and interaction, the context of the

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[81] Blau, '*Surrender to the Flow,'* 60.

[82] Philip Alperson, 'On Musical Improvisation,' *The Journal of Aesthetics and Art Criticism* 43/1 (Autumn, 1984): 17-29 (22).

[83] "The artist can start his work with an almost random manoeuvre – a brush stroke on canvas, an opening line, a musical motif – and then adapt his later moves to this gambit." Ted Gioia, *The Imperfect Art: Reflections on Jazz and Modern Culture* (New York: Oxford University Press Inc., 1990), 62.

[84] Blau, '*Surrender to the Flow,'* 56.

performance (music played before, the purpose of the occasion, etc.), and the instrumentation chosen.[85]

Solo Performance

I first began to perform unaccompanied in 2006. Influenced by saxophonists John Butcher and Evan Parker, I initially performed acoustically relying on a developing personal language based on extended techniques and performing improvised music without prior specific preparation. Solo performance has an interesting tradition among jazz performers and it raises many challenging questions around interactivity and its role with jazz group performance and consequently its position within a solo context. Celebrated examples include Art Tatum's solo legacy or Thelonious Monk's solo records, Jim Hall's famous solo guitar recordings or Keith Jarrett's solo 'spontaneously composed' catalogue. The unifying tie between these projects is that the musician is playing a chordal instrument, which can provide bass notes, chords and a melody on top of all that. In contrast to this 'one man band' aesthetic free improvisation has provided a particularly rich vein for unaccompanied performance. With less concerns in terms of interplay between harmony, melody and rhythm in today's free improvisation, monophonic instrumentalists have worked as solo performers almost as a norm. Woodwind artists including Ned Rosenberg, Lol Coxhill, Steve Lacy, Evan Parker, Lucio Capece and John Butcher have all devoted large portions of their careers to unaccompanied performance. While free improvisers who work with traditionally chordal instruments rarely attempt to provide harmonic or rhythmic support for melodic invention. Guitarist Derek Bailey turned exclusively to solo performance in the period between 1970 and 1971:

> I wanted to know if the language I was using was complete, if it could supply everything that I wanted in a musical performance. The ideal way of doing this, perhaps the only way, it seemed to me, was through a period of solo playing.

[85] These topics are expanded upon in Chapter Five.

> Alternating periods of group playing with solo playing is something I have tried to maintain ever since.[86]

In 2009, I began to introduce live electronics, which I had been using in group situations since 2002, into my solo practice. This enabled me to bring the grammar of solo free improvisation into play within a wider set of aesthetics. The initial obvious change to the potential soundworld was the ability to produce sound without having to physically move a column of air through an instrument. The electronics allowed me to layer sound, sample earlier parts of the performance and create loops resulting in much denser soundscapes than a single voice (albeit utilising multiphonics) could allow. The expansion into the world of electronics also addresses the age-old challenge of monophonic solo performance: how to convey harmonic movement with a single voice.

> Composing for a monodic instrument requires technical virtuosity of the composer as well as from the performer. In the most interesting works of this genre, several musical layers are in play simultaneously. With the capacity of sounding only one note at a time, the monodic instrument is given the task of implying a multiplicity of musical threads. Harmonic fields can be established through the repeated sounding of specific note groups. Thus, melody and harmony can be suggested. In addition, the full range of instrumental timbres can be employed as layers. The whole might be enhanced with integrated electronics in order to transform the "natural" sound of the individual instrument. This element provides yet another layer to add to the principle of 'plurality within singularity'.[87]

European music history is rife with examples of partitas and etudes from the canonical figureheads for solo instruments, which grapple with this need to provide melodic form with harmonic underpinning. The tape delays of the 1960s changed this dynamic, as the performer could now choose particular notes to sustain while continuing with the melodic line. The sophistication of today's time-based electronic processing (delay, live sampling and looping) enables the solo performer with live electronics to easily create several layers of simultaneous sound. Perhaps

[86] Bailey, *Improvisation,* 106.

[87] Margaret Lucy Wilkins, *Creative Music Composition* (Routledge, Taylor & Francis Group, New York 2006), 254.

ironically while new technology helps the musician to overcome this monophonic hurdle, aesthetic developments in the twentieth century point to the acceptance of 'static music' or Erik Satie's concept of *musique d'ameublement* (furniture music) – where the impetus to create music which carries a forward momentum becomes less important and where the listener can luxuriate in immobile textures and repetition.[88] Author and musician David Toop asserts that "music not *going anywhere* is one of the most fertile developments of the twentieth century."[89]

As a solo performer with live electronics, I am in the autocratic position where I can shape every performance parameter as it unfolds in real-time. This level of involvement satisfies my impulses as a composer where I can sculpt the overall arc of a piece compared to the jazz paradigm where any interaction is confined to a featured solo where often the emphasis is on a display of instrumental virtuosity rather than any compositional overview. This viewpoint is not uncommon among today's electronica producers who compose, create and engineer their own tracks although more often than not this isn't done as a live improvised performance.

Contemporary Electronica

A final important developmental strand to acknowledge alongside improvising instrumentalists, is a number of influential electronic musicians whose practices have helped shape my own aesthetic approach to the use of live electronics. The ambient soundscapes of producers Brian Eno and Jan Bang are closely aligned to some of my work for instance. The subversion of digital audio which spawned the glitch genre is also an important, if not immediately obvious, influence. The underlying preoccupation with risk and failure within the glitch genre has

[88] Satie's furniture music approach continues in the work of producers such as Brian Eno when he writes: "I suggest listening to the piece at comparatively low levels, even to the extent that it frequently falls below the threshold of audibility." Sleeve notes in Brian Eno, *Discreet Music,* vinyl long player Obscure no. 3. 1975.

[89] David Toop, *Ocean of Sound: Aether Talk, Ambient Sound and Imaginary Worlds* (London: Serpent's Tail, 1995), 193.

immediate parallels with free improvisation despite the sometimes painstakingly slow methods of artists such as Oval to create their music.

> There are many types of digital audio 'failure.' Sometimes, it results in horrible noise, while other times it can produce wondrous tapestries of sound. (To more adventurous ears, these are quite often the same.) When the German sound experimenters known as Oval started creating music in the early 1990s by painting small images on the underside of CDs to make them skip, they were using an aspect of 'failure' in their work that revealed a sub-textual layer embedded in the compact disc.[90]

The music of Oval, Carsten Nicolai (also known as Alva Noto) and Ryoji Ikeda spoke to the importance of texture, background and a warm digital realm where mistakes and idiosyncrasies had an important aesthetic role. Some of these artists such as Japanese musician Toshimaru Nakamura also worked as free improvisers, signalling to me that this post-digital language could be used in that context.

[90] Kim Cascone, 'The Aesthetics of Failure: 'Post-Digital' Tendencies in Contemporary Computer Music', *Computer Music Journal* 24/4 (Winter 2000): 12-18 (13).

Chapter Three: Designing a New Performance Practice

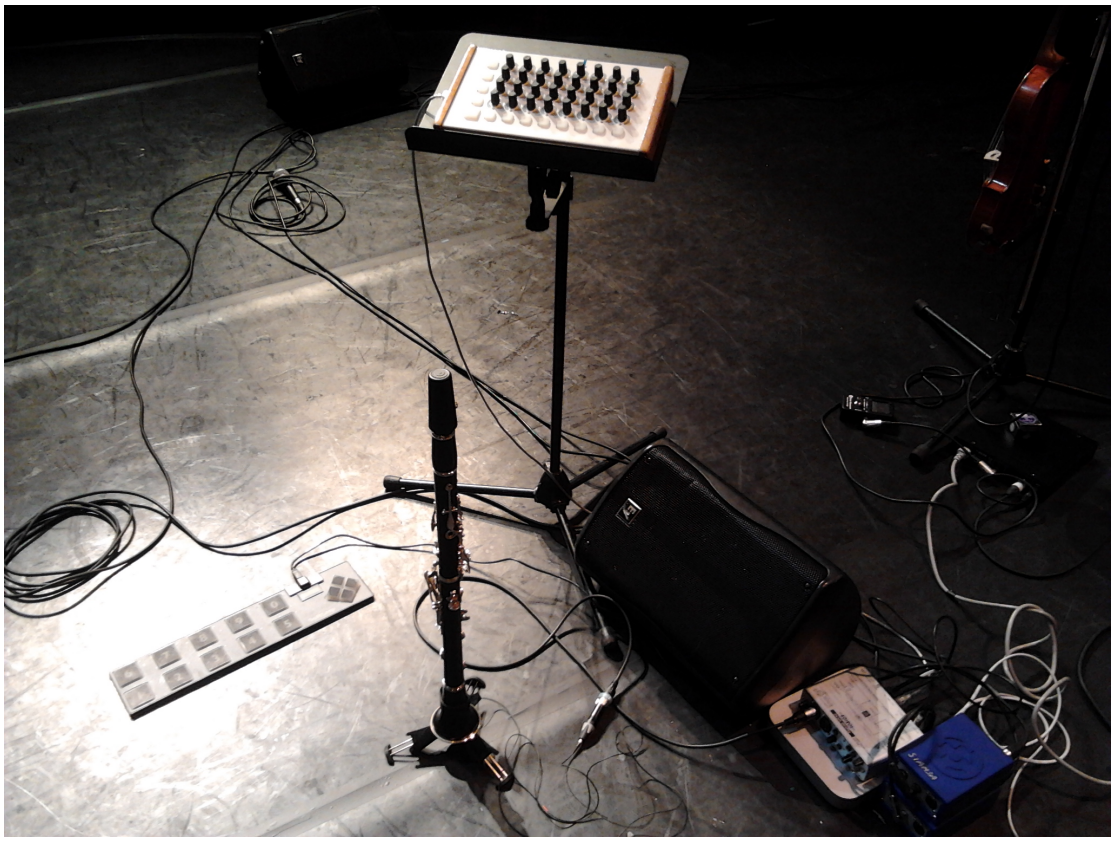


Figure 3.1 Full DSP set-up with clarinet, two MIDI controllers, audio interface and computer. Also seen is a stand, audio monitor, two direct input boxes and cabling.

Introduction

The primary impetus to incorporate digital signal processing (DSP) in this research is to serve and augment the aesthetic framework delineated in Chapter Two. Throughout this research it is important to contextualise this programming endevour: my primary activity is as an instrumentalist/researcher and all programming is carried out to reflect and to build on this. My computer programming skills have been developed to realise musical concepts and at all

times serve this musical end.

The crafting of an instrumental approach is an ongoing process of analysis and refinement, of listening and making judgments. This method is manifest on a preparatory level in terms of developing a consciously directed musical voice and on the immediate level in the context of live improvisation where each utterance is chosen in accordance with that same approach. The designing of the electronic processes also follows this procedure of analysis and refinement to sympathetically serve an aesthetic viewpoint. Analogous to the instrumental approach, the preparatory element of the electronic design is a programming task and, on the immediate level, during performance, the software is manipulated for real-time musical ends. Every programming decision has been guided by the aesthetic framework in attempting to match, play with, or complement, the conception of the woodwind sound. In this sense, non-summative rhythms, non-pitched material, alternative tuning systems, air and warmth all have a place within the electronic mirror of the instrument.

This ongoing development of a jazz musician's practice is highly compatible with the design of sympathetic software. Both processes build up skills or tools informed by an artistic direction, using these to reinforce and complement each other. These parallel interests have caught the attention of programmers such as David Wessel, the director of University of California Berkeley's Center for New Music and Audio Technologies (CNMAT):

> It seemed to me that jazz musicians were people who had to invent a sound of their own – a personal sound. It was almost like they were almost like instrument makers in a sense – they built a sound. Often times it was a very important part of what happened, and they would invent a kind of language that was a personal language. It seemed to me that computer musicians could do that kind of thing, simply because they were required to almost invent their instrument from the ground up. It seemed totally compatible to me with this kind of — aesthetic or ethic in aesthetics that I had about music the way it should go. It seemed to me

> that was kind of an ideal.[91]

The idea of individualisation within the tradition of instrumentalism is also mirrored here, as I employ a software system, which allows me to create new, bespoke and personalised processes. The unique qualities of this working method signals a deliberate rejection of generic factory-made hardware processors, and a reliance on a less prescriptive and more distinct pathway. The recent trajectory in audio software design is moving increasingly towards a simplification of user interface and generalised 'one size fits all' presets. This tendency in mainstream software programming works against the creative potential of these new tools as composer Kim Cascone explains:

> More and more people want single button functionality, and once you've done that you've taken all the possible statistical anomalies or accidents out of the hands of the user. It's made safe […] I'd much rather build my own software and work with the tools and have them get in the way because that's what makes you think. This conflict is lacking and the conflict is what creates and allows you to be innovative.[92]

The evolution of my performance practice is dealt with on a technological level comparing hardware-based antecedents to the current digital, software-based workflow. The integration of new digital technologies into an existing performance practice is the design question. Specifics relating to the software programming, its capabilities and its adaptability to live performance situations are discussed.

Leveraging Technology

The broad notion of technology presents itself today as a cornerstone of contemporary global culture. Technology is posited as an everyday driver of commerce, an essential ingredient of communication and an unlimited agent of

[91] Interview with David Wessel (http://cycling74.com/2005/09/13/an-interview-with-david-wessel/, accessed 14 March 2013).

[92] Kim Cascone lecture at Share Festival 2010, Smart Mistakes, Regional Museum of Natural Science, Torino, Italy (http://vimeo.com/17082963, accessed 2 April 2013).

creativity and advancement.[93] With such a wide usage of the term across so many sectors of society it behoves us to define this term for our purposes here:

> Technology – from the Greek *technē* (art) plus *logos* (word or discourse) – is the sum total of ways by which practical and aesthetic goals are realized. New technology allows new goals to be defined. Because technology constantly modifies what goals are possible, it provides a vital and dynamic link between human imagination and reality.[94]

Moore's contribution goes beyond mere statement to suggest that technology acts as a tool to expand, and test, creative limits and expectations.

In appraising the new role of the computer and digital technology in music, writers have come out with hugely ambitious claims about the importance of this new form of technology, characteristically heralding it as "the most fundamental change in the history of Western music since the invention of music notation in the ninth century."[95] With the introduction of digital technology just thirty-five years ago, it is perilous to quantify just how important it will be seen to be. However, it is an unassailable fact that digital technology has caused a paradigm shift in musical practice since the availability of affordable hardware in the 1980s. This is true of musical production, reproduction, dissemination and also musicians' approach to music in general.

> [The computer] has revolutionized the ways in which musicians think, or indeed can think, about sound and sonic expression, and married to the principles of electroacoustic music – or to music in general – forms a mighty alliance which will create the music of the future and transform the understanding of music of the past, will change the ways in which music is performed, and the uses to which music is put.[96]

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[93] See Frank Webster, *Theories of the Information Society* (London: Routledge, 2006), 10.

[94] F. Richard Moore, 'A Technological Approach to Music' in *Companion to Contemporary Musical Thought: Volume 1*, John Paytner, Tim Howell, Richard Orton and Peter Seymour (eds.), (London: Routledge, 1992), 329.

[95] T. D. Taylor, *Strange Sounds: Music, Technology & Culture* (New York: Routledge, 2001), 3.

[96] Richard Orton, 'Musical, Cultural and Educational Implications of Digital Technology,' in *Companion to Contemporary Musical Thought: Volume 1*, John Paytner, Tim Howell, Richard Orton and Peter Seymour (eds.), (London: Routledge, 1992), 320.

Richard Orton attributes this seismic shift in musical possibilities to the fact that for the first time in human history we have a means which, through its plasticity and time-based capabilities, can model the features of human thought.[97] The implication here is that the computer can create, organize, reproduce and perform music in a manner which is closest (thus far in our evolution) to our inner creative imagination.

The fact that technology acts as an agent between musician and music categorizes it as a tool. In the traditional sense of arts practice, it is quickly acknowledged that the sculptor's chisel does not represent the underlying intention of the art-work, but acts as a medium through which these intentions are communicated.[98] Yet in the realm of computer music, the characteristics of the tools adopted will greatly shape and influence the music presented, as we will see throughout this research.

> The use of tools involves interposing another factor between the subject and this object, a factor that occupies an intermediate position not only in terms of space and time but also in terms of its content. For on the one hand a tool is a mere object which is mechanically effective, but on the other hand it is also an object that we not merely operate *upon,* but operate *with,* as with our own hands […] By using tools we deliberately add a new link to the chain of purposeful action, thus showing that the straight road is not always the shortest. The tool is typical of what we might call our creations in the external world; on one hand it is formed exclusively by our own powers, and on the other it is devoted entirely to our own purposes.[99]

In contrast to today's all-pervasive presence of digital technology, the addition of a computer in a musical performance context often provokes scepticism, mystery and distrust among the wider public, despite a fifty-year history of practice. The controversy surrounding the use of computers in performance

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[97] *Ibid.,* 321.

[98] Marshall McLuhan's celebrated idea that 'the medium is the message' opposes this dominant idea. When applied to instrumental music this is particularly apt, where texture and the sonic fabric itself are the salient constituents. See Marshall McLuhan, *Understanding Media: The Extensions of Man* (London: Routledge, 2001).

[99] Georg Simmel, *Philosophy of Money,* David Frisby (trans.), 3rd edn (London: Routledge, 2004), 224.

contexts overshadows the principle reason for employing computers as a 'musical instrument.'[100]

> The phrase "The computer is just another musical instrument" is usually intended as a kind of apologia for the introduction of such advanced technology into the field. This statement is not the whole truth, however […] (The statement is frequently followed by a further apology – "and we mainly use it to do things that traditional instruments cannot do" – which is useful in trying to pacify some critics). What usually goes unstated, though, is that for many composers the computer may be the only musical instrument available which is capable of providing them with a means of expression appropriate to their needs.[101]

This unique means of expression is what drew me into the use of DSP, extending and further realising the artistic path I was undertaking as an acoustic instrumentalist. However in this process of digitally augmenting my acoustic instrument, I have been influenced and enthused by the possibilities presented by DSP technology. In short, it has been a dialogue between an existing practice and the malleable and responsive world of audio software language.

Max: A New Computer Music Paradigm

> "Computer performance of music was born in 1957 when an IBM 704 in NYC played a 17 second composition on the Music 1 program which I wrote. The timbres and notes were not inspiring, but the technical breakthrough is still reverberating." – Max Mathews.[102]

The history of music software programming stretches back to the late 1950s when Max Mathews developed a programming language called MUSIC 1. This provided

[100] Chief among these dilemmas are the removal of visual cause and sonic effect and the association of computer technology with a sphere of human activity far removed from the romantic notion of artistic creativity. See below.

[101] Michael McNabb, 'Computer Music: Some Aesthetic Considerations', in *The Language of Electroacoustic Music,* Simon Emmerson (ed.), (London: Macmillan Press, 1986), 143.

[102] Max Mathews, 1997 (http://www.csounds.com/mathews/, accessed 10 January 2011).

the foundation for much of today's music programming languages.[103] These software environments were (like the electronic studios of the day) the preserve of research centres such as AT&T Bell Laboratories and select universities. Critically, these programs took a long time to render sounds audible and could not be considered suitable for performance situations. It took until the early 1980s before software could synthesise and process music in real-time, opening the door for computers appearing 'live' on stage for the first time.

Miller Puckette a programmer at IRCAM in Paris developed a new graphic-based programming language in the mid-1980s. Puckette's work evolved into the language he named Max, after Max Mathews, who can be considered the initial pioneer of computer music. In 1987, for IRCAM's tenth anniversary, Max was used in a live performance of pieces by Thierry Lancino and Philippe Manoury.[104] Puckette's new software environment was "designed to process the interaction between computer and performer in real-time."[105] The adoption of Max in the 1990s and 2000s by a wide range of important composers and multimedia artists including Aphex Twin, Autechre, Morton Subotnick, William Kleinsasser, Carsten Nikolai, Pamela Z and Lawrence Casserley ensured its place as the "the lingua franca of the computer music community."[106] The emphasis on interactivity in a real-time situation was key to the popularity of the commercial version of Max released in 1991 and later, its specifically audio-based extension, Max / MSP in 1999.[107] The most recent expression of the software, Max 6, was released in September 2011.

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[103] Ge Wang, 'A History of Programming and Music,' in *The Cambridge Companion to Electronic Music,* Nick Collins and Julio d'Escriván (eds.), (Cambridge: Cambridge University Press, 2007), 60.

[104] Miller Puckette, 'Max at Seventeen,' *Computer Music Journal* 26/4 (2002): 31-43.

[105] History of IRCAM (http://www.ircam.fr/62.html?&L=1, accessed 11 January 2011).

[106] Max (http://harvestworks.org/index.php?option=com_content&view=article&id=324:maxscore-using-conventional-notation-in-maxmsp-and-max-4-live&catid=3:newsflash, accessed 12 January 2011).

[107] MSP (Max Signal Processing or Miller S. Puckette) was developed by David Zicarelli. Max 6 and related software are commercially available from San Francisco based software company Cycling '74.

Redesigning a Performance Practice: Hardware

When I initially set about programming a new software based instrument extension for use in live performance, there were a number of considerations. I wanted the new system to leave my two hands as free as possible to perform on the instrument. It was important for me not to have to interact directly with the computer during performance and preferably for it not to be visible on stage. The overall bulk of the set up needed to be travel friendly, including air travel as well as for transportation on bicycle.[108]

The visual presentation of this new performance practice is an important issue. Today it is common practice for laptop musicians to perform seated and motionless, staring into the lit screen of their instrument. This can be problematic in terms of engaging an audience unused to this paradigm and, at worst, a real obstacle to musical communication:

> Antagonism arises when a performer generates music by a process unknown to the audience; using technology more at home in an office cubicle than a musical performance. The laptop's signifier as a business tool is so ingrained in the public consciousness that its use as a musical instrument is considered a violation of the codes of musical performance. The audience feels cheated, because the laptop musician appears to be simply playing back soundfiles stored on their hard drive.[109]

Having crafted a performance technique as an acoustic instrumentalist, this was a outcome I was keen to avoid.

It was important from the start to have a clear idea of how best to interact with the new software during performance. Research in the field of human-computer interface suggests that "when an interactive system is well-designed, the interface almost disappears, enabling users to concentrate on their work,

[108] The logistics of international travel has very real implications for touring musicians' choice of equipment: see Jeff Kaiser, 'How I lost 150 lbs. thanks to Max/MSP!' (http://www.jeffkaiser.com/papers/spark_ 2007.pdf, accessed 3 December 2012).

[109] Kim Cascone, 'Laptop Music – Counterfeiting Aura in the Age of Infinite Reproduction,' *Parachute: Contemporary Art Magazine* 107 (2002): 52-58 (5).

exploration, or pleasure."[110] This is my aim not just from the point of view of the performer but also that of the audience in terms of removing technological distractions which could deter from the performative musical experience. The overriding concern with computers in performance is the question of gesture and the visual interrelationships between musician and audience where "the use of computers in live performance has resulted in a situation in which cause-and-effect has effectively disappeared, for the first time since music began."[111] Some of these complications are inevitable, however the presence (and the audible acoustic sound) of clarinets or saxophones goes some way to counteracting this tendency and is perceived as a more direct means of communication to an audience.

The hardware design went through repeated iterations. Initially I experimented with using only pitch-triggered processes so that simply by playing a particular pitch I could control software parameters. This eliminated any need to divert attention from the acoustic instrument in performance. Ultimately, this didn't provide enough direct control of the software and arguably presented an even further disembodied and mysterious connection with the computer.

A small MIDI controller at hand height was chosen to fine tune individual effect volumes, change signal routings and some parameters.[112] The Korg NanoKontrol, the Akai LPD8 and Livid Instruments Code were all workshopped and used in performances throughout this research, with Livid's controller proving the most versatile and well built, and providing ample control of the Max patch within a visually discrete package. The Code controller's innovative use of LED encoders provided me with a clear visual reference to individual parameters (particularly useful in dark environments).

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[110] Ben Shneiderman, *Designing the User Interface: Strategies for Effective Human-computer Interaction* (Reading: Addison-Wesley, 1997), 10.

[111] Andrew W. Schloss, 'Using Contemporary Technology in Live Performance: The Dilemma of the Performer,' *Journal of New Music Research* 32/3 (2003): 239-242 (240).

[112] A MIDI controller is an external piece of hardware, which when connected to a computer translates physical gestures into MIDI messages, which can be used to control software running on the computer. Traditionally these were keyboard interfaces although in recent years there have been more and more alternative controllers introduced to the market.

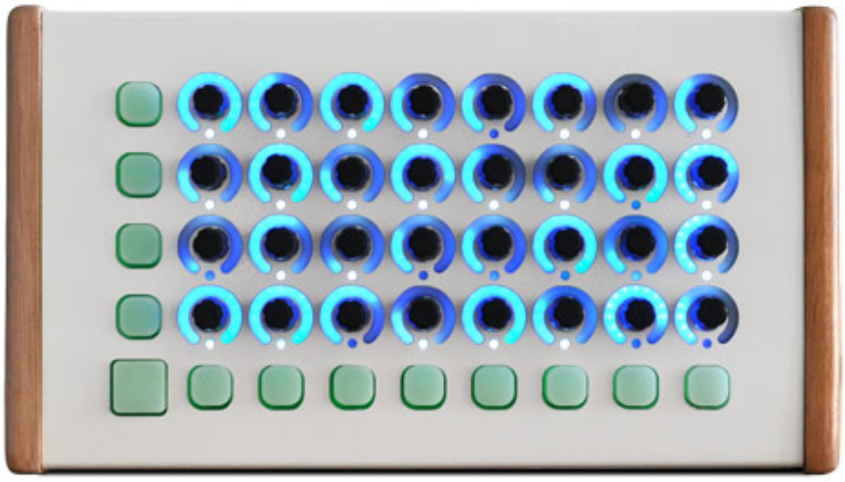


Figure 3.2 Front view of Livid Code controller.

Logically, it makes sense for a woodwind instrumentalist to use a foot controller – freeing up both hands. Having been frustrated with the limitations of using stomp-boxes designed for guitarists, the release in 2010 of the Softstep foot controller by Keith McMillen Instruments addressed these limitations.



Figure 3.3 Softstep foot controller made by Keith McMillen Instruments.

The Softstep controller represents an important advancement over other existing MIDI foot controllers in that much more information can be transmitted than either on or off messages. The Softstep controller has ten pads, each of which can transmit MIDI or OSC messages with information about foot pressure levels as well as measuring foot movement on both X and Y axes. In essence this means that each pad can give messages for 6 discrete parameters. This controller weighs just 590 grams, making it far lighter (and smaller) than any other comparable product.

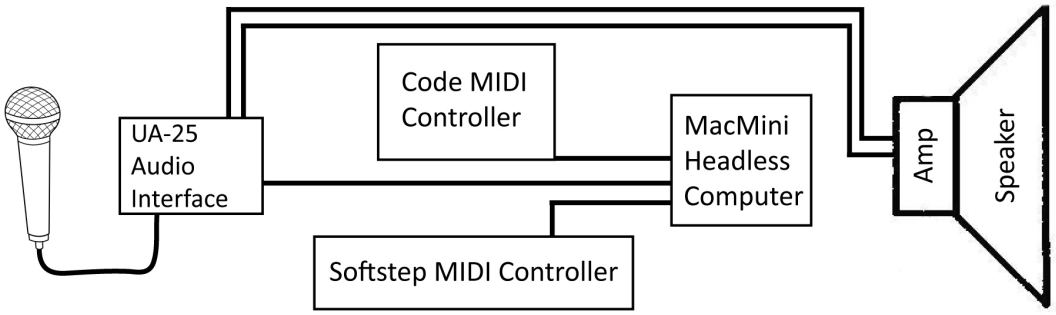


Figure 3.4 Outline schematic of hardware workflow.

During performance it is through one microphone and these two controllers alone that all messages between performer and computer are transacted. These two controllers (foot and hand) connect to a Mac mini computer (used 'headless' without monitor, mouse or keyboard). A clip-on microphone is used, eliminating the need for a microphone stand, further improving the visual communication between performer and audience. Two audio outputs from an audio interface connected to the computer provide clean (instrument) and wet (max patch) signals which are connected to the sound system.

The sounds systems used throughout this research range from typical house public address (PA) systems, to guitar amplifiers to specialised multichannel technologies. Entrusting the final link of the audio chain to an unknown engineer using an unknown audio system (hoping at least that it is known to her), is a perennial worry for any traveling musician. Leaving any audio quality issues aside, the traditional public address system model has limiting sound diffusion characteristics inherently built in. The nature of sound diffusion emanating from a single point – a loudspeaker cone – operates quite differently to the acoustics of a musical instrument which diffuses sound in many directions at once and interacts more readily with the acoustics of the room. This disparity becomes more pronounced in my work as a solo performer: depending on the audience's seating or standing position relative to the speakers, the listener can often hear the sounds coming from a place other than the instrument so that the aural and visual cues become disconnected. From the performer's perspective, musicians working with PA systems need an elaborate system of monitors in order to hear what the front of

house speakers are transmitting and very often unfortunately what the musician hears can be quite different to what an audience and sound engineer hears.

There have been moves towards presenting alternative models of sound reinforcement and sound diffusion.[113] In 2011, I was commissioned to work with a new form of hemispherical speaker, first designed by Perry Cook and Dan Trueman at Princeton University in 1997. This speaker design represents a paradigm shift from stereo speaker arrays as well as current alternative spatial music speaker arrays. The principle difference is the nature of sound diffusion:

> Hemispherical speakers are entirely different [from stereo and surround sound systems]. They produce "localized" sound that emanates from the speaker's position and interacts with a room's natural acoustics. The speakers have no front or back, and no sweet spot for listening. This allows electronically-produced sound to take on the characteristic intimacy of unamplified sound, changing the experience of both performer and audience, and improving the quality of hybrid performances that mix acoustic and electronic instruments.[114]

The second major difference to mono or stereo configurations I have used in the past is the hemispherical speaker's ability to output six discrete channels of audio. Essentially, this enables the diffusion of sound in six different directions and so, allows me to work spatially as well as temporally. I am drawn to using spatial speaker arrays in live performance as it significantly enhances the auditory experience, creating movement in the electronic processes as well as situating the electronic processes of my performance within a more acoustically compatible environment alongside the natural acoustic of my instrument.

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[113] The Bose L1 system signals the adaptation of these alternative models by a major audio company. "L1 systems feature a unique and highly effective vertical design: a column of closely spaced small speakers mounted in a slim enclosure […] The loudspeaker can be positioned behind or to the side of the performer — and you hear what the audience hears." (http://www.bose.com/controller?url=/shop_online/speakers/portable_amplification_systems/index.jsp, accessed 6 February 2013).

[114] *About Hemispheres* (http://isobelaudio.com/hemispheres/, accessed 19 April 2012).

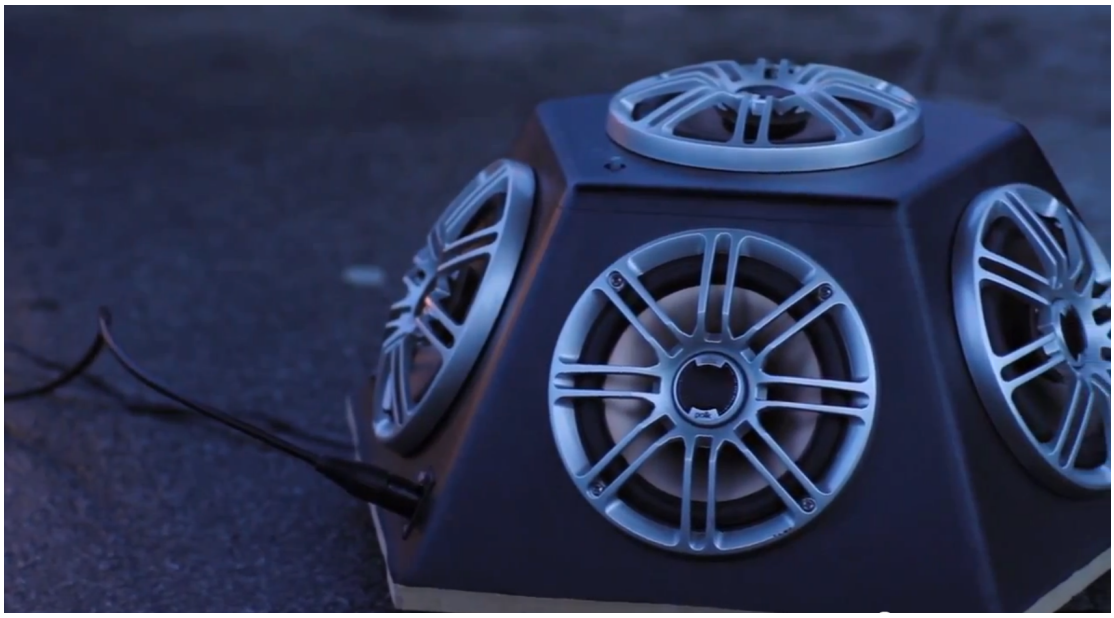


Figure 3.5 Isobel Audio's baritone hemispherical speaker.

Redesigning a Performance Practice: Software[115]

In making the initial transition from guitar foot effect pedals to a computer based set-up, the first goal was to recreate a software replica of my existing hardware and from there to experiment with designing new parameters to control in performance. Max was chosen ahead of other audio programming languages such as Pure Data (PD) – which has a less developed support structure or code-based languages such as Supercollider and ChucK which, typically have a longer learning curve. Max allows for a modular system of connecting smaller patches together which accurately mimicked the individual hardware units satisfactorily.

Early on in this workshop situation, it became evident that the capabilities of the new software far overpowered the previous hardware configuration. The computer could, in effect, replicate the hardware set up many times over so that multiple instances of a single effect could be realised creating textures and processes vastly increased in complexity. Many new types of digital processes could be experimented with without the financial commitment of buying new hardware.

[115] A more technical and detailed discussion of software is disclosed in Appendix A.

More important, however, was the ability to endlessly modify the software so that it met the needs at hand.

Following each workshop session and, in particular, each solo performance, the patch was evaluated and modified accordingly.[116] Effect modules which remained under utilised during a performance were altered or removed and processes which I returned to again and again remained in place and were further streamlined and improved if necessary. This spiralling research process allied the software development ever closer to my aesthetic concept. During the workshop sessions when the software suggested alternative choices these were road-tested in performance.[117]

The open-ended nature of working with Max presents many challenges. Without an imposed ceiling of limitation, boundless freedom can cause more problems than providing solutions. The initial limitations reside in the chosen hardware and my ability to interact with it in performance. The Code controller boasts seventy-seven adjustable parameters with the Softstep controller adding ten more. Within these (generous) hardware limitations I had to create virtual limitations within the software for the sake of usability and musicality. At all times the boundaries within each effect's capabilities were chosen with consideration for their musical characteristics.

Over the course of the first eighteen to twenty months of performing with Max onstage, a new patch was built for each performance.[118] By mid-2012, as the learning curve with Max plateaued somewhat, this approach was discarded in favour of a more consistent patch with which I could gain a working familiarity as I would with a traditional instrument. In tandem with this decision, I adopted a more open-ended approach and took a firm decision to pursue freely improvised

[116] I have also undertaken many group performances which make use of this new software instrument – in the region of thirty performances over the course of the research – which also served to road test the evolving software and hardware design.

[117] I am indebted to the work of many expert Max programmers particularly in relation to challenging my aesthetic concept of how the software should/could contribute to my own artistic development.

[118] My first performances using Max were in September 2010.

performances without any preconditions. Within the final eight to twelve months there was very little new programming and more time spent learning to integrate the potential of the software instrument with the acoustic instrument in live performance.

Interactivity

The vast possibilities of this software platform necessarily raises many choices in the design of the patch. In contrast to the guitar pedal set-up, Max offered an environment where the computer could react in specific directions to the acoustic instrument. I was initially drawn to the concept of interactive computer music, where the electronic processes are programmed to deliver a degree of autonomy. Programmer and composer Todd Winkler defines interactivity in this field as "a music composition or improvisation where software interprets a live performance to affect the music generated or modified by computers."[119]

This desire to build systems which listen and respond to the instrumental input became a guiding force for the software design. The initial expressions of these ideas were presented as open-ended compositions guided by the performer's improvisational skills. The three elements of composition, improvisation and computer interaction were used to create a balance where my personal language of improvised music could meet a wider field of digital signal processing to create a new and exciting form of expression.

> Interactive music suggests a new paradigm for computer music composition; one where the very fabric of a composition is informed by the subtleties of human gesture. These techniques offer non-musicians the direct experience of creatively shaping music through flexible compositional algorithms. At the same time, similar techniques can be used to capture musical nuances from expert musicians whose skills may impart a human expressive element to machine made music.[120]

[119] Todd Winkler, *Composing Interactive Music: Techniques and Ideas Using Max* (Cambridge: Massachusetts Institute of Technology, 1998), 3.

[120] Todd Winkler, *Proceedings of the 1995 Connecticut College Symposium on Arts and Technology*

By July 2010, I was designing software processes which enabled the computer to behave in a somewhat autonomous fashion. These concepts were initially quite simple: for example, patches which triggered sampling processes according to a timeline independent of the performer's actions thereby introducing a previously unavailable level of interaction between computer and performer. Aleatoric processes built into patches also extended this idea of creating a more 'independent' role for the computer. George E. Lewis's work with his *Voyager* project in this field extends this notion of interactivity, creating a computer system which acts as a musical partner to the human counterpart:

> I conceive a performance of Voyager as multiple parallel streams of music generation, emanating from both the computers and the humans – a non-hierarchical, improvisational, subject-subject model of discourse, rather than a stimulus/response setup.[121]

One such early piece, *Composition #6,* a guided improvisation for solo clarinet and interactive electronics, was performed in March 2011 in Project Arts Centre, Dublin. This performance is highlighted as it serves as an important marker in the evolution of the research by presenting a combination of free improvisation as well as housing a compositional structure which responds and interacts with the improvisation. Alongside these interactive processes the performer can directly control a number of digital signal processors including delay, chordal harmonizer and ring modulation. The performer is at liberty to decide when to start using the interactive elements during the performance.[122] The performance in March 2011 featured a lengthy freely improvised section which preceded the interactive composition section proper.

These early developmental stage performances had an individualised patch programmed for each discrete performance. These performances each dealt with a

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Strategies for Interaction: Computer Music, Performance, and Multimedia, 4.

[121] George E. Lewis, 'Too Many Notes: Complexity and Culture in Voyager,' *Leonardo Music Journal,* 10 (2000), 34.

[122] The specific interactive elements are software responses to pitch input (triggering samples) and random processes including sample length, panning and amplitude variation.

specific compositional interest. In the tradition of electroacoustic pioneers such as David Behrman and Gordon Mumma who stated that their custom built hardware instruments acted as a score, I view these Max patches as a score for a guided improvisation. This software score acts as a boundary box within which a set of compositional ideas are worked with in an improvised manner. Although the improviser must use this software score to navigate his way through the piece, the exact route is left open. From a compositional perspective, these early performances can be described as open works, in the sense that within the agreed parameters "considerable autonomy [is] left to the individual performer in the way he chooses to play the work." [123] These first research performances were preconceived compositions, albeit ones which relied on the improvisatory skills of the performer.

The compositional idea here can be likened to the effect of a clarinettist playing into the open lid of a grand piano while the pianist is holding down certain chords. The depressed keys mean the chosen notes are free to resonate with the clarinet tone, which can remotely 'play' the strings through sympathetic vibration. Pre-recorded clarinet tones, grouped into two pitch fields, are triggered by their corresponding live notes. Another element is the ability to change the harmonic content of the patch. When a particular note is performed (in this case a high D on the clarinet), the patch selects a new set of tones to listen to and trigger. Thus the performer can control the harmonic rate of the piece by choosing when and how often to play this particular note.

There are two distinct pitch fields of seven notes each. The performer chooses to trigger notes from either pitch field and can switch between fields as desired. Pitch field I features a wide spread over the instrument and heard as a chord has a rich euphonious character.



[123] Umberto Eco, *The Open Work*, Anna Cancogni (trans.), (Harvard University Press, 1989), 3.

Figure 3.6 *Composition #6,* pitch field I.

Pitch field II, has a narrower and higher register spread and heard as a chord has a more dissonant cluster nature. These characteristics should inform the improvisation.



Figure 3.7 *Composition #6,* pitch field II.

In the audio Example 3.1 we hear a melodic clarinet line over a shifting chordal structure. The clarinet line carefully chooses key notes from the pitch field (the pitch field changes from pitch field I to pitch field II at 01:12) to repopulate and interact with the computer processes.[124] Through note selection I can choose to emphasise certain qualities of either pitch field while simultaneously creating a melodic line which reflects and plays with these qualities.

This controlled interaction and tending to the electronic processes stands in stark contrast in terms of texture and use of rhythm with an earlier improvisation with the same patch but without engaging the compositional interactive processes. In Example 3.2, a clear structure emerges from a repeating rhythmic figure and various effects and improvised lines are worked over this figure. This early example shares much in common aesthetically with the later research examples. The sense of immersion, subverting expected rhythmic expectations, use of non-pitched materials and microtonal phrasing are all present.

While, technically, the interactive elements of *Composition #6* work, I was not musically satisfied with the outcome. The result does not match up with my aesthetic conception in an appealing way. Some textures in Example 3.1 last longer than I would choose (0:19) while others dissipate earlier than they would were I in direct control (2:13). In the period leading up to *Composition #6,* I had programmed interactive devices into patches, yet I found that during performance I would often choose not to enable these interactive (and deliberately unpredictable) processes,

[124] Audio examples are contained in Appendix D, compact disk two: Audio Examples.

reluctant to lose a certain level of control over the shaping of the piece.[125] As the research progressed, I curtailed or removed more and more of these interactive processes, settling for a compromise in using some stochastic processes (that is, random processes within a specified field) which can be enabled during performance and also guided within a range of values. The rejection of the computer interactivity paradigm does not imply, however, that I stopped 'interacting' with the DSP. The interplay between computer and performer became perhaps more traditionally interactive. Simple examples of these stochastic processes include panning and volume automation. More specialised and consequential processes include wet/dry mix of *Triple Delay;* random preset selection of *Spectral Delay;* random playback speed of *Reverse* module; random pitch shifting in *Extreme Slow Downer* module; organisation of material in the *SpectralConway* module.[126] This conflict between wanting to push myself beyond my comfort zone and yet having quite specific and dearly-held artistic aims in mind eventually forced the decision to commit to free improvisation for the remainder of this research.

In addition to the dissatisfaction with computer interactivity as a means to shape improvised music, I also rejected the notion of seeking to find an autonomous musical partner in the computer. In this age of increasing dependence upon computers in the realms of communication and social organisation, I wanted my programming to expand the musical gestures of the performer, enlarging the human impulse and mediating *that* in a digital context. True meaningful (social as well as musical) interaction can be only be found with another responsive human musician.[127]

[125] This balance between predictability and unpredictability is reflected in Winkler's own concept: "interactivity comes from a feeling of participation, where the range of possible actions is known or intuited, and the results have significant and obvious effects, yet there is enough mystery maintained to spark curiosity and exploration." Winkler, *Composing Interactive Music,* 3.

[126] See Appendix A for details of these processes.

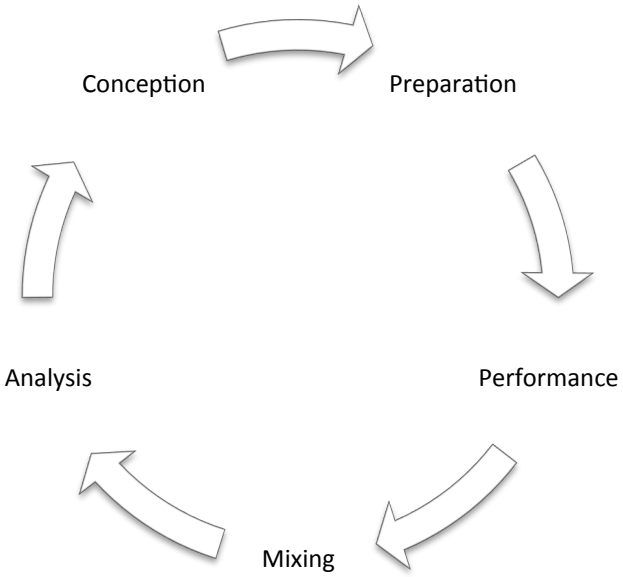
[127] This musical interaction between musicians is a fundamental concern in my broader musical practice but is outside the scope of this research, which is dedicated to solo performance.

Chapter Four: Capturing Outputs

Introduction

This chapter concerns itself with the methodology underlying the documentation and dissemination of a newly designed performance practice which combines free improvisation with customised digital signal processes. The ensuing performances (documented in Chapter Five) act as an expression of embodied knowledge in the field and serve as a road testing and proof of the design in 'real life' scenarios. Drawing on over thirty performances spread over three years, this research informs the planning and design of both the music presented and, more generally, the performance practice itself.

This practical research method can seen as a five-step iterative process.[128]



[128] Kemmis and McTaggart point to the spiralling process of the research process characterized by the action research protocol: "Characterized by spiralling cycles of problem identification, systematic data collection, reflection, analysis, data-driven action taken, and, finally, problem redefinition." S. Kemmis, R. McTaggart, *The Action Research Planner* (Victoria: Deakin University Press, 1982), 31.

Figure 4.1 Practical research spiral.

1) Initially a period of conceptualisation is required. Typically this involves visualising a performance in a particular performance space, choosing an appropriate instrument and sympathetic digital signal processes. More specific aims can occur here such as instructions for a guided improvisation, examination of source material (musical material, visual or text-based).

2) To realise a particular concept, an amount of preparation is required. This can occur in three areas: instrumental, software and/or further thought. Instrumental preparation includes practicing new fingerings, microtonal tunings, technical passages, etc. Software preparation typically is manifested as reworking existing Max patches to work for a specific performance, experimenting with new DSP techniques, or spatialisation techniques. Further thought can act as a refinement to the original conceptualisation, or memorisation of material (musical, text) and consideration of previous experience.

3) The performance is carried out within this research strategy so that the steps in the circle before the performance inform decisions during performance. The performance is bound to this research structure and as such differs considerably, from my perspective, to performances outside this research programme. Each performance is recorded as a high quality multi-track recording.[129]

4) The mixing step is a means to present musical output to listeners not present during the performance. It does not claim to truly document a performance in the traditionally held manner, but rather presents an audio file which is used as a basis for analysis and commentary.

5) The analysis and commentary serves as a reflective space in which to examine the process thus far. This step feeds into the conceptualisation (or re-conceptualisation) of the project, driving the research forward and preparing for the next performance.

[129] Each Max performance patch contains a 24bit uncompressed audio recorder. The patch captures twelve fully isolated discrete channels of audio, which allows me to create an uncompromised mix after the performance.

This chapter also explains my position in regard to notated music, identifying the perils of allowing the notational framework to cloud or limit our concept of music. Some time is spent examining the nature of recorded music and the problem of documenting improvisation as audio files. Central to this argument is the idea that recording music does not simply *record music* and that many other factors enter the fray once music has been recorded. The phenomenon of recorded music is used to leverage a discussion which examines musical activity as a social process rather than as an available product. This process-based viewpoint is essential in improvised music and shapes my approach to the dissemination of this work. This, in turn, implies that presenting an audio file as documentation is a heavily mediated transaction.

The position of musicological analysis in relation to my improvised performance practice is discussed here in order to clarify the methods undertaken in the following chapter. The traditional analytical model does not engage meaningfully with improvised music and so, I look to scoreless and phenomenological models used in electroacoustic and other music for appropriate avenues of analysis.

The Problems of Notation

The importance traditionally bestowed upon the interpretation of written notation in musicological analysis rests on the supposition that music notation carries and communicates the salient meaning of a piece of music. The ever-widening field of contemporary music research is witnessing a weakening of this paradigm. Composer Ferruccio Busoni posits notation as an obstacle between the composer's original inspiration and the actuality of the music, an issue which must be compensated through the creative input of the performer.

> Notation, the writing out of compositions, is primarily an ingenious expedient for catching an inspiration, with the purpose of exploiting it later. But notation is to improvisation as the portrait is to the living model […] Every notation is, in itself,

> the transcription of an abstract idea. The instant the pen seizes it, the idea loses its original form.[130]

Busoni's argument would seem to apply equally to the performance of music, that once a performer undertakes the mechanics of sound production, this too is a step away from an original abstract idea of music. However, his point holds that notation serves only to sketch out the principle ideas of the piece which must be embellished, on some level, by the musician to create music. The historical narrative, indeed, points out that before the nineteenth century notation served as a loose framework to be used in conjunction with extemporisation.[131]

While its continuing usefulness is undeniable, our notational system – like any system – contains limitations. Where these limitations can become problematic in real terms (that is, in the sonic plane which it aims to represent), is when we cease to be aware of the shortcomings and constructions of musical notation. To take one example, does a musician really play a middle *C* or would identifying it as 261.63 Hertz be more accurate?

> There is, in fact, no such thing as a "note" in music. A note is an abstract symbol representing a tone, which is an actual sound. You can play thousands of so-called *B*'s or *C*'s and they will all be different. Nothing can be standardized. Each vibratory event is unique.[132]

This is not disclosed as a pedantic or semantic exercise, rather this offers us an opportunity to investigate the assumptions which the tool of notation can promulgate in musical performance practice. In his book *On Sonic Art,* Trevor Wishart argues that conventional music theory treats its subject as if it functions on a *lattice,* a grid-like system consisting of three fundamental parameters: rhythm (or duration), pitch and fixed timbre (instrumentation).[133] Wishart references many

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[130] Ferruccio Busoni, *Sketch for a New Aesthetic of Music*, Theodore Baker (trans.), in *Three Classics in the Aesthetics of Music,* (New York: Dover, 1962), 17.

[131] John Butt and Laurence Dreyfus (eds.), *Playing with History: The Historical Approach to Musical Performance* (Cambridge: Cambridge University Press, 2002), 101.

[132] Stephen Nachmanovitch, *Free Play: Power of Improvisation in Life and the Arts* (New York: Jeremy P. Tarcher, 1993), 61.

[133] Wishart, *On Sonic Art,* 25.

musical practices, which deviate from this lattice (alternative tuning systems, folk embellishment, vocal timbral manipulation, Xenakis' use of glissandi), pointing out the inadequacies of the notational system particularly in relation to these musical expressions.

However, of much greater import is Wishart's thesis that this lattice model conditions our approach as composers, musicians and instrument designers to the possibilities and nature of music, thereby limiting our activity in areas between the received fixed constructs of the lattice model. In relation to the traditional analytical model this has fundamental implications: if a musical gesture can't be adequately represented on paper, it will not come under scrutiny in an analysis. This line of thinking has spawned new approaches to analysis which are considered below.

The role of notation in freely improvised music is, necessarily, a retrospective one and never functions as a tool with which to create music. I suggest that the paucity of notated free improvisation performances speaks not to the labour of transcription but rather that the aesthetics of free improvisation often aim toward "a musical experience where reference to the notational lattice is completely useless." [134] In fact, for some performers of free improvisation (particularly newcomers), this music represents an act of breaking down the assumptions implicit in written notation.

When using notation in this research, it is done with these considerations in mind. I will resist the temptation to heavily notate rhythmic complexity and trust the reader to treat notation here as a loose reference aid to the aural experience. In terms of rhythmic notation, little attempt will be made to accurately represent time values unless the example is attempting to illustrate a particular summative rhythmic device. Similarly, with pitch, the use of microtonality is not exhaustively annotated unless the example calls on recognising specific pitch interrelationships. In this regard, the developments in notation made in the latter half of the twentieth

[134] *Ibid.,* 36. My contention is borne out by the proliferation of improvised jazz performances, which have been subsequently notated for the purposes of analysis and as educational tools. While jazz music is an important strand in my own practice, the analysis of jazz music, based on discussions around note choice over chord progressions, time feel and rhythmic innovation over a relatively fixed pulse is unfortunately unsuitable as a model in our case.

century will be drawn on when they serve to illuminate particularly due to the frequent use of microtonality and non-metric rhythm in this research.[135]

The Recorded Artefact

Now it's a small minority of people who listen to music in the same place as the people making it. The majority of people today are listening to the sound of music more than they are listening to the music. – Basil Tschaikov.[136]

Writer Mark Katz's thesis that "recording does not simply record," but rather brings into play an interconnected set of considerations which place recorded music at a clear remove from the performance of music, presents a crucial distinction in this research.[137] The advent of recorded music in the early part of the twentieth century ushered in a new relationship to music which affected musicians as much their audiences.

> The performing musician was now expected to write and create for two very different spaces: the live venue, and the device that could play a recording or receive a transmission. Socially and acoustically, these spaces were worlds apart. But the compositions were expected to be the same! An audience who heard and loved a song on the radio naturally wanted to hear that same song at the club or the concert hall. These two demands seem unfair to me. The performing skills, not to mention the writing needs, the instrumentation, and the acoustic properties for each venue are completely different.[138]

Today's proliferation of recorded music has lead to a situation where there is a tendency to view an audio recording as a musical product, in and of itself, even when the recording is purportedly a document of a live performance. This commodification of music can be seen, on one hand, as a side-effect from the ever-

[135] Cage's use of note durations indicated by relative position on the score and the practice of including cent deviation from notated pitch are both useful additions to standard written notation.

[136] Quoted in *Settling the Score: A Journey through the Music of the Twentieth Century,* Michael Oliver (ed.), (London: Faber and Faber, 1999), 255.

[137] Mark Katz, *Capturing Sound: How Technology Has Changed Music* (Berkeley: University of California Press, 2005), 188.

[138] David Byrne, *How Music Works* (Edinburgh: Cannongate, 2012), 23.

widening influence of contemporary consumer culture. However, this viewpoint can also be traced back to a much earlier time through the lens of traditional musicology.

The discussion between musical process versus musical product is historically rooted in western art music theory, where the musical composition is represented as a written score. This score then becomes recognised as the musical work. Compounding this paradigm is the discipline of music analysis, which became a major component of traditional musicology. Traditionally, music analysis has concentrated almost exclusively on the composer's written score to furnish the musicologist with all the details necessary to carry out the task of presenting a cogent harmonic, rhythmic and structural overview of a piece of music.[139] Musicologist Nicholas Cook writes that "the text-based orientation of traditional musicology and theory hampers thinking about music as a performance art."[140] Cook goes on to say that "the nineteenth-century origins of the discipline [of musicology] lie in an emulation of the status and methods of philology and literary scholarship, as a result of which the study of musical texts came to be modelled on the study of literary ones," with the performance of these same musical texts acting "as a kind of supplement."[141]

Cook argues convincingly for a paradigm shift in the conceptualisation of music as something beyond the limitations of a product-based endeavour, towards a process-based activity. On one hand, this approach is necessarily more readily accepted in improvised music theory than western art music, which is where Cook's discourse is situated.[142] However, the debate around the *product* of music in opposition to the *process* of music has real implications to this research and the role

[139] It is, of course, common for contemporary 'new musicology' to consider external historical and sociological factors in an attempt to contextualise the composers decisions and possible expectations. See Lawrence Kramer, *Music as Cultural Practice, 1800-1900 (California Studies in 19th-Century Music)* (Berkeley: University of California Press, 1990).

[140] Nicholas Cook, 'Between Process and Product: Music and/as Performance,' *The Online Journal of the Society for Music Theory* 7/2 (2001). [no page numbers].

[141] *Ibid.*

[142] José Bowen, 'The History of Remembered Innovation: Tradition and its role in the Relationship between Musical Works and their Performances', *The Journal of Musicology* 11/2 (1993): 139-173.

of musical analysis and documentation. If we adhere to Christopher Small's assertion that music is an activity and not a *thing*, then the real value of this research must be seen as being contained in the musical performance and not the documentation thereof as

> The fundamental nature and meaning of music lie not in objects, not in musical works at all, but in action, in what people do. It is only by understanding what people do as they take part in a musical act that we can hope to understand its nature and the functions it fulfils in human life.[143]

Saxophonist David Borgo's writings chime in on this point when he claims that "music is all too often thought of as an objective or static commodity, whether as a notated score or a recorded performance, rather than as the dynamic individual and social activity that it more accurately represents."[144] In my particular case, the focus on this *process* of music rather than product is a core tenet in my conceptual approach to improvisation.

The analysis and depiction of a moving process is a much more evasive task than identifying a musical outcome. Indeed, the notion of documenting improvised art forms is, itself, a contentious issue. Open forms of music, designed or composed to sound radically different with each performance do not essentially sit well within the fixed medium of recorded music.

> Improvised music assumes its exact shape and sound only when executed. An improvised work or solo is, by definition, unique, belonging to a specific time and place. A recorded improvisation is therefore a paradox: it is music of the moment made timeless, the one-of-a-kind rendered reproducible, the spontaneous turned inevitable.[145]

The outcome of this approach is that "improvisations may come to be treated as fixed compositions, and studied as such."[146] Due to the intention of improvised

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[143] Christopher Small, *Musicking* (Middletown: Wesleyan University Press, 1998), 2.

[144] David Borgo, *Sync or Swarm: Improvising Music in a Complex Age* (New York: Continuum, 2005), 44.

[145] Katz, *Capturing Sound*, 79.

[146] *Ibid*., 79.

music to remain an open-ended, fluid process, it is important to consider performance and documentation of performance as wholly separate transactions. In this research the documentation of past performance points more to the *types* of processes which I use, instead of standing as fixed examples in their own right: I aim to document an evolving practice. Composer Michael Nyman compared a live performance and the recording thereof noting that "what a recording produced is a separate phenomenon, something really much stranger than the playing itself.

> Recordings of the most open processes are also misleading. Both Cage and Cardew have drawn attention to this. Talking of a composition which is indeterminate of its performance, Cage says that a recording of such a work 'has no more value than a postcard; it provides a knowledge of something that happened, whereas the action was a non-knowledge of something that had not yet happened.' Cardew is concerned about the practical problem of reproducing improvisation where documents such as tape recordings are essentially empty; they preserve chiefly the form that something took, give at best an indistinct hint as to the feeling, and cannot of course convey any sense of time and place.[147]

Documenting Performance

The presentation of audio recordings as part of this performance-based research must grapple with the problem that, "performance cannot be grasped as an object in time."[148] My background as an occasional record producer informs my awareness of some very real differences between presenting live performance and presenting recordings of music. The extension of these differences into the realm of documenting live performance as recordings raises a series of challenges. While acknowledging these issues, it is not my intention to diverge from the recorded

[147] Nyman, *Experimental Music,* 10.

[148] John Cage, *Silence* (London: Marion Boyars, 2009), 39.

structure or soundworld of the original performance and no additional recording will be carried out after the original performance.[149]

Typically, in a post-production situation, there are some different artistic decisions made during editing and mixing as opposed to during performing. Important recurring factors include: the acoustics of the performance space; audience reaction and interaction; visually informed decisions and improvisation versus composition (in-the-moment spontaneity contrasting with a post-performance consideration of the completed picture).

In discussing the acoustics of the performance space, the principal factor is the reverberation time and characteristics during the live performance. A big room with many hard, flat surfaces will tend towards a set of musical decisions entirely different to a performance in a small carpeted room with little distance between the performer and the audience. Attention to unusual acoustic phenomenon is, arguably, of even greater interest to the improvising musician, where the fabric of the music is designed to charge considerably from room to room.

> Like an extension of the improviser's instrument itself, the physical characteristics of a venue have the capacity to mold and shape an artist's sounds […] Performing on different parts of the stage and projecting sounds in different directions alter pitch colors and patterns of attack and decay. In especially reverberant halls, soloists sometimes create the impression of playing additional instruments.[150]

As the performances are close-miked, digital reverberation is added in post-production in order to either approximate the reverb characteristics of the performance space, or, more commonly, to present an idealised reverb type which is chosen in response to the specific musical content of the recorded performance.

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[149] One over-arching, obvious option is to present shortened extracts of performances which capture key elements under discussion. As there are almost ten hours of recorded material any attempt at total documentation is unrealistic.

[150] Berliner, *Thinking In Jazz,* 450.

The importance of the presence, participation and reaction of an audience during performance would be difficult to overstate.[151] Trombonist Curtis Fuller sums it up succinctly saying the audience is "what it's all about. No audience, no conversation. If I wasn't concerned with the audience, I might as well stay in a room alone and practice." [152] Perhaps the single biggest difference between the performance and the editing processes is that editing is a private, non-performative endeavour.[153] In my usual production work the absence of audience interaction triggers a range of different artistic choices, aiming to present music for a future listenership who may consume this music in ways beyond my control.

Closely connected to the issue of audience interaction is the role of visually informed decisions in this work. If the audience can visually connect the gestures of the performer with the production of sound this can greatly influence the nature of the performer's use of his physical being. To take an example, The Emerson String Quartet made calculated decisions when recording Shubert's Quintet in a recording studio:

> In concert, the performers would have lifted their bows off the strings after playing the chord, paused for a moment, and slowly returned them for the following phrase. Such a gesture would have heightened the drama of the moment and visually linked the two chords. On a recording, however, an extended silence like this would simply have been "dead air," something to be avoided.[154]

It is the loss of this nuance of visual gesture in performance which is at the heart of the difficulties of presenting live performances of computer music, a problem I was keen to avoid in my own practice (see Chapter Two). Stravinsky's assertion that "the sight of the gestures and movements of the various parts of the

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[151] For an analytical comparison between concert rehearsal and concert performance see Dirk Moelants, Michiel Demey, Maarten Grachten, Chia-Fen Wu and Marc Leman, 'The Influence of an Audience on Performers: A Comparison Between Rehearsal and Concert Using Audio, Video and Movement Data,' *Journal of New Music Research* 41/1 (March 2012): 67-78.

[152] Quoted in Berliner, *Thinking In Jazz,* 458.

[153] This is not an absolute shared viewpoint among studio producers. Lee 'Scratch' Perry considered his innovative production to be a form of performance. See Michael E. Veal, *Dub: Soundscapes and Shattered Songs in Jamaican Reggae* (Hanover: University Press of New England, 2007), 153.

[154] Katz, *Capturing Sound,* 22.

body producing the music is fundamentally necessary if it is to be grasped in all its fullness" is essentially true for performance.[155] Again, in my work outside this research documentation, I would strive to maintain a sense of musicality in terms of phrasing and timing in the absence of visual cues for a listening audience and to create a meaningful musical *recording.*

This method of disseminating or re-imagining performance for a listener who was not present at the original performance necessarily raises questions concerning the practice of improvisation and the practice of composition. These two disciplines have variously been considered as oppositional, unequal in terms of cultural 'worth', mutually dependant or elements of a dichotomous model which doesn't adequately represent the problem. However, presenting the audio documentation as compositions would undermine the importance of the performance practice and the sense of the audio file representing an improvised performance practice in action. This research is centred in the time and notion of performance. The use of, and interaction with, the new DSP tools is an on-going musical process, which is designed as an evolving pursuit towards creating improvised music. Any conception of the final documentation representing a composition is misplaced: the audio documentation can only be seen as a by-product from an improvised performance. This tension has accompanied the documentation of improvised music (and other performance art forms) since the advent of recording technology.

> If the similarity of Charlie Parker's recorded solos to compositions seems less than obvious, consider that when he recorded his music, the final product issued to the public would typically be picked as the best of several recordings "takes." (And Parker's case is not unique). So, there may be some correspondence between this practice and the kind of trial-and-error methods of composers.[156]

[155] Quoted in Leonard B. Meyer, *Emotion and Meaning in Music* (Chicago: University of Chicago Press, 1965), 80.

[156] Lee B. Brown, 'Improvisation,' in *The Routledge Companion to Philosophy and Music*, Theodore Gracyk and Andrew Kania (eds.), (London: Routledge, 2011), 63.

The 'composition' would be impossible without the prior performance. In this light I hope to present the documentation as a continuation of the intention behind the performance.

A Useful Analysis

An analysis which does not simplify the music for you is really a complete waste of time. – Cook.[157]

Edward T. Cone's aphoristic statement that "true analysis works through and for the ear" is a useful starting point for this research as is Cone's open minded approach to approaching an art work:[158]

> The good composition will always reveal, on close study, the methods of analysis needed for its own comprehension. This means that a good composition manifests its own structural principles, but it means more than that. In a wider context, it is an example of the proposition that a work of art ought to imply the standards by which it demands to be judged.[159]

Analysis is used here with three clear functions in mind: to present an account of the musical events (what); to discuss the compositional intentions of the performer (why); to reveal some of the mechanics involved (how). This process of written analysis contextualises and illustrates the aesthetic and compositional decisions behind the performance practice.

Music analysis has, in the main, been the preserve of musicology scholars and also composers. Music educator Joel Lester, writing about recent analytical publications aimed at performing musicians, suggests that "with rare and quite circumscribed exceptions something is strikingly absent from this literature – namely, performers and their performances." He puts forth the case that this

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[157] Nicholas Cook, *A Guide to Musical Analysis* (Oxford: Oxford University Press, 1994), 24.

[158] Edward T. Cone, 'Analysis Today,' *The Musical Quarterly* 46/2 (April 1960): 172-188 (174).

[159] *Ibid.*, 187.

practice has engendered a situation where "performers and performances are largely irrelevant to both the analytical process and the analysis itself."[160]

This situation can arise only when the musical work is seen, in a Platonic sense, as of more value than the music itself. This is an approach to analysis, which depends solely on the composer's written instructions and ignores singular performances of the piece. If music is a sonic activity designed to be heard, then, in terms of analysis and commentary, it seems unwise and incomplete to rely exclusively on a written instruction divorced from the sonic event. While this point has been argued in relation to musical works from the western art tradition, the issue becomes very much simpler when no score exists. A shift in approach away from examining musical works to understanding a 'particular rendition' is where analysis can play a role in examining improvised music where there is no concrete 'musical work'.[161] In addition to this viewpoint, I will argue that the most useful approach is to adopt some of the techniques used in analysis of electroacoustic music.

The traditional analytical model houses a number of sedimented ideas, which I wish to unpick here, as they represent important concepts in my transition from a traditional jazz instrumentalist to my current performance practice and, more broadly, in my understanding of music. Music analysis is, by definition, in a situation where it must constantly play catch-up with the latest developments in music making. The seismic changes in twentieth century compositional approaches and their acceptance onto the university campus and into international concert halls, quickly meant that the analytical profession had to adapt. The re-adoption of chance processes, open-form compositions and improvisation into the world of western art music and its discourse quickly brought about an environment where the traditional analytical model was inadequate in dealing with contemporary

[160] Joel Lester, 'Performance and Analysis: Interaction and Interpretation,' in *The Practice of Performance: Studies in Musical Interpretation,* John Rink (ed.), (Cambridge: Cambridge University Press, 2005), 197.

[161] *Ibid.,* 197.

compositional approaches.[162] By 1960, analyst Edward T. Cone asserted that analysis is simply unable to tackle the chance music of Cage, the deterministic music of Boulez or Stockhausen's Klavierstück XI, "where improvisation is given such free rein that it actually creates the form of the work anew at each performance."[163] Where analysis ignores the performance of the music in question this remains indubitable. Cone's observations of a changing aesthetic where "chords can no longer be precisely named, nor can their identity be maintained in differing contexts," signals a re-evaluation of the analytical toolkit.[164]

Another change, perhaps yet more fundamental, starting in the 1950s and gaining true momentum in the 1960s, was the creation of non score-based electroacoustic music. The rapid increase in composition of electronically produced music since has caused musicologists to seek new means of analysis and criticism, as the existing paradigm, based on score analysis, clearly no longer served the work being composed.[165] Consequently the acceptance of electroacoustic music as a branch of western art music has meant that many of the long-held ideas concerning written notation have came under increased scrutiny.

Pierre Schaeffer, one of the key exponents of the new, technologically-probing musical form and himself a committed theorist, wrote an analytical treatise *Traité des Objets Musicaux* in 1966.[166] Schaeffer approaches analysis of electroacoustic music in a 'scientific' manner, attempting to impose an empirical framework on recorded music. Schaeffer reduces sound events to identifiable '*objet sonore'* and establishes categories and sub-categories in which to file sounds according to mass, timbre, harmony, dynamics, grain, allure, melodic profile and so

[162] "Most compositions for tape do not come with a score. The lack of a written document creates great difficulties for the musicologist who insists on carrying out rigorous, "objective" work […] Because of this problem, music for tape has been somewhat disregarded by musicology." Thomas Licata, *Electroacoustic Music: Analytical Perspectives* (Westport, Greenwood Press, 2002), xv.

[163] Edward T. Cone, 'Analysis Today', *The Musical Quarterly* 46/2 (April 1960): 172-188 (176).

[164] Cone, *Analysis Today*, 185.

[165] This applies only to electronic music produced under the auspices of western art music, typically initially in university research centres during the 1950s and 60s. Until recently, electronic music operating in the popular music sphere garnered very little scholarly research.

[166] Pierre Schaeffer, *Traité des Objets Musicaux* (Paris: Éditions du Seuil, 1966).

on. This approach continued among his collective Groupe de Recherches Musicales (GRM) in Paris with Schaeffer's protégé François Delalande's and others' subsequent work through the 1970s, 80s and 90s. [167]

Given the existing music analysis paradigm and the laboratory-like work environments of early electronic music pioneers, it is unsurprising that notions of data analysis and categorisation featured heavily in early attempts to analyse this new music form.[168] The belief that analysis can discuss music in scientific – that is, quantifiable – terms has gained much weight but is misguided: It should follow that one could create formulae to compose masterpieces.

> It remains theoretical until it's happened. It's not like somebody doing rigorous scientific research, where you set out to determine, *is this true?* then link together the outcome of those smaller experiments to test the bigger hypothesis. It's not really like that. Could be dressed up as that, but what's really going on is a nonverbal, largely non-conceptual kind of activity, once called 'play.' You know, 'playing' the saxophone.[169]

Yet this thinking is easily debunked given the facts that musicians don't accurately play the precise intervals indicated and that temperament and rhythmic feel are subject to a fluidity and an idiosyncrasy among performers. More importantly, listeners don't experience a perfect fourth or a flattened thirteenth as identifiably such. Cook clarifies: "the one or two pigeonholes marked 'minor second' do not belong to the psychology of musical perception; they are artifices of

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[167] A clear example of this is Delalande's analysis of gesture in video footage of pianist Glen Gould performing works by J.S. Bach. See François Delalande, 'Meaning and behaviour patterns: The creation of meaning in interpreting and listening to music,' in Musical Signification: Essays in the Semiotic Theory and Analysis of Music, Eero Tarasti (ed.), (Berlin: Mouton de Gruyter, 1995), 219-228.

[168] I will sidestep much of the discourse surrounding the analysis of electroacoustic music in relation to the concept of acousmatic sound. Acousmatic refers to sound removed from its locus of production and heard purely on its own 'sound' terms. In my practice all of the sounds heard originate from the instrument (and in some instances the instrument and/or the voice), referencing nothing, on a sonic level, outside of itself.

[169] Evan Parker interviewed in John Corbett, *Extended Play: Sounding Off from John Cage to Dr. Funkenstein* (North Carolina: Duke University Press, 1994), 205.

musical notation."[170] Again, this all applies to the practice of analysing a mere written abstraction of music and not analysing the performance of music itself. Cook's final simile of this scientific methodology is to claim it is "the musical equivalent of trying to analyze Shakespeare by counting the letters on the page and working out the principles governing their distribution."[171]

In the context of contemporary practice-led arts research, this comparison of music research with the traditional methodologies of the 'hard sciences' which values empirical data and objectivity above the subjective and personal is seen as a less useful approach. Creative arts theorist Carole Gray's alternative model of research incorporates a series of principles which serves us here as a basis for a useful analytical framework:

> We are not scientists wearing a white laboratory coat and safety glasses replicating the research of others towards consensus […] In the creative arts we acknowledge individual realities and subjectivity; we recognise the involvement and interaction of the researcher with the research material and context - real situations which are usually complex and changing, requiring flexibility, responsiveness and improvisation; we negotiate understanding through inter-subjective views, personal construction, and relationship to context; research may not necessarily be replicated, (as in science) but the learning from it can be made accessible and possibly transferable in principle (probably not specifics) so as to be useful to others. [172]

This acknowledgement of the position of arts research in relation to the traditional hard sciences has allowed new methodologies to be tested in the field, opening the way for listening analysis and visual solutions.

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[170] Cook, *Musical Analysis,* 225.

[171] *Ibid.,* 227.

[172] Carole Gray, 'A Different Way of Knowing? Inquiry through Creative Practice,' Keynote paper in *'Production as Research', 1st Symposium of Visual Studies International Conference*, Universidad de Nuevo Leon, Monterrey, Mexico. 4-7 April 2006.

Listening, Looking

The growing independence of artistic research and analysis from the hegemony of the scientific model, has, over the course of the last thirty years, presented new approaches to analysing music. Lawrence Ferrara's influential 1984 essay *Phenomenology as a Tool for Musical Analysis* debunks the myth that any knowledge can be objective and firmly presents "a priori reverence for the human element in music. At both the composing and interpreting stages, music is imbued with a human presence."[173] For Ferrara, this presents the acts of listening and engaging with musical perception as crucial elements of his approach to analysis. He presents a five-stage process where "with each turn inward into the work – syntactical, semantic, and ontological – the analyst enters with increasing depth."

The first stage is described as 'open listening' where the listener adopts a non-critical stance "allowing any dimension of meaning […] to emerge." A narrative description of impressions is made following a series of open listenings. After this first stage, the analyst focuses on syntactical meanings in the music, listening through again and attempting to "bracket out semantic and ontological meanings that might come to mind while doing the syntactical section of the analysis. Ferrara claims that this can result in "an astounding experience of hearing sound purely as such." The third and fourth stages repeat this formula focusing on semantic and ontological qualities in the music respectively. Each stage ends in written impressions based on the nature of the listening task. The final stage is another 'open listening' where the author hopes that "the syntactical, semantic, and ontological levels of meaning may stand out in a conceptual, contrapuntal design of meaning-dimensions. They do not appear as separate or linear foci but in a three-dimensional texture of meanings that embellish and amplify each other by their very distinctiveness yet organic bond as part of the same work."[174]

Ferrara's approach serves as a useful precursor to the contemporary idea of listening analysis and the production of a 'listening score'. If Wishart's statement

[173] Lawrence Ferrara, 'Phenomenology as a Tool for Musical Analysis,' *The Musical Quarterly* 70/3 (Summer 1984): 355-373 (357).

[174] *Ibid.,* 360.

that "the experience that the listener has *is* the music and the composer's methodology, no matter how rational it may be, is a heuristic device realising the source of that experience in sound" is true, then the act of listening is surely central to understanding and talking about a piece of music.[175]

Electroacoustic music's absence of written score led some practitioners to explore alternative graphical interfaces with which to represent (and in some cases to compose) their electroacoustic music. Iannis Xenakis, who had a background in civil engineering and for whom architecture played an important role in his practice, was among the first to work with new methods of computer music notation.[176] His UPIC system, conceived in the 1950s and realised in the 1970s, incorporates both a graphic representation of the sounds heard as well as using this image to 'perform' the music, which is realised as music for tape:[177]

> Instead of a keyboard to perform the music, the UPIC's performance device is a mouse and/or a digital drawing board. These are used to trace the composer's graphic score into the UPIC computer program, which then reinterprets the drawings as real time instructions for sound synthesis – the composition/performance of a graphic musical score and real-time sound synthesis are unified by the UPIC's approach.[178]

Other software concerned with the visual representation of sound include the Electronic Music Plotting System (EMPS), developed in the 1980s and Acousmographe developed at Groupe de Recherches Musicales (GRM) in Paris.[179] In his discussion of the EMPS, Goffredo Haus says in the realm of electronic music two

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[175] Wishart, *On Sonic Art,* 43.

[176] Harley, James, *Xenakis: His Life in Music* (London: Taylor & Francis Ltd, 2005).

[177] Another computer music graphic composition software called Hyperscore is commercially available from http://hyperscore.wordpress.com where it is described as "computer-based visual language that conveys the "ingredients" for music in a more intuitive way [than conventional notation]."

[178] From liner notes of Iannis Xenakis, *Electroacoustic & Instrumental works from CCMIX Paris,* two compact discs Mode 98/99, 2001.

[179] First developed in the late 1980s and further refined throughout the 1990s, Acousmographe "is a software dedicated to the graphic representation of electronic and computer music. Was designed as a tool for teaching support and for the study and analysis of electroacoustic repertoire." The current expression of Acousmographe 3 was released in 2004. (http://www.musicainformatica.org/topics/acousmographe.php, accessed 1 August 2012).

scores are needed: an "executable" score and a listening score "containing information designed to facilitate comprehension of the music during listening."[180] The need for an executable score is redundant in the discussion of improvised electronic music. However the Acousmographe is adept at providing clear graphical information, detailing frequencies, harmonic constituents and allowing the analyst to include all manner of visual aids and text.

Methodology

The absence of a musical score in this research immediately reduces the available analytical approaches. Looking more specifically at analytical approaches used in non score-based music there are three dominant models to consider: the phenomenological approach; graphic listening score; written analysis.

The use of graphical representation, in our case, does not serve to clarify the music presented in the audio files. In fact, through the fixed presentation of an image, this method further abstracts and removes the listener from the moment of performance. The complex layering and interweaving of textures presents technical obstacles to rendering a coherent visual aid.

Ferrara's phenomenological method is relevant insofar as it allows for the unencumbered reaction of the listener and presents an account of the music as heard by the listener. In my case it is a moot point as to whether I can truly approach the musical material as an 'open listener.' This coloured viewpoint is seen as an advantage, providing an insider's analysis of this particular material. Ferrara's approach is modified then to form the basis of a written analytical commentary.

I have adopted a written analysis, which is based both on the audio recordings of the performances as well as the experiential element of the performer/researcher. The singular combined viewpoint of performer and analyst enables me to draw on memories, impressions and particulars of the performance

[180] G. Haus, 'EMPS: A system for graphic transcription of electronic music scores,' *Computer Music Journal* 7/3 (1983): 31-36 (35).

as well as drawing on musicological analysis. This first-hand account of the performer/composer places great value on discussing the lived experience of the creation of the music. As writer Nicholas Cook states simply: "I think that the emphasis many analysts place on objectivity and impartiality can only discourage the personal involvement that is, after all, the only sensible reason for anyone being interested in music."[181] The balance of description versus purposeful analysis is the analyst's challenge. However, even seemingly broad identification of the music heard can have far-reaching implications:

> So in analyzing music: reading the score several times, describing the details of the music in ordinary language, perhaps parsing the more complex chords – these simple procedures are usually more productive than immediately launching into some complex, theory-laden analysis. And in any case the difficulty two analysts can have in even agreeing what the facts of the matter are shows that the simplest description is not really neutral, but already involves interpretative criteria of some sort.[182]

I have a unique viewpoint in this field, singularly representing composer, performer and commentator. The positioning of the researcher within the field of knowledge under discussion has many unique positive attributes: The motivation to develop new knowledge is a based on a strong personal interest; an uncovering of tacit understanding and examination of intuitive processes; the extrapolation of personal subjective experience into the realm of the universal; and a rigorous 'real-world' testing of this new knowledge.[183]

The commentary splits the recorded material into five thematics: texture, time, movement, pitch and space. Each theme represents a recurring musical concern and relates directly to the aesthetic positioning discussed in Chapter Two.

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[181] Cook, *Musical Analysis*, 3.

[182] *Ibid.*, 230.

[183] Estelle Barrett and Barbara Bolt (eds.), *Practice as Research: Approaches to Creative Arts Enquiry* (London: I.B. Tauris, 2010), 5.

Chapter Five: Commentary on Performances

Introduction

The commentary here draws on over thirty performances in the field. The first of these solo performances at The Electric Picnic music festival in Co. Laois dates from September 2010 and the final one dates from August 2013 at Town Hall, Skibbereen Arts Festival, Co. Cork.[184] Five broad thematics are used to discuss and draw on the recorded material: texture, time, movement, pitch and space. While this is an artificial division and some overlap between thematics is inevitable, it is hoped that each thematic elucidates an area of recurring musical interest and illustrates various paths of navigation I have taken in relation to the specific concern.

Audio examples are contained in Appendix D, compact disk two: Audio Examples.[185]

Texture

Texture has traditionally been considered a signifier of whether music is monophonic, homophonic or polyphonic.[186] Thus, texture speaks to how individual musical lines are co-ordinated. However, this term's catchment is widening in the wake of twentieth century composers foregrounding 'texture' as another compositional concern. The treatment of texture in contemporary practice means that today "no longer will it suffice simply to define texture by differentiating quantities of strands in the musical fabric."[187] Johanna Frymoyer traces the use of the term in musicological circles back to the visual arts.

[184] See Appendix B for a full list of performances.

[185] Examples are numbered to reflect CD track numbers. E.g. Example 5.17 is track seventeen on Appendix D cd 2. (Examples 5.1 and 5.2 do not exist for this reason).

[186] Charles R. Hoffe, *Music Listening Today* (Belmont: Cengage Learning, 2009), 21.

[187] John Downey, 'Texture as Psycho-Rhythmics,' *Perspective of New Music* 20/2 (Summer 1982): 640-648 (644).

> Many textbooks encourage a certain intertextual understanding with the visual arts for the musical use of texture. Texture therefore acts in music analysis, first and foremost, as analogy […] The "tactile" sense of musical texture might be understood as a visceral or meaningful reaction to particular musical details that stand out within the listening experience but fail to fall within the technical explication of traditional analytic theories.[188]

This translation of terms from a representational, non-temporal art form to a temporal art form is problematic, as the textures and relationships of a painting can be viewed and reconsidered from the multiple perspectives of the viewer. In music the listener hears the piece sequentially – allied to a moving timeframe. Nevertheless, Frymoyer moves to a workable definition for texture as an analytical thematic in music:

> Musical texture is the composite effect of musical parameters interacting and vying with one another for the listener's attention in the totality of a listening experience […] Although many analysts list texture alongside pitch, rhythm, instrumentation, dynamics, and articulation, texture encompasses each of these parameters.[189]

I will use texture in a general sense here with Frymoyer's exposition in mind, referring to musical lines as well as density, timbre and details within the fabric of the music.

Textures themselves are used as musical building blocks resulting in structures quite removed from the traditional roles of melody, harmony and rhythm. However the live instrumental material originally is, more often than not, intended as melodic not textural. It is the DSP which recontextualises it as texture-material.

> The fairly simple rhythmic cells of former musical times, put in juxtaposition with one another, generate new rhythmic life, functioning as parts of larger time cycles […] The observation of [these new complex rhythmic cells] in action, through time,

[188] Johanna Frymoyer, 'Rethinking The Sign: Stylistic Competency and Interpretation of Musical Textures, 1890-1920' (Ph.D. diss., Princeton University, 2012), 2.

[189] *Ibid.,* 16.

> has the effect of renovating and extending our basic notion of texture; more precisely, of altering the very basis upon which texture may be perceived.[190]

Once it operates as a texture-field it forms a sonic bed with which new melodic material interacts. In this way texture predominantly operates as a background layer over which the instrument improvises and interacts.

Theorist Panayiotis A. Kokoras suggests a useful new textural grouping *holophony*, extending beyond the traditional textural boundaries of monophony, polyphony and homophony.

> In monophony, with only one voice, the listener's attention is focused solely on a single melodic line. In polyphony, the listener follows the melodic activity from one voice to another and, later, in homophony, which has a melody with chordal accompaniment, the listener focuses on the melody in the predominant voice. According to my proposal, in the next stage, termed *holophony*, the listener focuses on the synthesis of the simultaneously-layered sound streams and their morphopoiesis [the process of making structures in music] over time.[191]

Kokoras's categorisation resonates strongly with my own approach where "holophonic musical texture is best perceived as the synthesis of simultaneous sound streams into a coherent whole with internal components and focal points." This layering of concurrent audio processes is a near constant feature of the new software-enhanced practice. Kokoras suggests that the holophonic texture requires a change in perspective on the listener's behalf.

> The focus of the listener shifts in and out from one layer to another or from one group of layers to another. Overloading the structure with too many layers could produce chaos, however, whereas too few or excessively contrasting layers could move the perceptual interest away from the intrinsic elements of the sound, or could limit the potential for further development.[192]

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[190] Downey, 'Texture as Psycho-Rhythmics,' 644.

[191] Panayiotis A. Kokoras, 'Towards a Holophonic Musical Texture', *The Journal of Music and Meaning* 4 (Winter 2007). (http://www.musicandmeaning.net/issues/showArticle.php?artID=4.5, accessed 10 June 2013).

[192] Kokoras, 'Towards a Holophonic Musical Texture', section 5.

Careful management of a number of layers (the Max patch is capable of up to nine simultaneous effects) is crucial to maintaining musical clarity. Filters are often used to avoid dense textures cluttering the sonic space. Each effect module has an in-built dedicated filter allowing control of positioning sounds within a specific frequency range, which coupled with individual volume control on each module enables quite nuanced live mixing, allowing me to sculpt and fine tune textural details.

The initial source of all texture – in the timbral sense – in this music stems from the characteristics of the clarinet or saxophone sound. The concept of texture in my saxophone and clarinet technique is heavily influenced by the jazz musicians I studied as I began to develop my own approach to the instrument, in the sense of imbuing the tone with as much colour, nuance and texture as possible.[193] To help achieve this, I use an embouchure (as well as reed, mouthpiece and ligature set-ups) typical of a jazz musician. On a broad level this translates as incorporating breath sounds, spittle, air and grit into the tonal palette, the very qualities which are discouraged among today's classically trained woodwind musicians. With this attention to texture within the sound of the instrument, it was important for the computer software to have the ability to absorb and amplify these qualities rather than deliver an anodyne representation, stripped of the original intention. A fundamental musical aim of this research is to create an electronic mirror of the instrument, a mirror which opaquely portrays qualities of the live input and seeks to create a digital counterpart. Yet this electronic mirror also expands on the original musical gesture and reveals facets of its sound which are beyond the acoustic possibilities of the instrument. In turn, the instrumental line responds to these new avenues, driving the improvisation forward. It is an important concept for me that during the performance the electronics seemingly grow 'organically' from the woodwind sound. With this in mind, I have resisted the use of any computer synthesized sound and work only with processed sound from the instrument.

[193] This is in contrast with what has been called a 'legit' tone. i.e. the result of a classical embouchure, which values tonal consistency, blend with surrounding orchestral instruments and very accurate intonation.

Adding an audio stream underneath this instrumental voice is the most simple form of layering used in this research practice. The most prevalent expression of this is through the use of drones to underpin the live instrumental line. These can be grouped in two ways: the pure 'traditional' drone and drones which are infused with rhythmic elements and internal movement.[194] Example 5.3 and Example 5.4 show these contrasting uses of a drone, both drones serve to deliver a clear tonal centre, yet the second example implies much more beyond an identifiable harmonic key.[195] Throughout the performance recordings it is relatively rare to come across a simple, constant, monophonic drone. In general, I am keen to introduce an unstable base on which to improvise as this provides more avenues of investigation. Example 5.4 demonstrates the use of a drone which incorporates complex repeating rhythmic figures and textural details. These details are treated as secondary components of a drone which establishes a tonal centre in a more traditional sense. Example 5.4 illustrates the treatment of the traditional building blocks of music – melody, rhythm and harmony – as 'textural fields'. While clear rhythmic and structural elements can be heard, these are often considered on a textural level. This approach allows me to superimpose asynchronous rhythmic and harmonic material and to use these as a background layer for instrumental melodic activity.

Example 5.5 and Example 5.6 show a more involved level of layering to create denser textures. In Example 5.5 short melodic fragments are sampled and immediately repeated, looped and their contexts changed providing new material. The original melodic concerns of contour, tension and release, range and internal logic are all cast aside in favour of populating a sonic textural space, providing a call and response structure between the clarinet and the computer. In Example 5.6 rhythmic parts provide the basis of a textural space. We can hear the transition in this example from metric repeated material to a textural bed. The initial looped 2-beat triplet figure frames an interlocking melody. At 00:37 seconds, an

[194] Traditional in the sense of how drones are used in Irish traditional or Indian classical music where the drone is a pure tone devoid of any rhythmic, or attention-drawing, characteristics.

[195] Example 5.4 gives us a clear example of use of filters: here a resonant band filter emphasises high-mid frequencies allowing space in the lower frequencies for the bass clarinet improvisation.

asynchronous delay line breaks the rhythmic figure's dominant drive and thereafter the initial loop becomes a textural backdrop to the new improvisation. A second high pitched loop establishes a central role as the first loop fades out slowly. Meanwhile the clarinet superimposes a third rhythmic shape with low register trills. Melodic and rhythmic material are both treated in these examples as a textural force, with the transition from traditional to textural roles providing a forward moving narrative.

The transition to a new texture is almost always done via long cross-fades, creating an unbroken flow from one section to another. This is a music without edges or seams, where long gestures and overlapping textures serve to create a sense of immersion. Example 5.7 illustrates just such a textural transition: while the bass rumble drone is continuously present, many shifting layers above this form a complex texture which changes slowly. Identifying where a change starts or ends is impossible. These long cross-fades (the effect is heightened here by long notes on the clarinet) provide a sense of some movement within a static field. Example 5.7 also demonstrates clearly the notion of holophony with various layers attracting the listener's attention at times before merging into a background role.

This phenomenon of shifting layers of activity is closely related to the area of generative systems of music making, where the movement of layers is guided by forces beyond the direct control of the musician. This systems-based music plays with simple sets of rules to create an unfolding, non-repeating music. In the context of an underlying drone, this seemed to present an interesting layer of interactivity against which I could improvise. Generative systems, used in tandem with more static systems seemed a useful method to introduce processes which I didn't maintain ongoing control over.

Brian Eno, credited with popularising the term 'generative music,' uses mechanics and software to create autonomous musical systems. Removing the musician's agency is a central tenet here: "I wanted something that had an organic quality to it, had some sense of movement and change. Every time you played it

something slightly different happened."[196] Eno was deeply influenced by generative systems such as mathematician John Horton Conway's Game of Life, a self-generating cellular automaton. Eno used this as a starting point for the creation of some of his generative music.

> The rules are very simple. In the next generation, the next click of the clock, the squares are going to change statuses in some way or another. The square which has one or zero neighbors is going to die, a live square that has one or zero neighbors is going to die. A square which has two neighbors is going to survive. A square with three neighbors is going to give birth, is going to come alive, if it isn't already alive. A square with four or more neighbors is going to die of over crowding.[197]

In August 2012, I was serendipitously asked to perform a piece for generative Max patch and bass clarinet composed by Scott McLaughlin entitled *Whitewater.*[198] *Whitewater* uses an algorithm directly based on Conway's Game of Life. McLaughlin generously shared his Max object *SpectralConway*, built in collaboration with Dr. Pierre Alexandre Tremblay at the University of Huddersfield, and I built a new module around it which creates an evolving generative texture governed by the microphone input. The significance of *SpectralConway* is that "the process eschews the traditional quantised grid paradigm of the CA [cellular automata] in favour of a frequency continuum."[199] The precise mechanics of this system are of less importance to me than the resulting effect which manifests as a fluid shifting texture not bound by a notational grid of discrete pitch values. In Example 5.8 we can hear *SpectralConway* isolating particular clarinet tones and emphasising higher partials within these tones. A complex pattern of shifting beating tones and high range interferences form a soundscape which moves without any direct parameter manipulation. This process has become a permanent

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[196] Brian Eno, 'Generative Music: A talk delivered in San Francisco, June 8, 1996.' (http://www.inmotion magazine.com/eno1.html, accessed 29 January 2013).

[197] Brian Eno, 'Generative Music.'

[198] Scott McLaughlin, Pierre Alexandre Tremblay, 'SpectralConway: Cellular Automata Off The Grid,' *Proceedings of the International Computer Music Conference* (New York: ICMA, 2010), 68-71.

[199] McLaughlin, Tremblay, 'SpectralConway,' 68.

part of my evolved Max patch and can create drone-like textures which respond 'organically' and unpredictably yet maintain a useful musicality. In Example 5.8 the *SpectralConway* module reacts to note changes while also maintaining a constant pattern when the clarinet line stops or stays within a limited range (dynamically and harmonically). In Example 5.8, all the harmonic backing is provided by *SpectralConway*, at times sounding organ-like and later responding by issuing harsher 'electronic' sounding clusters.[200]

Another permanent module in my Max patch is the *Harmonizer*. This has been programmed to produce purely tuned intervals and also to act in an organic manner in terms of balance of (up to four) voices.[201] While nine chordal settings are available, I have found that, during performance, as we can hear in Example 5.9 there are two which I consistently favour. Tellingly, these two settings are those which carry the least amount of harmonic information: doubling the instrument up a perfect fourth and a perfect fifth or doubling the instrument down a perfect fourth and a perfect fifth. Rather than choosing from just intoned major sixth chords or minor diads (to take examples from two of the settings), with these two settings I am looking to achieve a textural change, rather than pointing to parallel moving harmonic activity. This chordal translation of a monophonic line thickens the texture of the instrumental line without implying chordal movement. It highlights my value of texture over harmonic or melodic movement.

Time

"The nature of music itself is that it flows past the listener through time" – Jennifer Judkins.[202]

[200] *SpectralConway* is one of the few truly interactive processes (in the computer music sense) remaining in the patch. See Chapter Three.

[201] This is approximated by a stochastic process where the amplitude and stereo panning of each harmonized voice varies independently.

[202] Jennifer Judkins, 'Silence, Sound, Noise, and Music,' in *Routledge Companion to Philosophy and Music*, Andrew Kania and Theodore Gracyk (eds.), (Routledge: Electronic Book, 2011), 15.

Time, in the most basic way, is the canvas that every musician draws upon. The thematic of time is used here to leverage discussion around duration, rhythmic aesthetics and time-based effect processes. Questions around performance duration raise a particular set of considerations with regard to solo performance. How long can one musician generate music for? Does stamina become a consideration? How long can a single musician engage an audience for? Throughout this research I have tended to favour performances around twenty to thirty minutes long. This is, for me, an ideal duration to maintain a non-stop performance as one continuous, immersive piece of music. Some situations have called for longer works (the longest was fifty minutes – a site specific piece accompanying sunset on the winter solstice). Occasionally the concert format calls for several ten minute improvisations. A number of shorter solo sets took place in the context of performing solo within a group performance. These have ranged from four to seven minutes. In my experience, it seems that after forty minutes I tend to repeat my musical ideas and it becomes increasingly difficult in terms of physical/mental stamina to remain in a satisfying musical flow.

Considerations of duration in solo performance also penetrate into the realm of individual note duration. The need for a woodwind instrumentalist to constantly support and manipulate a vibrating column of air to produce sound has immediate implications in terms of stamina. Simply put, one must breathe. When a saxophonist stops playing to breathe in, the music stops. In an unaccompanied solo performance this is a defining truth.[203] The work of saxophonists such as Evan Parker and John Butcher has established circular breathing as an important tool in maintaining a constant stream of sound in a contemporary solo saxophone context.[204] In Example 5.10, I use circular breathing to keep a continuous drone underneath a sequence of sung notes creating a chordal movement. The use of digital delay can be seen as the electronic extension of circular breathing – a digital

[203] Abnormally long reverberation times are sometimes used in solo performance to counteract this. See Unni Løvlid, *Vita,* compact disc Heilo B0009IVVWY, 2005.

[204] John Butcher, *13 Friendly Numbers*, compact disc ACTA 6, 1992. Evan Parker, *Six of One,* vinyl long player Incus Records 39, 1982. (These contemporary players have built on the early pioneering work of saxophonists Earl Bostic and Rahsaan Roland Kirk).

counterpart to the acoustic technique. Delay is a time-based effect, delaying a live signal and repeating it at a later time. This can be used to provide an extra layer of dimension and depth to the music. Delay based effects are the most commonly employed digital signal processes throughout this research.

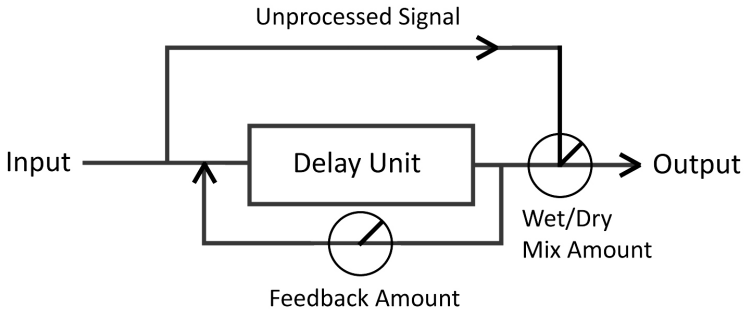


Figure 5.1 Digital delay schematic.

There are a number of ways, varying in complexity, in which delay is used. Example 5.11 is one of the most straightforward examples. Here a single delay line allows a simple phrase to build into a chordal wall of sound. The delay is turned off to allow certain phrases pass through unprocessed and then turned on again to sample new phrases. This technique allows me to build up certain chords or tonal centres while playing other notes outside the chosen pitch field. Differing sampling length (controlled by a footswitch) means that some notes fade out quicker than others creating an unpredictable shimmering effect. The structure created here needs to be fed a stream of notes otherwise it slowly decays away to silence.

I am interested in delay lines which do more than simply repeat a selection of notes a certain number of times in ever-decreasing volume. In an attempt to introduce a level of unpredictability I designed the *TripleDelay* module, which houses three distinct time-based processes: reverse, changing speed and changing octave.[205] We can hear a clear example of this in Example 5.12, where the clarinet line repeats and varies an insistent fragment which is cut up and reordered. The

[205] See Appendix A for detailed discussion of this software process.

effect of this is analogous to the cut and paste techniques of visual artists working in collage at the turn of the century as well as Schaeffer's audio equivalent.[206]

> Collage [...] is direct quotation, literal repetition or citation of something taken out of its context and placed in another […] The aim is to construct something new out of old, to connect what may appear dissimilar in order to achieve new insights and understanding.[207]

The *TripleDelay* module renews previously heard material, camouflaged through electronics processes and re-presents it where, often, as in this example the underlying context has changed. My own use of audio collage and the *TripleDelay* module is an example of one of the less predictable processes in the Max patch. While the design and use of this process is conscious, the results cannot be accurately guessed at, placing me in a position of heightened listening and interactivity with the digital signal processes. This extreme cut and paste texture is also something which is beyond the acoustic technical possibilities of the instrument, providing a previously unattainable texture.

Investigating further levels of complexity in digital delays made me interested in working with spectral delay. Spectral delay represents an interesting variant to standard digital delay by isolating discrete frequency bands (bins) and applying different delay times to these.[208] Using a fast Fourier transform the audio signal's frequencies are analysed and distributed into bins. In the *SpectralDelay* module these bins are delayed by varying times and are used for musical applications which reach far beyond traditional delay effects.

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[206] See for visual examples of this work see Dorothea Dietrich, *The Collages of Kurt Schwitters: Tradition and Innovation* (Cambridge: Cambridge University Press, 1995).

[207] Walter Benjamin quoted in Michael Shanks, *Experiencing the Past: On the Character of Archaeology* (London: Routledge, 1992), 188-190.

[208] For in depth discussion see Dr. David Kim-Boyle, 'Spectral Delays With Frequency Domain Processing,' Proceedings of the 7th International Conference on Digital Audio Effects, 5-8 October 2004. (http://dafx04.na.infn.it/WebProc/Proc/P_042.pdf, accessed 20 February 2013).

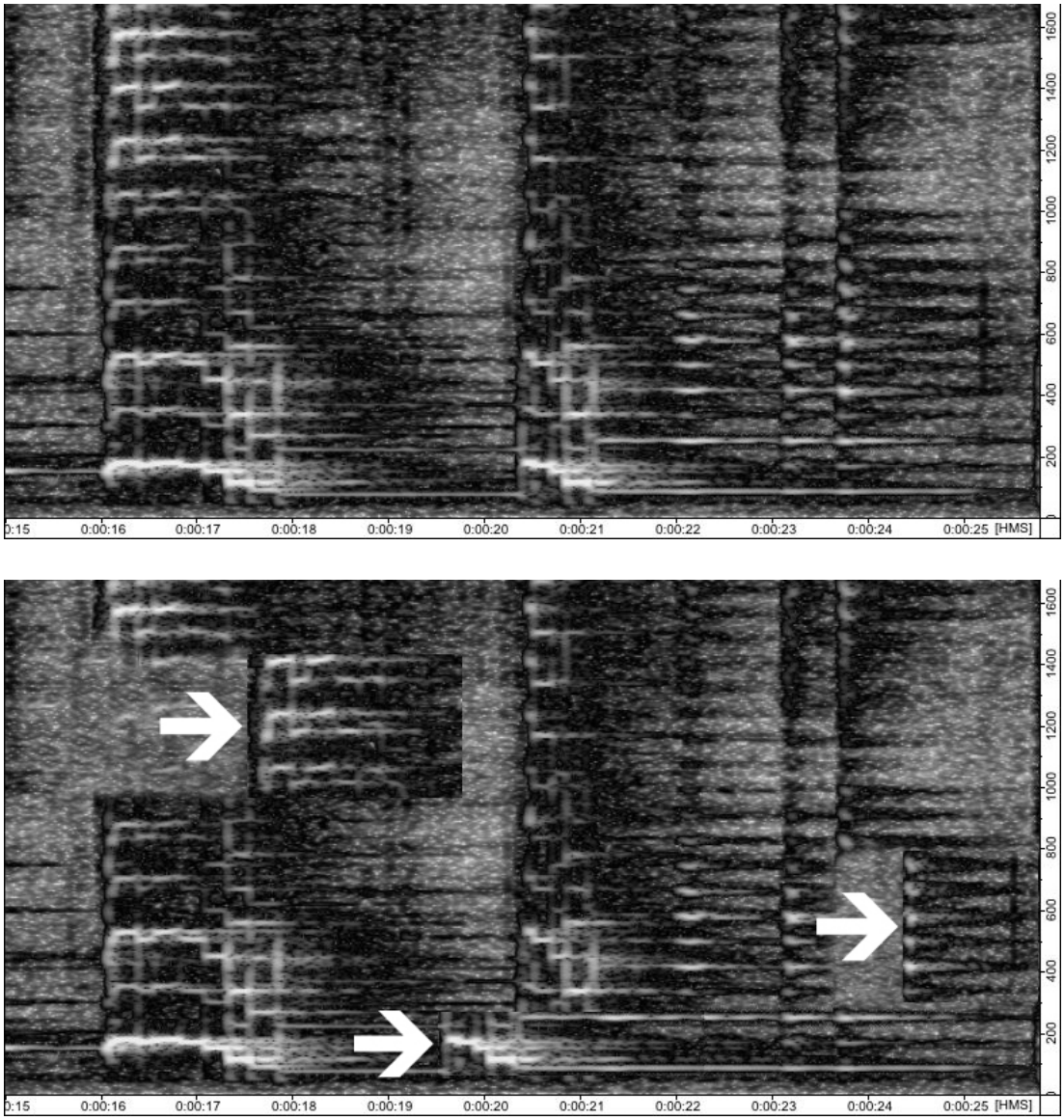


Figure 5.2 Spectral delay. The top image shows a spectrogram (time is represented on the horizontal axis and frequency on the vertical axis) of a 10 second recording of bass clarinet. The image below displays the same recording with spectral delay processing, three segments in discrete frequency bands (1000 Hz – 1440 Hz; 60 Hz – 280 Hz; 310 Hz – 790 Hz) have changed temporal position. (Note, this is a semi-schematic diagram).

The two discrete *SpectralDelay* modules in my patch are used to create rhythmically active soundscapes which, while a direct result of the incoming signal, bear little or no resemblance to the original musical gesture. This effect provides an immediate soundscape, the exact character of which is hard to predict. This unpredictable quality, similar to *TripleDelay* above, is useful, acting as an element

with which to improvise and interact. In Example 5.13 *SpectralDelay* provides a circular loop with interesting rhythmic details over which I improvise a simple repeated figure on the clarinet. Example 5.14 shows that the spectral delay module can also be used to generate shifting textures which respond continuously to the live improvisation. This malleability has ensured that spectral delays are an oft-used effect in the Max patch.

These various uses of delays are tied to my concepts of working with time in a rhythmic sense: the question of time in music is, generally, most clearly expressed in terms of metric rhythm. Metric rhythm, groove or playing 'in time' serves to delineate the perceived passage of linear time. Yet, we can think of a number of different treatments of time as a continuum from regular pulse to a free rubato sense of time. Let us suppose that the most basic use of time is to treat it as a repeating metric pulse. The next progression from this is to use overlapping layers of pulse simultaneously. The effect of changing time feels (accelerando, changing bar lengths) to break expectations of regular recurring pulse is sometimes used. Still further along this continuum is the notion of pulse as a textural force, where pulse is removed from its usual context of providing the tempo of a piece. Finally, the furthest removed from metric rhythm is the use of rubato time feel. I will provide examples of each of these time interpretations in sequence below.



Figure 5.3 Time continuum moving from pulse based music to rubato phrasing.

Electronic loops (formed from acoustic live samples) are a useful and immediate method to create regular, non-shifting rhythmic pulsing patterns during an improvisation. Non-pitched extended techniques are sometimes used, as in Example 5.15, to generate percussive rhythmic patterns such as these bass clarinet key clicks. When using clearly delineated rhythmic loops, I will often treat the cycle as a measureless bar as can be heard in Example 5.16, that is, a continuous pulse without a start or an end. This ensures that phrases and accents will not start and

end in an expected stage of the loop. This method of phrasing helps to break up the expected pattern and maintains a circular feeling to the music. In the case of Example 5.17, a rudimentary microphone thump with a low frequency resonant filter creates a bass drum sound. Again, the pulse is treated as an unending measure without bar lines. The simple repetition of a bass drum maintains and delivers the audience's expectation - this constant pulse foreshadows the clarinet melody, allowing for a very spare melodic line which neither builds nor develops.

Broadly speaking, throughout this research I am less interested in clear use of metric rhythm than in the use of repetition as a type of texture. Example 5.18 illustrates a recurring technique using two or more asynchronous rhythmic parts layered over each other. In this example, we hear two loops moving in and out of phase with each other. The bass clarinet phrasing seems at times to respond to the underlying shifting rhythmic implications and yet maintains a floating relationship with them in terms of accurate timing. Having more than a single stream of rhythmic pulse affords me a much freer, looser sense of phrasing. Towards the end of the extract the clarinet uses a repeated figure incorporating a two note slap tongue percussive effect. The result is three repeating rhythmic layers moving forward simultaneously. To ensure audibility these three layers are carefully separated in terms of frequency through the use of filters.

Further along this continuum towards freedom from repetitive rhythmic drive and phrasing is the combining of odd-time 'bar lengths' and rhythmic styles.[209] This is a direct influence from my earlier work in contemporary jazz where I composed written music for small group ensembles which made much use of changing time signatures, giving the music surprising rhythmic angles and cycles.[210] This complexity in rhythmic structure found in today's jazz music has its roots in the twentieth century modernist music and works such as Stravinsky's *Rite of Spring*

[209] 'Bar lengths' is in inverted commas to remind the listener that the music is improvised and, as such, is not originally conceived of in written notation.

[210] For an example of this previous work see Trihornophone, *Breathing Time,* compact disc Diatribe DIACD004, 2008.

where "by changing the time signatures of successive bars, over fairly long spans of time, the effect of conventional meter may come to be negated altogether."[211]

These underlying structures, in turn, add a rhythmic complexity to the melodic line. Example 5.19 shows a move away from summative rhythms – none of the rhythmic values are precise subsets of each other – with quick transitions between phrases grouped in varying patterns to free rubato phrasing. Figure 5.4 below, a transcription of the first seventeen seconds of the piece, shows the use of changing bar lengths as well as ritardandi to create an approach to rhythmic phrasing which darts and turns, creating fluidity and suspense.



Figure 5.4 Transcription of clarinet line in Example 5.19.

At 00:56, the *TripleDelay* module repeats an earlier fragment and telescopes it by playing it at a much faster tempo, reflecting the clarinet's own treatment of changing time values. For these techniques to work coherently, these rhythmic elements are treated as a textural force, so that time and texture now become an intertwined concern.

In Example 5.20 a lyrical improvised melody is best served by tempo rubato. Rubato phrasing is diametrically opposed to the concept of summative rhythms. In this example the bass clarinet line is subtly supported by the electronics which do not imply any rhythmic time. I also commonly use rubato phrasing when the DSP

[211] Downey, 'Texture as Psycho-Rhythmics,' 642.

may have a strong rhythmical element. While Example 5.21 has a rhythmically driving loop, I superimpose an interpretation of an Irish traditional air (Amhrán na Leabhar) over this, disregarding the phrasing of the loop. This suggests a playing between the notions of forward movement and static sound. This placing of the instrumental voice within a repetitive soundscape is a recurring theme of this research, allowing the momentum of melody to sit within varying levels of moving structures.

Movement

Movement here refers to harmonic pace as well as the number of discrete musical events in a specific duration. As discussed in Chapter Two, my practice has seen a shift away from the dense harmonic structures typical of be-bop era jazz towards a much slower harmonic pace and a fascination with more static music. The same is true of melodic complexity and speed of phrasing. This research investigates the use of stasis as a building block in improvisation. We can view these concerns in terms of varying degrees of stasis with linear phrasing and an intensification in the frequency of discrete musical gestures at one end of a continuum contrasting with more ruminative, sparse and often repetitive music occupying the other end.

The use of stasis has two distinct origins in my practice: electroacoustic minimalism (typified in the drone work of Phill Niblock and La Monte Young among others) and various folk musics. One clear example of a slow unfolding folk idiom is Japanese Gagaku, which uses continuous drones, chord clusters, slow tempi and repetition.

> One of the most notable characteristics of the Gagaku ensemble is its intentionally modest means. The clear intention – in other Japanese art forms as well – is to achieve as much as possible with limited means […] Sharp timbres are set against each other, sharp attacks, nothing is polished in this music. The Shō is a wonder. Seventeen pipes, coming together in an air chamber that the player blows into […] There are analogous forms of the instrument in China and Southeast Asia, but it is

> the Japanese version that has attained perfect beauty of sound. It produces chords that envelop the sound on the entire ensemble, almost 'freeze' it.[212]

Gagaku also makes use of quite select timbres among its instrumentation. The shō, a free reed instrument is clearly referenced in Example 5.22, which resides at the far end of the stasis continuum.[213] This example uses processing to create static blocks of sound over a textural drone. Using a minimum of means (unusually none of the DSP parameters are modified over the course of these three and a half minutes), this piece seeks to let each gesture breathe on its own terms, as it were. This continuous loop was created in the performance by sampling a short section of a clarinet drone which also contained a note simultaneously sung a perfect fifth above the clarinet. This sample was then pitched an octave lower. This loop is also sent through a band-pass filter which serves to accentuate mid-frequency details. The loop has a drone quality (in the sense that it establishes a tonal centre) as well as much timbral detail. It also contains complex rhythmic qualities: it can be heard as a one bar loop in 7/4 at approximately 110 bpm, however other poly-rhythms disguise this structure, yielding a satisfyingly ambiguous rhythmic feel suitable for a figure, which is maintained for over three minutes. In order to create these blocks of sound a harmonizer processes the live clarinet, which radically changes the sound characteristics of the instrument. This harmonizer is set to cluster chords providing an added textural element. The clarinet chords reinforce the 7/4 ostinato loop by playing only on the downbeat of the seven beat cycle. This is used to set up a sense of stasis which becomes subverted later in the piece as the clarinet syncopates the phrasing.

In contrast to Example 5.22 above, where stasis provides a condition of rest, Example 5.23 uses the static field to create a sense of tension. A repeating phrase (a looped slap-tonguing pattern) sets an unchanging rhythmic tone. Within the details

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[212] Ton de Leeuw, *Ton de Leeuw (Netherlands Music Archive),* John Lydon (trans.), (London: Routledge, 1997), 24-34.

[213] The shō is a mouth organ from the same family as the *khaen* (Thailand) and the *sheng* (China). The sheng was the precursor to the development of reed organs, the harmonium and the accordion. See Jeremy Montagu, *Origins and Development of Musical Instruments* (Lanham: Scarecrow Press, 2007), 95-97. The shō has been featured in the work of contemporary composers such as Toshi Ichiyanagi, Toru Takemitsu and John Cage.

of the digital processes, however, there are beating patterns and subtle changes of timbre. The instrumental line is both insistent and spacious. While not as appreciable through a recording, I feel there is huge tension created in performance if I play sparsely with long spaces between phrases. The DSP processes here maintain a constant tension while the instrumental line imbues movement.

Linear phrasing, more typical of jazz melodic phrasing, seeks to imply a sense of forward motion and logic-driven voice leading. Example 5.24, which uses the acoustic instrument without any DSP (but makes use of a – literally – cavernous reverberation time), demonstrates a melodically sparse approach to implying tonal movement. The instrumental line implies a diatonic harmonic movement – an E Phrygian chord resolving to a D minor triad – but working with the natural reverb and incorporating silence this can be quite obliquely stated.

The amount of movement within the melodic line can reconfigure the context of the digital processing. Example 5.25, illustrated in Figure 5.5, sees a melodic line used to create a sense of changing harmony over a static field which drives forward a musical narrative: the example contains a clear beginning, middle and end. The computer maintains a constant drone, the primary notes of which are G and E. This suggests a tonal centre of C major. The second gesture, a multiphonic trill, ends on a B natural changing the implied harmony to E minor. A double time figure resolves back to the fifth. The end section (starting here on the third system) uses a slower rhythm and a three note motif with alternating note choice which implies a simple three chord movement between tonic, mediant and relative minor.

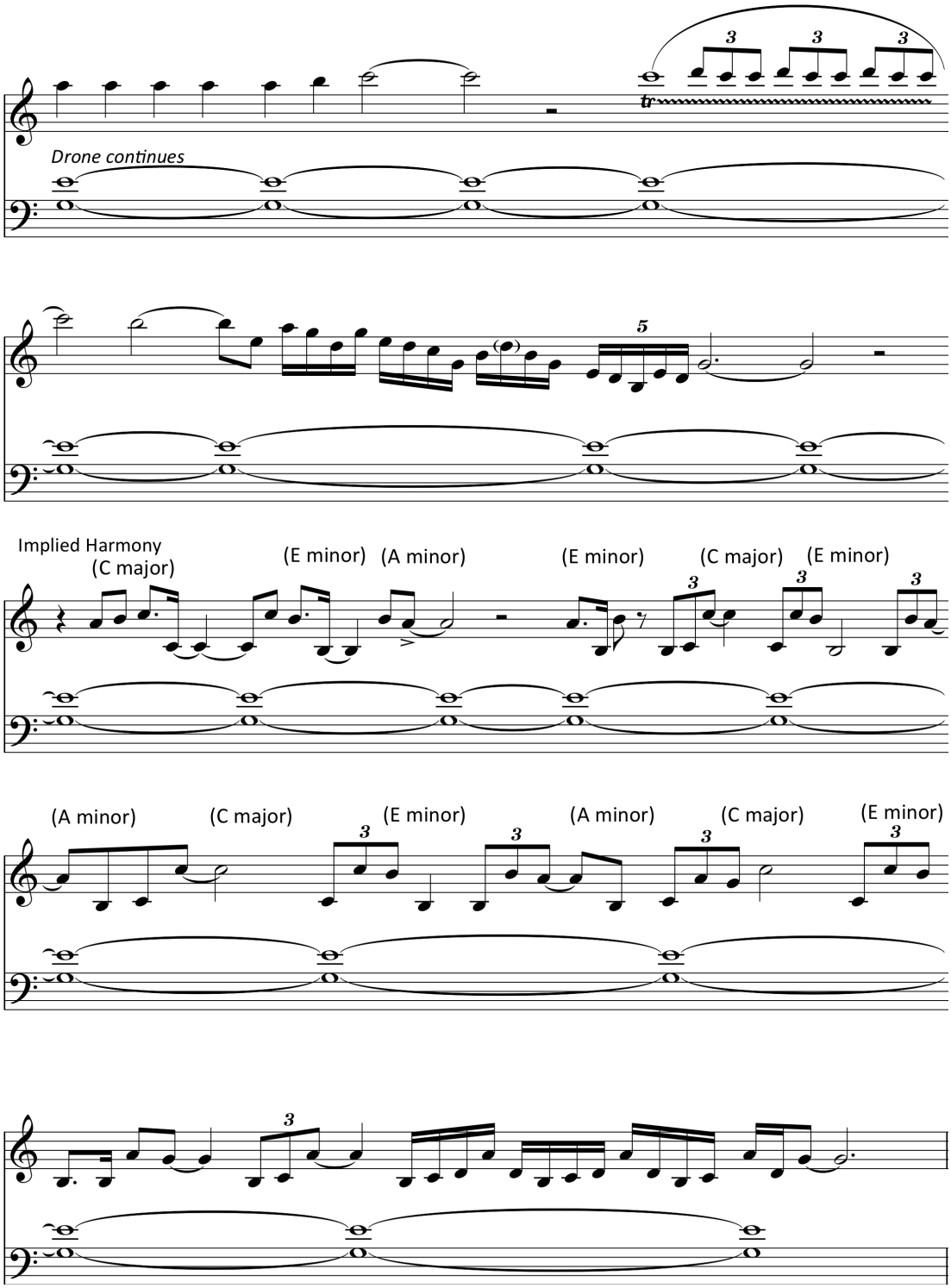


Figure 5.5 Transcription of saxophone line in Example 5.25 with drone and implied harmonic movement.

Outside of textural and melodic movement, modulation and real chordal movement is also occasionally used in this work. In accordance with my position on tuning and pure intervals, I use modulation in a harmonically limited sense. Within

the melodic line, it is unusual for me to play with any degree of chromaticism or stray far away from a scalar mode. I have programmed simple modulation capabilities into some of the effect modules however. Example 5.26 modulates up a fourth from the tonic providing a sense of lift supporting the melodic direction and returns again to the tonic. (Note the low bass frequencies in the drone, this performance made use of a powerful subwoofer system.) Straightforward modulations beyond the range of a fourth or fifth are only rarely used in this work.

Another technique I use to create harmonic movement is the *Extreme Time-Stretch* module. This module owes its initial concept to 9 Beet Stretch, an online streaming project taking Beethoven's ninth symphony and time stretching it to a twenty-four hour duration.[214] This project, in turn, lead to Romanian audio software engineer Paul Nasca developing a software program with which users could perform their own time stretching with any audio.[215] The success and popularity of Nasca's program interested the Max community and Volker Böhm built a Max object on which it is loosely based. The *Extreme Time-Stretch* module stretches samples to twelve times their length, resulting in ambient soundscapes with a glacial quality. This module also features a harmonizer which can be set for a number of chord types. These chordal presets mainly consist of fourths, fifths and octaves above and/or below the original pitch, thereby largely avoiding harmonic movement.[216] If the sample (which is recorded live) has enough melodic movement, then the resulting time-stretched signal can act as a chord sequence of sorts. In Example 5.27 the time-stretched signal is heard along with a tremolo loop and a low rumble, the clarinet plays sporadic lines in response to the chordal wall.

Singing and playing simultaneously through the instrument can create rich chordal textures. In the performance recorded in Example 5.28, the Max patch processes are outputting a bouncing, somewhat volatile soundworld. I use the acoustic device of singing perfect fourths, fifths, major sixths, minor sevenths and

[214] 9 Beet Stretch (http://www.expandedfield.net, accessed 28 March 2013).

[215] Paul's Extreme Sound Stretch (http://www.paulnasca.com/open-source-projects#TOC-Paul-s-Extreme-Sound-Stretch, accessed 29 March 2013).

[216] There is also a random chord harmonizer overriding these chordal presets.

the octave above the unchanging fundamental while circular breathing. This raw acoustic presence grounds the piece and also provides a moving sequence of chords over a constant drone. The presence of beating tones within these chords points to my on-going interest in tuning systems and subtle manipulation of pitch.

Pitch

Using pitch is the most basic and obvious resource of any traditional instrumentalist.[217] Yet, in the wake of the twentieth century modernists, non-pitched materials have become common currency among improvising instrumentalists.[218] I use both these elements, sometimes pitting non-pitched percussive sounds against melodic pitched material. Within the use of pitch material the manipulation of intonation and use of microtonality is frequent throughout this research.[219] My masters thesis research into microtonality was centred on quartertone production on the alto saxophone, an area which is receiving ever more attention among the contemporary music milieu.[220] Since then, my use of microtonality found expression as a tool for melodic embellishment as well as performing in just intonation and the use of associated acoustic phenomena such as beating tones and difference tones. Much of the impetus of this direction comes not from contemporary new music but rather through the study of various folk musics.

We will first look at some examples of my use of pitch (and non-pitch) materials which don't directly involve the use of digital signal processing to attain an understanding of how I work directly with melody, microtonality and ornamentation. Both Example 5.29 and Example 5.30, devoid of any computer

[217] Pitch here refers to melodic, as opposed to harmonic, structures.

[218] The language of twentieth century compositional works such as Berio's *Sequenzas* have made a lasting influence on contemporary improvising musicians.

[219] As a general term, microtonality is defined here as any amount of conscious cent deviation from twelve tone equal temperament.

[220] Seán Mac Erlaine, 'Microtonality as an Expressive Device: an Approach for the Contemporary Saxophonist,' (Masters diss., Dublin Institute of Technology, 2009). Available from http://arrow.dit.ie/aaconmusdiss/1/

processing, demonstrate a melodic line which fills up much of the available space and both clearly aim to imply a harmonic underpinning over which the melodic action occurs. It is telling to see how dense these improvisations are compared to other examples which do use DSP. Having other sounds playing when I am not physically playing the instrument encourages less melodic activity. Figure 5.6 shows the melodic line repeatedly reinforcing the root (C) as if to maintain that note in the listener's mind while other melodic and tuning concerns are played out.



Figure 5.6 Transcription of xaphoon line in Example 5.29 with cent deviations of key note choices.

In Figure 5.7 the fast descending figure interspersed within the improvised melody grounds the piece to low E on the instrument. This example emphasises the note B, using it as a pivot point at the beginning, jumping up to the B, and, with the repeated fast descending figure, starting on B and ending on the low E, reinforcing a V - I cadence.

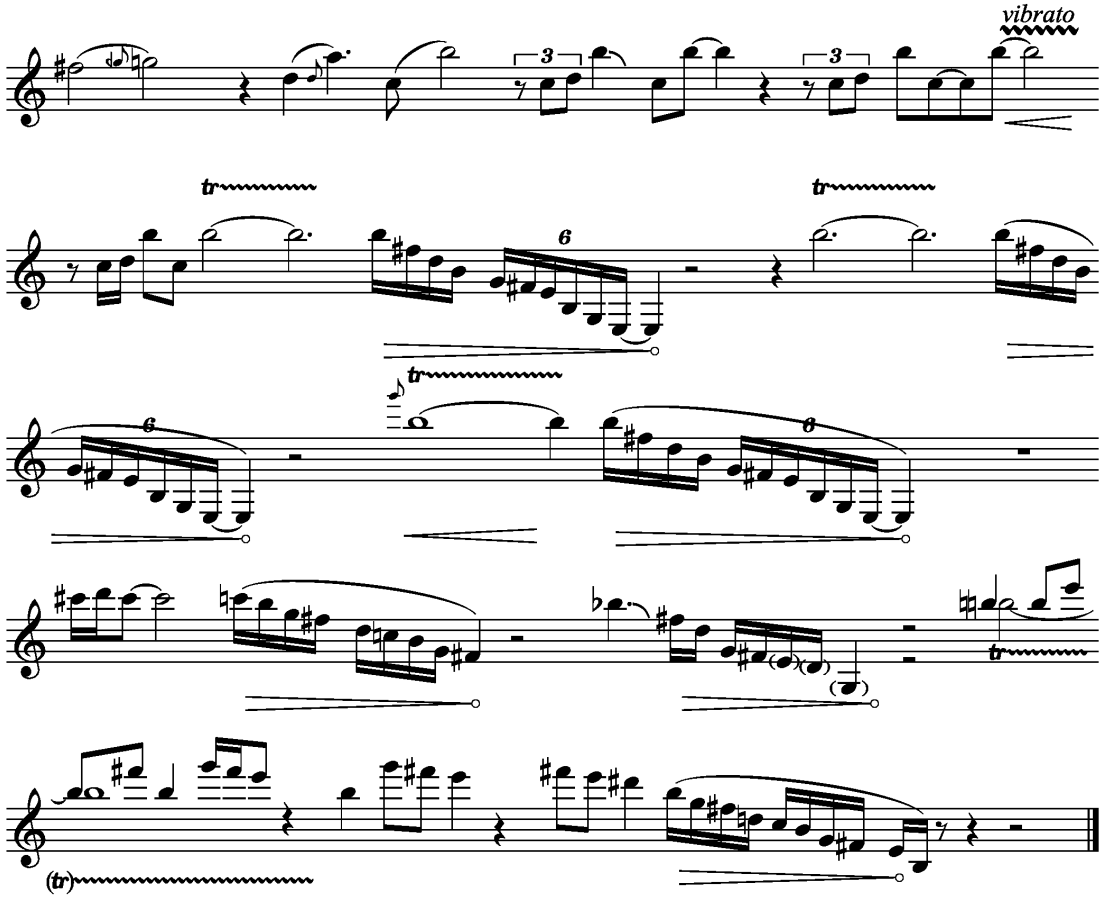


Figure 5.7 Transcription of bass clarinet line in Example 5.30.

These twin concerns of implying a harmonic underpinning (generally a fixed tonal centre) and the notion of creating a full and immersive sense of music go to the crux of why I engage with digital signal processing, broadening the reach of my acoustic practice. The idea of a harmonic underpinning ranges from the examples above where a tonal centre is implied through the use of melodic line, to the use of drones and the creation of an immersive soundscape from where the instrumental line emerges. All of these settings are designed to work with my instrumental use of pitch and melody. These two examples will also serve to illustrate more specific concerns in terms of pitch: microtonality, repetition of simple material and timbral variation.

Working with microtonality to adjust interval sizes is also something I use to increase nuance as well as create a harmonic ambiguity.[221] Returning to Example

[221] See George W. Boswell, 'The Neutral Tone as a Function of Folk-Song Text,' *Yearbook of the International Folk Music Council*, Vol. 2 (1970): 127-132.

5.29, this is performed on a xaphoon, a single reed keyless wind instrument with a two octave range, which allows much fluidity in intonation. The xaphoon is used here to specifically reference the Armenian duduk in terms of tone. Octaves are sometimes stretched (high C is sometimes up to sixty-two cents sharp) as are repeated notes, imbuing a level of nuance unusual for an outwardly simple diatonic melody. Taking C as a tonal centre, I am interested mainly here in altering the major and minor thirds of the IV chord. This technique creates a sense of ambiguity as to the chord quality (F major or F minor or perhaps something else).[222] Figure 5.6 pinpoints cent deviation from twelve tone equal temperament. A pitch analysis of the intonation of the thirds shows significant deviations, sometimes tuning pure major thirds and at other times sharpening minor thirds so that they approach major harmony, occupying the area known as neutral thirds – neither major nor minor.[223] The use of simple and repeated material serves to accentuate the varying tuning of recurring notes.

The melodic segment heard in Example 5.30, performed on bass clarinet, illustrates some preoccupations in terms of repetition of simple material, using timbral variation to move the improvisation forward and using the acoustic of the space (this was recorded in quite a large underground cavern). While the melodic line is busy at times, it also allows for space in which we hear the decay of the flurries of activity. This is a clear response to improvising in such a particular acoustic space. Melodic material is arranged in a scalar fashion and wide intervallic leaps are avoided. However this example also uses the full range of the instrument. Instabilities in microtonal trills are exploited, creating at times more than one line. The tonal colour of the bass clarinet is quite vocalised and insistent.

Folk music is a constant influence in melodic choice. One recurring melodic source of inspiration throughout this research is Irish traditional music. The tendency is that the allusions are quite oblique, as evidenced in Example 5.31 and Example 5.32. In Example 5.31 the clarinet is heard over a loping rhythmic figure.

[222] The influence of my study of Swedish folk melodies is clear here as this major/minor ambiguity is a recurring feature in much Swedish folk music.

[223] Pitch analysis was carried out using Melodyne software. http://www.celemony.com/

Although removed from its context and disguised, the influence of Irish uilleann pipe music is clear, through the tuning and ornamentation typical of this tradition. The forceful keening timbre and microtonal flattening of the repeated notes immediately evoke traditional pipe music. Another use of Irish traditional material, this time using typical phrasing patterns is heard in Example 5.32. Microtonal embellishments are here interwoven into the melodic line over a simple clarinet drone.

The two previous examples illustrate the most elementary use of pitch in the DSP, in the sense that the computer is reproducing an unchanging and recurring pitch field. In Example 5.32 it is a single tone which acts as a tonal centre, in Example 5.31 we hear a regular 4/4 pattern, one bar long which doesn't vary.

A further stage of complexity occurs when the live instrumental line interacts and responds to the pitch fields of the Max patch. In Example 5.33, simple melodic fragments are processed in ways to create chromatic and timbral tensions between the live and the processed sound. In this example a simple repeated clarinet phrase is re-contextualised through various types of live processing: at times delay lines are transposed microtonally creating beating textures, at other times small shards of electronically manipulated sound create a parallel field of depth alongside the clarinet improvisation. The phrasing of the improvised line plays with the unpredictable phrasing of the effect module as well as its tuning.

Another form of pitch interaction occurs when the patch provides clear harmonies which call on traditional voice leading skills, building melodic lines in response to the DSP. Example 5.34 provides such an example, where the *Extreme Time-Stretch* module repeats a sample recorded during the performance at 1/12th of its original speed. This extremely slow movement gives the sample an unpredictable nature in terms of when the notes might change, introducing a quality of interactivity for the improviser. Although in this example we hear several iterations of the slow sample (approximately a forty second cycle), the melodic line alternates its quality, starting in the bass clarinet's high register, working throughout the range to form melodies built on the shifting chords underneath.

After a pause in the melodic line a new repeated note rhythmic figure imbues a new direction to the piece.

Example 5.35 is a complete piece which illustrates my approach to pitch combining microtonal embellishment, non-pitched sounds, chordal textures and vocalization. A seven-note microtonal phrase starts the piece.

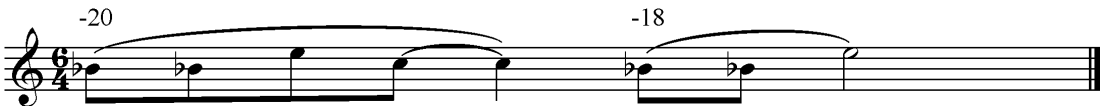


Figure 5.8 Melodic theme from Example 5.35.

After repeating this three times, I noticed particularly loud key noise picked up from the microphone.[224] As I continued the improvisation I used this non-pitched source in order to form a triplet figure loop. This non-pitched figure is used as a textural foil against which the melody develops in complexity, embellishing more and more notes with microtonal inflections. The use of a harmonizer creates cluster chords until a new loop develops at 2:10. This new texture pushes the improvisation forward and instils a new level of dynamic energy reflected in the vocalization and growing intensity of the melodic line. Slap-tonguing is used to provide more non-pitched material. By 3:20 a short delay line is introduced which has the effect of generating a new textural field which is fed from the live pitch material of the melodic line. At the same time the triplet figure loop is faded out allowing for a change in mood. Responding to this new amorphous texture, the clarinet line starts to slow down, drawing out longer lines with increasing space until finally it resolves on a single note. As in Example 5.34 above, we hear constant interaction between pitch and non-pitch materials from the software influencing the melodic clarinet line throughout the piece.

[224] This performance in The Cork Opera House used a large PA system which over-amplified the vibrations of the wood via a clip-on microphone directly attached to the body of the instrument.

Space

Space is, here, a polysemous term. A music with space is a music which allows and encourages thought. Space is closely related to transparency and silence. Yet space also refers to the performance space, a critical component of this research. A final consideration of the term speaks to an internal space and considers Csikszentmihalyi's notion of flow during performance.

One of the attractions for me in solo unaccompanied music is the degree of transparency attainable in the sonic field. Detail comes to the fore in any solo music and, for this research, maintaining this transparent quality is an important consideration. During performance, I continuously monitor individual levels of effect modules against the balance with the instrument to maintain clarity and transparency in the music. In performance and during the mixing stage I also use audio compressors to highlight low level details in the mix. This live element of mixing while performing is contingent on my ability to hear the blended sound of instrument and electronics. The nature of the performance space in this regard becomes a crucial consideration.

This is a practice which can enjoy completion during a performance only. For performance to happen, my practice needs to be met by an audience in an agreed space. The demands of free improvisation mean that the nature of the performance space and the audience in it become critical factors in the arc of the music made. The contract between and audience and performer is, in freely improvised music, a special one and the space where it happens can determine the success of the endevour.

> To improvise and not to be responsive to one's surroundings is a contradiction if not an impossibility […] The audience for improvisation, good or bad, active or passive, sympathetic or hostile, has a power that no other audience has. It can affect the creation of that which is being witnessed. And perhaps because of that possibility the audience has a degree of intimacy with the music that is not achieved in any other situation.[225]

[225] Bailey, *Improvisation,* 44.

To be comfortable working with the challenge of a new space for each performance, adaptability is essential.[226] This adaptability is called for in terms of available sound equipment, set-up, duration of performance and, most critically, within the fabric of the music itself. When an improviser is forced to work outside her usual conditions (if, indeed, any usual conditions prevail) this appraisal of the current situation acts as a starting point and, ideally, as a musical catalyst. A challenge in this dissertation is to present a clear demonstration of my adapting to varying spaces as text or audio examples convey nothing of the original architectural venue and so, comparing one with another can be of limited value. The true display of this must be witnessed at the time of performance.

I have been extremely fortunate, over the course of this research, to perform in a wide range of venues. Some are purpose built music venues, some are re-appropriated for performance and still others rarely house musical events.[227] The architecture of the space acoustically, aesthetically and physically determines, in some large part, the nature of the music improvised there. This welcome variance between spaces provides the initial mark on the blank canvas of the free improvisation. The characteristics of the space along with my own performance and the presence of an audience are the three ingredients necessary for a successful event.

On an architectural level, the performance spaces used have included black box spaces, art galleries, theatres, churches, concert halls, a cave, radio stations and outdoor spaces. While contemporary audiences are becoming ever more familiar with performances happening in site-specific situations and in re-purposed spaces, many such spaces do retain particular characteristics due to historical social or religious uses.

The black box model is seen as a *tabula rasa* for performing arts. The format of a simple rectangular room, painted black is developed from contemporary

[226] Just two spaces – The Joinery and Smock Alley Theatre – were used twice over the course of this research.

[227] For a complete list of venues and events see Appendix B.

theatre practice since the 1960s.[228] Examples of such spaces used include Project Arts Centre, Dublin (80 seater); Portalen, Denmark (120 seater); Nun's Island Theatre, Galway (40 seater). While these spaces offer excellent lighting options, I find their neutralised and functional design subtract from the richer potential of a repurposed space. Acoustically, the black box is optimised for spoken word and lacks the acoustic depth and resonances one finds in other spaces.



Figure 5.9 Performance space at Banquet Hall, Smock Alley Theatre, Dublin.

One common alternative in my career to performing in a theatre space has been to make use of churches. Three research performances were undertaken in Irish churches: Banquet Hall, Smock Alley (decommissioned), Dublin 2 (100 seater); Saint Audoen's Church, Dublin 7 (120 seater); Saint Patrick's Church, The Hill of Tara, Co. Meath (60 seater). Christian church acoustic design is renowned for its long decay reverberation. This is particularly true for older churches.[229] Built in 1190, Saint Audoen's Church (the only remaining medieval parish church in Dublin) has a surprisingly short reverberation time as does Saint Patrick's Church (also built in the 1190s). Originally built as a theatre in 1662, Smock Alley was redesigned as a church in 1811, deconsecrated in 1989 and is today again requisitioned as a theatre

[228] William Missouri Downs, Lou Anne Wright and Erik Ramsey, *The Art of Theatre: Then and Now* (Belmont: Cengage Learning, Inc., 2012), 402.

[229] Mendel Kleiner, David Lloyd Klepper and Rendell R. Torres, *Worship Space Acoustics* (Florida: J Ross Publishing, 2010).

and performance space.[230] The Banquet Hall space (see Figure 5.9) boasts a particularly long reverberation time.

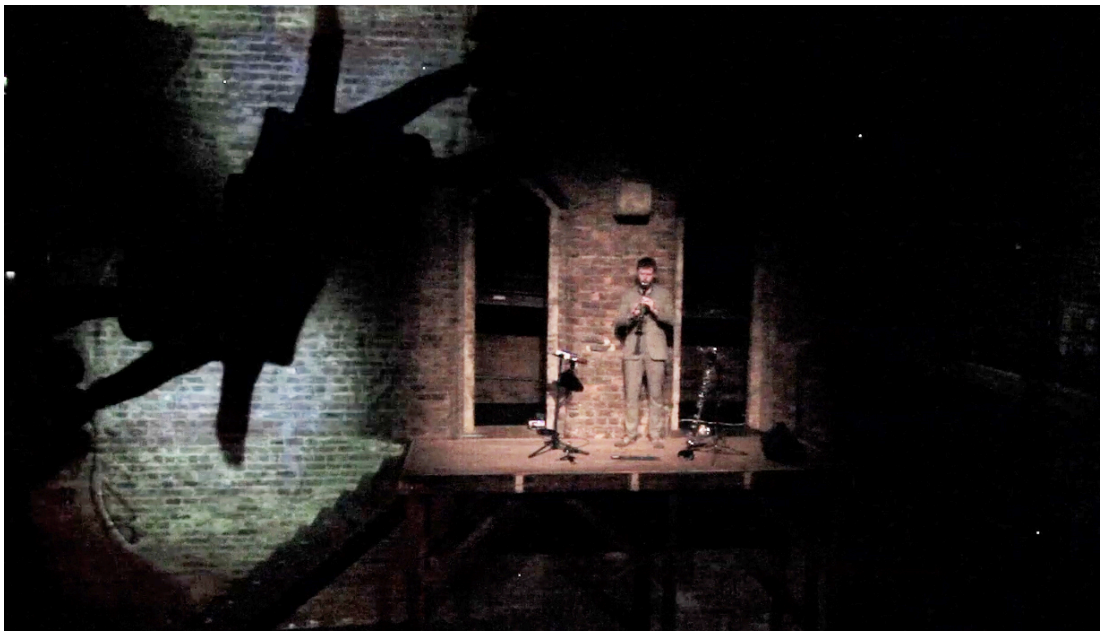


Figure 5.10 Performance at Boy's School (with live visuals by Donal Dineen), Smock Alley Theatre, Dublin, 17 March 2013.

Site specific performances in unusual or repurposed spaces have proven to be the most fruitful during this research. Examples of these include The Bandstand, East Pier, Dun Laoghaire, Dublin (30 seater); The Boy's School, Smock Alley, Dublin 2 (120 seater); The Atrium, The Model, Sligo (40 seater); Irish Museum of Modern Art at Earlsfort Terrace, Dublin 2 (60 seater); The Back Loft, Saint Augustine Street, Dublin 7 (40 seater); Mitchelstown Cave, Co. Cork (120 seater); The Courtyard, Contemporary Music Centre, Dublin 2 (50 seater); The Joinery, Stoneybatter, Dublin 7 (70 seater). Each of these spaces presents challenges and idiosyncrasies, both logistical and acoustic, which are absent in a black box, yet these very specifics often form the germ of the improvisation. Logistical difficulties are used as a starting point for a creative dialogue between music and space.[231] Or as trombonist

[230] Smock Alley house three distinct performance spaces. Two of these were used during this research. (http://smockalley.com/our-history/, accessed 18 April 2013).

[231] Examples of logistical challenges might occasionally include sub-standard sound equipment, unsympathetic organisers, sound bleed from near-by musical events, or a talkative audience.

George E. Lewis suggests: “Perhaps a ‘good’ improviser consistently makes good use of the conditions he or she finds.”[232]

The absence of a reflective acoustic space is the immediate challenge with outdoor performances. Three performance took place outdoors at The Electric Picnic; The Courtyard of The Contemporary Music Centre; and The Bandstand, East Pier, Dun Laoghaire. I feel that this immersive and engulfing music is less successful without the acoustically reflective walls of a building. This can be counteracted somewhat by using more powerful sound systems.



Figure 5.11 Performance at Band Stand, Dun Laoghaire, 21st December 2012.

Extremely intimate venues such as The Joinery or The Back Loft where the small (20-40 people) audience is positioned very close to the performer deliver a special performance intensity. Levels of scrutiny appear higher and the performance becomes undoubtedly the centre of everyone’s attention. Sound diffusion issues disappear as the audience hears the same relationship between instrument and electronics as I do and can clearly hear the acoustics of the instrument not mediated through a sound system. These venues also tend not to

[232] George E. Lewis, Improvisation as a Way of Life: Reflections on Human Interaction, Columbia University Lecture, 2011, (https://www.youtube.com/watch?feature=player_embedded&v=3cswYCMQnl4, accessed 12 July 2013).

use special lighting, raised stages or other devices which might further divide a performer from an audience.

Black box spaces and purpose built theatres (aided by the use of theatrical lighting, which typically casts the audience in darkness and places a spot light on the performer) also tend to present the notion of a fourth wall. The influential eighteenth century critic Denis Diderot's advice for actors to "think no more of the audience than if it had never existed. Imagine a huge wall across the front of the stage, separating you from the audience," is a strategy I am keen to avoid.[233] Where possible, I like to speak before a performance or individual piece in order to create an interpersonal connection with an audience. The success of these spoken communications again depends on the space, how the space is used and the proximity of performer to audience.

The placing of audience and performer is a variable which I pay a great deal of attention to. The black box model pits the audience in a block with very clear rules as to where the audience can sit (often using unmovable chairs). When performing in these spaces I often request 'café-style' seating which breaks up the space and brings the audience closer to the performer. If possible, I play on the same level as the audience which also helps to remove the notional fourth wall and presents a less formal arrangement. The close proximity of performer and audience is preferred also for acoustic reasons. As I am mixing and adjusting sound levels throughout the performance, the ideal scenario is where the audience hears the same things that I do. Very often the performer's audio mix is mediated through the use of on-stage monitoring whereas the audience hear the music via a front of house public address system. This arrangement often results in a situation where the performer hears a different mix to the audience. The easiest way to by-pass this dual system is to work on a smaller scale where the audience is close enough to benefit from hearing the speakers and the same acoustic environment that the musician is working from.

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[233] Denis Diderot, 'On Dramatic Poetry' (1758), quoted in Barrett Harper Clark, *European Theories of the Drama: An Anthology of Dramatic Theory and Criticism from Aristotle to the Present Day, in a Series of Selected Texts, with Commentaries, Biographies, and Bibliographies* (New York: Stewart & Kidd Company, 1918), 299.

Audience numbers throughout the research have varied from 300 people to a tenth of that amount. By and large, I prefer smaller audiences with about fifty-eighty listeners being the ideal amount.[234]

To talk clearly about the importance of a space and an audience for my performances, I will lean on the work of theatre director Peter Brook who argues that it is in the three French words – *répétition, représentation, assistance* – we can find a formula which encapsulates what is needed to bring a work to life before an audience. Repetition (*répétition*) is the slow laborious building of technique:

> No clown, no acrobat, no dancer would question that repetition is the only way certain actions become possible, and anyone who refuses the challenge of repetition knows that certain regions of expression are automatically barred to him. At the same time, repetition is a word with no glamour; it is a concept without warmth […] Repetition is what leads to all that is meaningless in tradition.

Tellingly, saxophonist Evan Parker uses this precise language to talk of exploring new ground: "That's where the use of repetition, although it appears to be a voluntary loss of freedom, actually opens up regions of the instrument which otherwise I wouldn't be aware of."[235] In my practice, this repetition clearly refers to many years of instrumental practice as well as the preparation involved in software programming and familiarisation with hardware controllers. Yet, of course, this still isn't enough to bring engaging work to an audience.

Représentation translates as performance, yet the French word leads us to consider performance as a re-presentation – "when something from the past is shown again – something that was, now is, […] a making present."[236] A successful performance must contain this aspect of making existing things (or, if improvising, previously unattempted things) present in the moment.

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[234] The challenges of audience development for improvised music in Ireland are beyond the scope of this dissertation but suffice to say that, ideal scenarios aside, the majority of the performances enjoyed small numbers in the region of thirty or forty people.

[235] Evan Parker interviewed in John Corbett, *Extended Play*, 205.

[236] Peter Brook, *The Empty Space* (London: Penguin Modern Classics, 2008), 155.

It is for this leap from past repetitions to performing with immediacy that an audience is needed. Rehearsing and workshopping this material divorced from an audience is a meaningless endevour if not taken to the next step. Brook points to the special qualities that the word *assistance* holds: "I watch a play: *j'assiste à une pièce.* To assist – the word is simple: it is the key. An actor prepares, he enters into a process that can turn lifeless at any point. He sets out to capture something, to make it incarnate."[237] This quality of engagement is crucial for the work to come to life on the stage.

> With this assistance, the assistance of eyes and focus and desires and enjoyment and concentration, repetition turns into representation. Then the word representation no longer separates actor and audience, show and public: it envelops them: what is present for one is present for the other. The audience too has undergone a change. It has come from a life outside the theatre that is essentially repetitive to a special arena in which each moment is lived more clearly and more tensely. The audience assists the actor, and at the same time for the audience itself assistance comes back from the stage.[238]

To elicit this level of assistance from an audience is a delicate task and is the primary reason for my testing different venues, seating arrangements and performance techniques (presentation, speaking to an audience, or question and answer sessions). When, for whatever reason, the balance tips away from *assistance* towards *indifférence* an audience "may just stare at the spectacle, expecting the actor to do all the work and before a passive gaze he may find that all he can offer is a repetition of rehearsals."[239] In my capacity as a performer, I am keen to avoid this situation and perhaps more acutely so when the material is entirely improvised.

The nature of the contract between an audience and the performer has great impact on the chances of artistic success. I have, through this research, endeavoured to perform in venues and events which engender a sense of occasion.

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[237] Brook, *The Empty Space,* 156.

[238] *Ibid.*, 156.

[239] *Ibid.*, 156.

In this sense, my performances fall into the site-specific category and are presented as unrepeatable musical experiences (for better or worse!). As the practicalities of this contract also impacts on the goodwill of an audience, I have experimented with performing without an admission price (Solstice, Smock Alley, Odessa) or presenting music in a space where an audience will rarely have the opportunity to listen to music (Mitchelstown Cave, Dun Laoghaire Band Stand, Nun's Island Theatre, Irish Museum of Modern Art). Evaluating the success of a performance is not a straightforward question. At times I have been surprised at positive audience reaction following, what seemed to me, to be an uninspired improvisation. The varying subjective experiences of, say, eighty listeners forms a complex tapestry too tangled to elicit any meaningful reaction here. Rather, I must rely on an internal gauge which operates only in the midst of the performance.

Undertaking improvised music performance brings me to a space entirely distinct from common, everyday life. The quality and intensity of this space is of great significance to me as a performer and often serves as the sole measurement of the success of a performance. The work of psychologist Mihaly Csikszentmihalyi has deeply explored the notion of flow in high-level specialised activities. Csikszentmihalyi's research rings true for much of my own experience in my career as a live performer. His definition of the flow state pinpoints my own perceived condition during successful performances (his allusion to jazz is a convenient yet illustrative one):

> [Flow is] being completely involved in an activity for its own sake. The ego falls away. Time flies. Every action, movement, and thought follows inevitably from the previous one, like playing jazz. Your whole being is involved, and you're using your skills to the utmost.[240]

My experience is that in the most rewarding live situations, there is a sense of channelling the music. Yet this space does not necessarily imply an abandonment, rather an easy control of the musical and performative processes

[240] Mihaly Csikszentmihalyi interviewed by John Geirland, 'Go With The Flow,' *Wired Magazine* 4/9 (1996). (http://www.wired.com/wired/archive/4.09/czik_pr.html, accessed 3 April 2013).

where "action follows upon action according to an internal logic that seems to need no conscious intervention."[241]

> In flow the self is fully functioning, but not aware of itself doing it, and it can use all the attention for the task at hand. At the most challenging levels, people actually report experiencing a *transcendence* of self, caused by the unusually high involvement with a system of action so much more complex than what one usually encounters in everyday life […] When all these elements are present, consciousness is in harmony, and the self – invisible during the flow episode – emerges strengthened. The negentropic quality of the flow experience makes it *autotelic,* or intrinsically rewarding. The mountaineer does not climb in order to reach the top of the mountain, but tries to reach the summit in order to climb. The goal is really just an excuse to make the experience possible […] Irrelevant thoughts, worries, distractions no longer have a chance to appear in consciousness. There is simply not enough room for them. Self-consciousness, or the worry we so often have about how we appear in the eyes of others, also disappears for the same reason. Because the activity forces us to concentrate on a limited field of stimuli, there is a great inner clarity, awareness is logically coherent and purposeful.[242]

In the presence of this flow state, my observation is that this special state becomes communicated to an audience. This in turn can help foster a sense of immersion and meditative listening. The music is often pitched with this in mind as is the choice of venue, lighting and my overall approach to performance.

Performance Recordings

I have selected eight representative complete recordings from the total pool of fifty-three individual pieces spanning ten hours. It is hoped that these audio documents convey many of the points raised and provide the listener concrete examples of the aesthetic values, instrumental approach, digital processing and improvisation which has occupied this dissertation. The recordings can be found in Appendix D, compact disc three: Performance Documentation and compact disc four: Performance Documentation.

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[241] Mihaly Csikszentmihalyi, *Beyond Boredom and Anxiety* (New York: Jossey-Bass Inc., 1975)*, 36.*

[242] Mihaly Csikszentmihalyi, *Optimal Experience: Psychological Studies of Flow in Consciousness* (Cambridge: Cambridge University Press, 1992), 34.

CD three: Track one *Xmas Special*

Recorded for live broadcast on RTÉ 2FM, 24 December 2012. Alto saxophone, 4:50 minutes. Part one of six short improvised interludes for a Christmas broadcast hosted by Donal Dineen and featuring a number of Irish acts including Katie Kim, Villagers and Lisa O'Neill. A small studio audience was also present.

A drone is created using a *TransDelay*, this is supplemented by a spectral delay loop which adds high frequency rhythmic details. *SpectralDelay* creates a mirroring effect at 2:20. The *Extreme Time-Stretch* module is introduced briefly at 4:25 providing a pad-like atmosphere. The saxophone line throughout is diatonic, unambiguous and song-like.

CD three: Track two *National Concert Hall*

Recorded April 2013 in The Kevin Barry Room, National Concert Hall, Dublin. Clarinet, 18:08 minutes. Presented in a double bill with leading Irish free improvisers Gavin Prior, Paul G. Smyth and David Lacey. The Kevin Barry Room is a reasonably large rectangular room and enjoyed a small but attentive audience.

This piece opens with layers of breath noise which continues, forming a wave-like soundscape. This soundscape determines the mood and tempo of the piece, acting as a slowly breathing presence. The clarinet line makes use of alternate fingerings, clouding the melodic line through microtonal intervals, trills and glissandi. The improvisation moves forward with a minimum of melodic material which is both slowly added to and re-examined. Circular breathing and singing through the instrument raise the intensity from the half-way point. At 9:24 the *Extreme Time-Stretch* module diverts the piece into new territory, providing a moving chordal wall. At 12:03, *TripleDelay* is used, creating unstable fragments. When these processes fade out at 13:25, the clarinet refers to the initial motif which started the piece. The circular breathing and singing effects are heard again, this time resolving to a simple high sustained note a major sixth above the fundamental in response to the electronic processes heard in the background.

CD three: Track three *New Theatre*

New Theatre is a relatively early document recorded at Dublin's New Theatre in March 2012. Bass clarinet, 10:25 minutes. This short set was a support slot for well known Dublin group Si Schroeder in a traditional theatre setting for an audience of fifty. This performance made use of some effect processes which have since been replaced, notably a granular processor.

A detailed looping drone establishes a sonic bed. The bass clarinet weaves a melody around this loop, providing plenty of space to let it be heard. At 2:27 a resonant filter accentuates the loop's mid-range frequencies providing a colour contrast. Further on, the filter cuts out much of the treble frequencies and the piece assumes a darker character. *Harmonizer* is employed at 7:04 introducing a new colour. This, combined with a slap-tonguing rhythmic figure, is used to form a new loop driving the piece forward. The final minute of this piece sees a number of rhythmic processes acting in a complex polyrhythm with the bass clarinet mimicking one of the rhythmic parts.

CD three: Track four *Album Launch*

I performed four pieces for the launch of my album *Long After the Music is Gone* in Odessa Club, Dublin on 25 September 2012. Bass clarinet, 5:54 minutes. This is the second piece recorded in a medium sized room for an audience of about fifty.

This piece starts with accompaniment from *SpectralConway*. The two seven-note phrases – a call and response – form the basis for all the melodic content of the piece. A chord is built up which is transposed providing tonal changes and clear moments of tension and release for the improvisation. The low range of the bass clarinet provides a guttural coda to close.

CD four: Track one *Culture Night*

Recorded in the courtyard of the Contemporary Music Centre, Dublin for Culture Night, 21 September 2013. Clarinet, 12:36 minutes. This small outdoor space contained about thirty listeners. A good sound system is augmented by a number of

ancillary speakers surrounding the courtyard, creating an immersive sound field. My improvised set was just one of many performances curated that night by composer Karen Power. This performance marked the first use of the *SpectralConway* module.

TripleDelay is used to introduce the DSP here, creating a jittery, unsettled texture. The clarinet phrasing is more energised than in other performances here and makes almost continual use of microtonal shading and manipulation. The *SpectralConway* textures become ever more prominent from 4:10 onwards and, in turn, encourage the use of multiphonics in the clarinet line. The complexity of material from *SpectralConway* and the number of delays means that for the second half of the piece, the clarinet sings over the top less and engages more directly in feeding and blending into the dense textures.

CD four: Track two *The Joinery*

Recorded in The Joinery, Arbour Hill, Dublin. Clarinet, 30 minutes. 28 February 2013. The Joinery, an alternative arts space in Dublin, is among my favourite performance spaces in the city. It is a small irregularly shaped room with a powerful PA system. This performance was part of an evening celebrating the launch of a new independent record label with about thirty people in attendance.

The digital sounds heard at the start of this improvisation are *SpectralDelay* pitch-shifted down an octave as well as the *Reverse Sampler.* The clarinet phrasing responds to the playback of the *Reverse Sampler* which is operating under random parameters. From 5:26 onwards a new rhythmic figure, created by *SpectralDelay,* fades up providing a broad low end block of sound. The clarinet responds by improvising in a higher register. This texture gives way at 11:03 and opens to a brighter, major modality. From 16:08 on, the *Reverse Sampler* again interacts with the clarinet phrasing over a bass-heavy *SpectralDelay* loop. At 20:00 new melodic material emerges which serves as the germ to complete the improvisation.

CD four: Track three *Nun's Island*

Final piece of several short pieces separated by question and answer sessions in Nun's Island Theatre, Galway, 23 March 2013. Bass clarinet, 7:38 minutes. Medium sized black box theatre space with an audience of thirty-five.

This pieces relies on a simple use of the *Delay* module with added distortion to repeat bass clarinet figures. A bass-drum effect is created by looping a microphone thump, this is then filtered and tuned up or down as the piece progresses. A sparse melodic line is bolstered with the use of *Harmonizer*. The *Tremolo* module is routed through the *Reverb* at the end of the piece creating a shimmering ethereal effect to the bass clarinet utterances.

CD four: Track four *Skibbereen Town Hall*

Selected from the final research performance at the Skibbereen Arts Festival, 2 August 2013. Bass clarinet, 3:40 minutes. This is the second of four pieces performed to live visuals by film maker Donal Dineen in a large hall as part of a local festival. I used a cinema surround sound system and fifty people attended.

A short loop sustained by *SpectralDelay* provides a background for an uplifting pentatonic improvisation. The loop is pitch-shifted down an octave for the final forty seconds dissipating the energy to find an ending.

Conclusion

With the availability, development and refinement of electronic and digital audio technologies, generations of musicians have become fluent with a range of new tools which have changed their working practice in a number of ways. Some composers have abandoned notation in favour of producing fully orchestrated compositions, which have been conceived of and are entirely confined to the digital domain, which is both paperless and people-less. Improvising instrumentalists have learnt to interact with digital signal processing in live performance and many musicians have abandoned traditional instrumentation in favour of performing with samplers, DIY electronics and laptops.

These shifts away from earlier pre-digital forms of production have left an indelible mark on the aesthetics of contemporary improvised music. While the new tools play an indispensible role in realising a chosen aesthetic, we can not point to an over-arching aesthetic tendency between these instrumentalists, save perhaps to acknowledge that each seeks to augment the sonic palette of their traditional instrument or voice. Just as the advancements in keyboard technology of the late eighteenth century spawned a creative breakthrough for subsequent composers and pianists, so too the recent legacy of electronic audio can claim a lineage of pieces and practices impossible without its development. Performers such as Terry Riley, La Monte Young, Pamela Z and Jon Hassell have created bodies of work which are dependant on electronic technology, not just as a performance enabler, but also to fulfil an aesthetic concern.

By and large, most improvising musicians using digital technologies are still working outside of the homogenising tendencies of a formal education background. Furthermore, it is typical that musicians working in the field of live instrumental performance augmented with DSP are approaching their work in a non-specialised manner, that is, they have directly designed, altered or programmed the chosen technology, blurring the lines of specialisation between musician and engineer or

instrument designer.[1] It can be seen that among improvising musicians engaging with electronic technologies there is a leaning towards experimentalism or progressive tendencies. This approach, combining a self-styled performance practice incorporating DSP and experimental improvised music, is not coincidental. That the tools chosen can support an individualised aesthetic outlook is seen as a powerful endorsement of their usefulness.

My own practice is shaped by a traditional jazz education coupled with the experiences of working across the fields of free improvisation and contemporary new music. My artistic work is concerned with weighing up the fundamental influence of being a jazz musician with the challenges of negotiating a stylistic language devised by musicians from a very different culture, geography and history than my own. The process can be thought of an attempt to dissociate jazz from its contemporary vocabulary and instead draw on its tenets of absorption, innovation and individuality. In this sense, I approach music making as a process-based endevour.[2]

This narrative raises the issue of the relevance of my musical practice to my situation within Irish (and wider) contemporary society. This research responds through the interweaving of Irish traditional music and other folk traditions into the fabric of these improvisations along with the use of contemporary digital technology, presenting a relevant and exciting avenue of exploration.[3] Music has long had a special interlocking role with technological development and has posed aesthetic questions concerning this role since at least the early twentieth century when Ezra Pound wrote:

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[1] An exception to this is seen in the world of audio production, where homogenic and prescriptive software tends to flatten out idiosyncrasies between record producers.

[2] Pianist Bill Evans points out his own process-based approach: "Jazz is not a what, it is a how. If it were a what, it would be static, never growing." Evans, *The Universal Mind of Bill Evans*, DVD.

[3] Allusions to Irish traditional music and electronic processing are two important directions in my most recent solo album. This work balances six unaccompanied acoustic pieces against six which use DSP, providing an insight into both aspects of my work. See Seán Mac Erlaine, *Long After The Music Is Gone,* compact disc / vinyl long player Ergodos Records er8, 2012. Available from www.longafterthemusicisgone.com

> I take it that music is the art most fit to express the fine qualities of machines. Machines are now a part of life, it is proper that men should feel something about them; there would be something weak about art if it couldn't deal with this new content.[4]

The design and working adoption in performance of these new digital tools is carefully tailored to a set of aesthetic concerns outlined in Chapter Two. The designing of a new performance practice remains an unproven exercise until road-tested in the arena of live performance. This process underwent continuous refinement until a workable design (both in hardware and software) was reached. After this point, the research became concerned with attaining fluidity with this new electronic extension of the instrument. The specific tools designed helped me attain and further my aesthetic needs. The software led directly to the undertaking of many successful performances and recordings. The balance between my ability to sculpt layers of material and the processes where the computer takes the material to unforeseen places, creates a fertile ground for improvisation.

Following an examination of new analytical models designed for electro-acoustic and improvised music, the audio documentation is combined with written commentary and, at times, musical notation. The audio files available here are an illustration of a live process which occurs before a live audience. This recorded music serves to reflect on a practice of music making which incorporates digital technology, a practice which draws on new embodied knowledge created through this process. In this light, the analysis is weighted in favour of broad observation of a *process*, supported by specific examples drawn from the body of recorded material.

This exploration continues beyond the life cycle of this research and it is hoped that much of this knowledge will be transferable both through the assimilation of the ideas contained within, the free access to the software instrument and through future teaching undertaken by the author. Appendix C disseminates the software as both an editable Max patch and as a standalone

[4] R. Murray Schafer (ed.), *Ezra Pound and Music* (New York: New Directions Publishing Corporation, 1977), 261.

computer application, which is intended for users without programming experience. Author James P. Carse writing on the nature of playing, dividing games into two types: finite and infinite. "A finite game is played for the purpose of winning, an infinite game for the purpose of continuing the play."[5] This research falls squarely into the latter category serving as a four year snapshot into an evolving artistic practice. More broadly then, the research stands as a marker along the path of a creative process whose life continues beyond the scope of this research.

> Infinite players cannot say when their game began, nor do they care. They do not care for the reason that their game is not bounded by time. Indeed the only purpose of the game is to prevent it from coming to an end, to keep everyone in play […] The time of an infinite game is not world time, but time created within the play itself. Since each play of an infinite game eliminates boundaries, it opens to players a new horizon of time. For this reason it is impossible to say how long an infinite game is played, or even can be played, since duration can be measured only externally to that which endures.[6]

[5] James P. Carse, *Finite and Infinite Games: A Vision of Life as Play and Possibility* (New York: Free Press, 1986), 3.

[6] *Ibid.,* 7.

Bibliography

Ake, David, Charles Hiroshi Garrett, and Daniel Goldmark (eds.), *Jazz/Not Jazz: The Music and Its Boundaries* (Berkeley: University of California Press, 2012).

Anderson, Leon, 'Analytic Autoethnography,' *Journal of Contemporary Ethnography* 35/4 (August 2006): 373-395.

Archer, Bruce, 'The Nature of Research,' *Co-design, Interdisciplinary Journal of Design* (January 1995): 6-13.

Bailey, Derek, *Improvisation: Its Nature And Practice In Music* (London: Da Capo Press, 1980).

Ballou, G. M., *Handbook for Sound Engineers* (Oxford: Elsevier Science & Technology, 2005).

Barrett, Estelle and Barbara Bolt (eds.), *Practice as Research: Approaches to Creative Arts Enquiry* (London: I.B. Tauris, 2010).

Bartolozzi, B., *New Sounds For Woodwind* (London, New York: Oxford University Press, 1967).

Bent, Ian and William Drabkin, *Analysis* (London: Macmillan, 1987).

Berliner, Paul A., *Thinking In Jazz: The Infinite Art of Improvisation* (Chicago: The University of Chicago Press, 1994).

Bernstein, David W., *The San Francisco Tape Music Center: 1960s Counterculture and the Avant-Garde* (Berkeley: University of California Press, 2008).

Blau, Jnan Ananda, '"The trick was to surrender to the flow:" Phish, the Phish Phenomenon, and Improvisational Performance Across Cultural and Communicative Contexts' (Ph.D.diss., Southern Illinois University Carbondale, 2007).

Bochner, Arthur P., 'It's About Time: Narrative and the Divided Self,' in *Qualitative Inquiry* 3/4 (1997): 418-438.

Boehm, Theobald, Dayton C. Miller (trans.), *The Flute and Flute-Playing* (New York: Dover, 2011).

Borgo, David, *Sync or Swarm: Improvising Music in a Complex Age* (New York: Continuum, 2005).

Boulanger, Richard (ed.), *The Csound Book: Perspectives in Software Synthesis, Sound Design, Signal Processing, and Programming* (Cambridge: The MIT Press, 2000).

Bowen, José, 'The History of Remembered Innovation: Tradition and its role in the Relationship between Musical Works and their Performances,' *The Journal of Musicology* 11/2 (1993):139-173.

Boyd Raeburn, B., *New Orleans Style and the Writing of American Jazz History* (Ann Arbor: The University of Michigan Press, 2009).

Brook, Peter, *The Empty Space* (London: Penguin Modern Classics, 2008).

Brown, J. R., *A Concise History of Jazz* (Missouri: Mel Bay Publications, 2004).

Busoni, Ferruccio, *Sketch for a New Aesthetic of Music*, Theodore Baker (trans.), in *Three Classics in the Aesthetics of Music,* (New York: Dover, 1962).

Butt, John, and Laurence Dreyfus (eds.), *Playing with History: The Historical Approach to Musical Performance* (Cambridge: Cambridge University Press, 2002).

Burke, David, *Heart of Darkness: Bruce Springsteen's Nebraska* (London: Cherry Red Books, 2011).

Byrne, David, *How Music Works* (Edinburgh: Cannongate, 2012).

Cage, John, *Silence* (London: Marion Boyars, 2009).

Cardew, Cornelius, *Cornelius Cardew: A Reader*, Edwin Prévost (ed.), (Harlow: Copula, 2006).

Carse, James P., *Finite and Infinite Games: A Vision of Life as Play and Possibility* (New York: Free Press, 1986).

Cascone, Kim, 'Laptop Music – Counterfeiting Aura in the Age of Infinite Reproduction,' *Parachute: Contemporary Art Magazine* 107 (2002): 52-58.

———, 'The Aesthetics of Failure: 'Post-Digital' Tendencies in Contemporary Computer Music,' *Computer Music Journal* 24/4 (Winter 2000): 12-18.

Chadabe, Joel, *Electric Sound: The Past and Promise of Electronic Music* (Upper Saddle River: Pearson, 1996).

Christensen, Dieter (ed.), *Yearbook for Traditional Music* Vol. 22 (Ljubljana: International Council for Traditional Music, 1990).

Christensen, Thomas, *The Cambridge History of Western Music Theory* (Cambridge: Cambridge University Press, 2002).

Clark, Barrett Harper, *European Theories of the Drama: An Anthology of Dramatic Theory and Criticism from Aristotle to the Present Day, in a Series of Selected Texts, with Commentaries, Biographies, and Bibliographies* (New York: Stewart & Kidd Company, 1918).

Clayson, Alan, *Edgard Varèse* (London: Sanctuary Publishing Ltd, 2002).

Collins, Nicholas and Julio d'Escriván (eds.), *The Cambridge Companion to Electronic Music* (Cambridge: Cambridge University Press, 2007).

Cone, Edward T., 'Analysis Today,' *The Musical Quarterly* 46/2 (April 1960): 172-188.

Cook, Nicholas, *A Guide to Musical Analysis* (Oxford: Oxford University Press, 1994).

———, 'Between Process and Product: Music and/as Performance,' *The Online Journal of the Society for Music Theory* 7/2 (2001). [no page numbers].

——— and Anthony Pople (eds.), *The Cambridge History of Twentieth-century Music* (Cambridge: Cambridge University Press, 2004).

Cook, R and B. Morton (eds.), *The Penguin Guide to Jazz Recordings,* 8th edn (New York: Penguin, 2006).

Corbett, John, *Extended Play: Sounding Off from John Cage to Dr. Funkenstein* (North Carolina: Duke University Press, 1994).

Cox, Christoph and Daniel Warner (eds.), *Audio Culture: Readings in Modern Music* (London: Continuum, 2004).

Csikszentmihalyi, Mihaly, *Beyond Boredom and Anxiety* (New York: Jossey-Bass Inc., 1975).

———, *Optimal Experience: Psychological Studies of Flow in Consciousness* (Cambridge: Cambridge University Press, 1992).

Davis, Tracy C. (ed.), *The Cambridge Companion to Performance Studies* (Cambridge: Cambridge University Press, 2008).

Dean, Roger T., *Hyperimprovisation: Computer-Interactive Sound Improvisations* (Middleton: A-R Editions, 2003).

de Leeuw, Ton, *Ton de Leeuw (Netherlands Music Archive),* John Lydon (trans.), (London: Routledge, 1997).

Demers, Joanna, *Listening Though The Noise: The Aesthetics of Experimental Electronic Music* (New York: Oxford University Press Inc., 2010).

Denzin, Norman K. and Yvonna S. Lincoln (eds.), *Handbook of Qualitative Research* (Thousand Oaks: Sage, 2000).

DeVeaux, S., *The Birth of Bebop: A Social and Musical History* (Los Angeles: University of California Press, 1999).

Dietrich, Dorothea, *The Collages of Kurt Schwitters: Tradition and Innovation* (Cambridge: Cambridge University Press, 1995).

Downey, John, 'Texture as Psycho-Rhythmics,' *Perspective of New Music* 20/2 (Summer 1982): 640-648.

Downs, William Missouri, Lou Anne Wright and Erik Ramsey, *The Art of Theatre: Then and Now* (Belmont: Cengage Learning, Inc., 2012).

Duckworth, William and Richard Fleming (eds.), *Sound and Light: La Monte Young and Marian Zazeela* (Cranbury: Associated University Presses, 2009).

Duffin, Ross, W., *How Equal Temperament Ruined Harmony (and Why You Should Care)* (New York: W.W. Norton, 2007).

Eco, Umberto, *The Open Work*, Anna Cancogni (trans.), (Harvard University Press, 1989).

Emmerson, Simon (ed.), *The Language of Electroacoustic Music* (London: Macmillan Press, 1986).

Erskine, Peter, *Time Awareness: For All Musicians* (Los Angeles: Alfred Publishing Company, 2005).

Ferrara, L., 'Phenomenology as a Tool for Musical Analysis,' *The Musical Quarterly* 70/3 (Summer 1984): 355-373.

Ferraro, Gary and Susan Andreatta, *Cultural Anthropology: An Applied Perspective* (Stamford: Cengage, 2009).

Fogle, Megan, 'Understanding Electronic Music: A Phenomenological Approach' (Ph.D. diss., Florida State University College of Music, 2009).

Ford, A., *Illegal Harmonies: Music in the Modern Age* (Collingwood: Black Inc., 2011).

Frayling, Christopher, 'Research in Art and Design,' *Royal College of Art Research Papers* 1/1 (1993/1994): 1-5.

Frymoyer, Johanna, 'Rethinking The Sign: Stylistic Competency and Interpretation of Musical Textures, 1890-1920' (Ph.D. diss., Princeton University, 2012).

Fuller, R. Buckminster, *Operating Manual for Spaceship Earth* (New York: Simon and Schuster, 1969).

Gagne, Nicole V., *Historical Dictionary of Modern and Contemporary Classical Music* (Lanham: Scarecrow Press, 2011).

Garnett, G., E., 'The Aesthetics of Interactive Computer Music,' *Computer Music Journal* 25/1 (2001).

Gelbart, Matthew, *The Invention of "Folk Music" and "Art Music"* (Cambridge: Cambridge University Press, 2007).

Geller, D., *Praktische Intonationslehre für Instrumentalisten und Sänger* (Kassel: Barenreiter, 2003).

Geirland, John, 'Go With The Flow,' *Wired Magazine* 4/09 (1996).

Giddins, G., *Visions of Jazz: The First Century* (New York: Oxford University Press, 1998).

Gioia, Ted, *The Imperfect Art: Reflections on Jazz and Modern Culture* (New York: Oxford University Press Inc., 1990).

Gracyk, Theodore and Andrew Kania, *Routledge Companion to Philosophy and Music* (London: Routledge, 2011).

Gray, Carole, 'A Different Way of Knowing? Inquiry through Creative Practice', Keynote paper in *'Production as Research', 1st Symposium of Visual Studies International Conference*, Universidad de Nuevo Leon, Monterrey, Mexico. 4-7 April 2006.

Hamilton, Andy, *Lee Konitz: Conversations on the Improviser's Art* (Ann Arbor: The University of Michigan Press, 2007).

———, *Aesthetics and Music* (London: Continuum, 2008).

Harley, James, *Xenakis: His Life in Music* (London: Taylor & Francis Ltd, 2005).

Haus, G., 'EMPS: A system for graphic transcription of electronic music scores,' *Computer Music Journal* 7/3 (1983): 31-36.

Hoffe, Charles R., *Music Listening Today* (Belmont: Cengage Learning, 2009).

Holmes, Thom, *Electronic and Experimental Music: Technology, Music, and Culture* (London: Routledge, 2008).

Ingham, Richard (ed.), *The Cambridge Companion to the Saxophone* (Cambridge: Cambridge University Press, 1999).

Jenkins, Todd S., *Free Jazz and Free Improvisation: An Encyclopaedia* (Westport: Greenwood Press, 2004).

Jost, Ekkehard, *Free Jazz* (Cambridge: Da Capo Press, 1994).

Katz, Mark, *Capturing Sound: How Technology Has Changed Music* (Berkeley: University of California Press, 2005).

Kemmis, S. and R. McTaggart, *The Action Research Planner* (Victoria: Deakin University Press, 1982).

Kernfeld, Barry (ed.), *The New Grove Dictionary of Jazz, Volume 2* (New York: Macmillan, 1991).

Kivy, Peter, 'It's Only Music: So What's To Understand?,' *Journal of Aesthetic Education* 20/4 (Winter 1986): 71-74.

———, *Sound Sentiment: An Essay on the Musical Emotions* (Philadelphia: Temple University Press, U.S., 1989).

———, *Music Alone: Philosophical Reflections on the Purely Musical Experience*

(Ithaca: Cornell University Press, 1991).

Kleiner, Mendel, David Lloyd Klepper and Rendell R. Torres, *Worship Space Acoustics* (Florida: J Ross Publishing, 2010).

Kokoras, Panayiotis A., 'Towards a Holophonic Musical Texture,' *The Journal of Music and Meaning* 4 (Winter 2007). (Available from www.musicand meaning.net/issues/show Article.php?artID=4.5, accessed 10 June 2013).

Kramer, Lawrence, *Music as Cultural Practice, 1800-1900 (California Studies in 19th-Century Music)* (Berkeley: University of California Press, 1990).

———, *Interpreting Music* (California: University of California Press, 2011).

Kutschke, Beate, 'Improvisation: An Always-Accessible Instrument of Innovation,' *Perspectives of New Music* 37/2 (Summer 1999): 147-162.

Larson, Steve, 'Composition versus Improvisation?,' *Journal of Music Theory* 49/2 (Fall, 2005): 241-275.

Lewis, G. E., 'Too Many Notes: Computers, Complexity and Culture in Voyager,' *Leonardo Music Journal* 10 (2000): 33–39.

Lester, Martin, P., *Visual Communication: Images with Messages,* 4th edn (Belmont: Cengage Learning, Inc., 2005).

Licata, Thomas, *Electroacoustic Music: Analytical Perspectives* (Westport, Greenwood Press, 2002).

McLuhan, Marshall, *Understanding Media: The Extensions of Man* (London: Routledge, 2001).

Manning, Peter, *Electronic and Computer Music,* 4th edn (New York: Oxford University Press, 2013).

Meyer, Leonard B., *Emotion and Meaning in Music* (Chicago: University of Chicago Press, 1965).

Miranda, Eduardo Reck and Marcelo M. Wanderley, *New Digital Musical Instruments: Control and Interaction Beyond the Keyboard* (Middleton: A-R Editions, 2006).

Moelants, Dirk, Michiel Demey, Maarten Grachten, Chia-Fen Wu and Marc Leman, 'The Influence of an Audience on Performers: A Comparison Between Rehearsal and Concert Using Audio, Video and Movement Data,' *Journal of New Music Research* 41/1 (March 2012): 67-78.

Montagu, Jeremy, *Origins and Development of Musical Instruments* (Lanham: Scarecrow Press, 2007).

Mukherji, Subha (ed.), *Thinking on Thresholds: The Poetics of Transitive Spaces* (London: Anthem Press, 2011).

Nachmanovitch, Stephen, *Free Play: Power of Improvisation in Life and the Arts* (New York: Jeremy P. Tarcher, 1993).

Nebeker, F., *Signal Processing: The Emergence of a Discipline, 1948 – 1998* (New Brunswick: Rutgers University, 1998).

Nettl, Bruno, *The Study of Ethnomusicology: Thirty-one Issues and Concepts* (Baltimore: University of Illinois Press, 2006).

Nicholson, Stuart, *Is Jazz Dead?: (Or Has It Moved To A New Address?)* (New York: Routledge, 2005).

Nyman, M., *Experimental Music: Cage and Beyond* (Cambridge: Cambridge University Press, 1974).

Ó Canainn, Tomás, *Traditional music in Ireland* (London: Routledge, 1978).

Oliver, Michael (ed.), *Settling the Score: A Journey Through the Music of the Twentieth Century* (London: Faber and Faber, 1999).

Patterson, D. W. (ed.), *John Cage: Music, Philosophy and Intention, 1933-1950* (New York: Routledge, 2002).

Paytner, John, Tim Howell, Richard Orton and Peter Seymour (eds.), *Companion to Contemporary Musical Thought: Volume 1* (London: Routledge, 1992).

Potter, Keith, *Four Musical Minimalists: La Monte Young, Terry Riley, Steve Reich, Philip Glass* (Cambridge: Cambridge University Press, 2000).

Pound, Ezra, *Ezra Pound and Music,* R. Murray Schafer (ed.), (New York: New Directions Publishing Corporation, 1977).

Prendergast, M., *The Ambient Century: From Mahler to Trance - The Evolution of Sound in the Electronic Age* (London: Bloomsbury Publishing, 2000).

Puckette, M., *The Theory and Technique of Electronic Music* (San Diego: University of California, San Diego, 2007).

———, 'Max at Seventeen,' *Computer Music Journal* 26/4 (2002): 31-43.

Reich, Steve, *Writings About Music, 1965 – 2000* (New York: Oxford University Press, 2004).

Rink, John (ed.), *The Practice of Performance: Studies in Musical Interpretation* (Cambridge: Cambridge University Press, 2005).

Ringer, Alexander L. (ed.), *Yearbook of The International Folk Music Council, Vol. 2* (Ljubljana: International Council for Traditional Music, 1970).

Rodgers, Tara, *Pink Noises: Women on Electronic Music and Sound* (London: Duke University Press, 2010).

Ross, A., *The Rest Is Noise: Listening to the Twentieth Century* (New York: Farrar, Straus and Giroux, 2007).

Rothenberg, D., *Sudden Music: Improvisation, Sound, Nature* (Athens: University of Georgia Press, 2002).

Rowe, Robert, *Machine Musicianship* (Cambridge: Massachusetts Institute of Technology, 2001).

Rust, Chris, Judith Mottram and Jeremy Till, *AHRC Research Review: Practice-Led Research in Art, Design and Architecture* (Sheffield: AHRC, 2007).

Rustin, Nichole T. and Sherrie Tucker (eds.), *Big Ears: Listening for Gender in Jazz Studies* (North Carolina: Duke University Press, 2009).

Santi, Marina (ed.), *Improvisation: Between Technique and Spontaneity* (Cambridge: Cambridge Scholars Publishing, 2010).

Sawyer, R. Keith, *Explaining Creativity: The Science of Human Innovation* (New York: Oxford University Press, 2012).

Schafer, R. Murray, *The Soundscape: Our Sonic Environment and the Tuning of the World* (Rochester, Vermont: Destiny Books, 1994).

Schaeffer, P., *À la recherché d'une musique concrète* (Paris: Éditions du Seuil, 1952).

———, *Traité des Objets Musicaux* (Paris: Éditions du Seuil, 1966).

Schwartz, K. Robert, *Minimalists* (London: Phaidon Press, 1996).

Schechner, Richard, *Performance Studies: An Introduction* (New York: Routledge, 2002).

Schön, D., The Reflective Practitioner: How Professionals Think In Action (San Francisco: Basic Books, 1983).

Schloss, Andrew W., 'Using Contemporary Technology in Live Performance: The Dilemma of the Performer,' *Journal of New Music Research* 32/3 (2003): 239-242.

Self, D., *Small Signal Audio Design* (Oxford: Focal Press, 2010).

Shanks, Michael, *Experiencing the Past: On the Character of Archaeology* (London: Routledge, 1992).

Shneiderman, Ben, *Designing the User Interface: Strategies for Effective Human-computer Interaction (*Reading: Addison-Wesley, 1997).

Simmel, Georg, *Philosophy of Money,* David Frisby (trans.), 3rd edn (London: Routledge, 2004).

Small, Christopher, *Musicking: The Meanings of Performing and Listening* (Middletown: Wesleyan University Press, 1998).

Steen-Nokleberg, Einar, William Halverson (trans.), *Onstage with Grieg: Interpreting His Piano Music* (Bloomington: Indiana University Press, 1997).

Stone, K., *Music Notation in The Twentieth Century: A Practical Guidebook* (New York: WW Norton & Co, 1980).

Strandman, Pia (ed.), *No Guru, No Method: Discussion on Art & Design Research* (Helsinki: University of Art & Design, UIAH, 1998).

Tagg, Philip, 'Analysing Popular Music: Theory, Method and Practice,' *Popular Music* 2 (1982): 37-67.

———, *Everyday Tonality: Towards a Tonal Theory of What Most People Hear* (New York: The Mass Media Scholars' Press, 2009).

Tarasti, Eero (ed.), *Musical Signification: Essays in the Semiotic Theory and Analysis of Music* (Berlin: Mouton de Gruyter, 1995).

Taruskin, Richard, *The Oxford History of Western Music: Music in the Late Twentieth Century* (Oxford: Oxford University Press, 2009).

Taylor, T. D., *Strange Sounds: Music, Technology & Culture* (New York: Routledge, 2001).

Toop, David, *Ocean of Sound: Aether Talk, Ambient Sound and Imaginary Worlds* (London: Serpent's Tail, 1995).

———, *Haunted Weather* (London: Serpent's Tail, 2004).

Tschmuck, Peter, *Creativity and Innovation in the Music Industry* (New York: Springer-Verlag, 2006).

Utz, Christian and Frederick Lau (eds.), *Vocal Music and Contemporary Identities: Unlimited Voices in East Asia and the West* (New York: Routledge, 2012).

Veal, Michael E., *Dub: Soundscapes and Shattered Songs in Jamaican Reggae* (Hanover: University Press of New England, 2007).

Voegelin, Salomé, *Listening to Noise and Silence: Towards a Philosophy of Sound Art* (New York: Continuum, 2010).

Wanderley, M. and M. Battier (eds.), *Trends in Gestural Control of Music* (Paris: IRCAM, 2000).

Warren, John T., 'Reflexive Teaching: Toward Critical Autoethnographic Practices of/in/on Pedagogy,' *Cultural Studies <=> Critical Methodologies* 11/139 (2011): 3.

Watson, B., *Derek Bailey and The Story of Free Improvisation* (London: Verso Books, 2004).

Webster, Frank, *Theories of the Information Society* (London: Routledge, 2006).

Weidenar, Reynold, *Magic Music from the Telharmonium* (Lanham: Scarecrow Press, 1995).

Wilkins, Margaret Lucy, *Creative Music Composition* (New York: Routledge, 2006).

Winkler, Todd, *Composing Interactive Music: Techniques and Ideas Using Max* (Cambridge: Massachusetts Institute of Technology, 1998).

Wishart, Trevor, *On Sonic Art* (Amsterdam: Harwood Academic Publishers, 1996).

Zak, Albin J., *I Don't Sound Like Nobody: Remaking Music in 1950s America* (Ann Arbor: The University of Michigan Press, 2010).

Zorn, John (ed.), *Arcana II: Musicians on Music* (New York: Hips Road, 2007).

Webography:

About Hemispheres (http://isobelaudio.com/hemispheres/, accessed 19 April 2012).

AHRC Research Centre for Musical Performance as Creative Practice (www.cmpcp.ac.uk/index.html, accessed 23 October 2011).

AHRC Research Centre for the History and Analysis of Recorded Music (www.charm.kcl.ac.uk/index.html, accessed 23 October 2011).

Aksdal, Erling, 'The Jazz Summit 2012' (http://www.youtube.com/watch?v=tsgJRuLEnXU, accessed 3 May 2013).

Amirkhanian, Charles, 'Brian Eno interviewed by on KPFA's Ode to Gravity' (www.archive.org/details/BrianEno, January 26, 2011).

Autoethnography: An Overview (http://nbn-resolving.de/urn:nbn:de:0114-fqs1101108, accessed 18 November 2011).

Cascone, Kim, 'Smart Mistakes' (http://vimeo.com/17082963, accessed 1 May 2013).

Casserley, Lawrence, 'A Digital Signal Processing Instrument for Improvised Music' (http://www.chiltern.demon.co.uk/DSP_Inst.html, accessed 23 March 2010).

Code MIDI Controller (http://lividinstruments.com/hardware_code.php, accessed 27 August 2012).

Collins, Nicolas, 'Before Apple There Was Kim – the Microcomputer, Music and Me' (www.nicolascollins.com/texts/microcomputermusic.pdf, accessed 3 May 2012).

EARS: Electroacoustic Resource Site (www.ears.dmu.ac.uk/, accessed 10 May 2010).

Eno, Brian, 'Generative Music: A talk delivered in San Francisco, June 8, 1996' (http://www.inmotion magazine.com/eno1.html, accessed 29 January 2013).

John Cage and Morton Feldman In Conversation, 1967 (http://archive.org/details/CageFeldmanInConversation, accessed 1 September 2009).

Johnson, Tom, 'The Voice of New Music' (www.editions75.com/Books/TheVoiceOfNewMusic.pdf, accessed 4 October 2009).

Gross, Jason, 'Interview with David Behrman' (http://www.furious.com/perfect/behrman.html, September 12, 2011).

Hamm, Sam, 'Computers and Live Performance: Interactive, or Interference?' (http://samhamm.com/papers.html, accessed 8 August 2013).

Lewis, George E., 'Improvisation as a Way of Life: Reflections on Human Interaction' (https://www.youtube.com/watch?feature=player_embedded&v=3cswYCMQnl4, accessed 12 July 2013).

Lewis, G. E., 'Live Algorithms and The Future of Music' (www.ctwatch.org/quarterly/ articles/2007/05/live-algorithms-and-the-future-of-music/, accessed 6 July 2013).

Kaiser, Jeff, 'How I lost 150 lbs. thanks to Max/MSP!' (www.jeffkaiser.com/papers /spark_ 2007.pdf, accessed 3 December 2012).

Proceedings of the 7th International Conference on Digital Audio Effects, 5-8 October 2004 (http://dafx04.na.infn.it/WebProc/Proc/P_042.pdf, accessed 20 April 2013).

Geirland, John, 'Go With The Flow' (www.wired.com/wired/archive/4.09/czik_pr. html, accessed 3 April 2013).

Gray, Carole, 'Inquiry Through Practice: Developing Appropriate Research Strategies' (http://carolegray.net/Papers%20PDFs/ngnm.pdf, accessed 16 November 2011).

Nasca, Paul, 'Paul's Extreme Sound Stretch' (http://www.paulnasca.com/open-source-projects#TOC-Paul-s-Extreme-Sound-Stretch, accessed 29 March 2013).

Nunn, Tom, 'Wisdom of the Impulse: On the Nature of Musical Free Improvisation' (www20.brinkster.com/improarchive/tn_wisdom_part1.pdf, accessed 10 May 2010).

Taylor, Gregory, 'Interview with David Wessel' (http://cycling74.com/2005/09/13/ an-interview-with-david-wessel/, accessed 14 March 2013).

The Online Repository for Electroacoustic Music Analysis (OREMA) project (www. orema.dmu.ac.uk/, accessed 26 October 2011).

Truax, Barry, 'Handbook For Acoustic Ecology online edition' (www.sfu.ca/sonic-studio/handbook/index.html, accessed 29 June 2011).

Zattra, Laura, 'Analysis and Analyses of Electroacoustic Music' (http://smcnetwork. org/conferences, accessed 30 August 2012).

Discography:

AMM, *Newfoundland,* compact disc Matchless Recordings MRCD23, 1992.

Jan Bang, *... And Poppies From Kandahar,* compact disc Samadhisound ss018, 2010.

William Basinski, *The Disintegration Loops,* compact disc 2062 0201, 2002.

David Behrman, *Wave Train (music from 1959 to 1968)*, vinyl long player Alga Marghen, 5NMN.020, 1988.

John Butcher, *13 Friendly Numbers*, compact disc Acta 6, 1992.

Uri Caine, *Gustav Mahler Primal Light,* compact disc Winter & Winter 910 004-2, 1998.

Hayden Chisholm, *13 Views of The Heart's Cargo,* compact disc box set Moontower Foundation MT1-13, 2012.

Miles Davis, *Filles de Kilimanjaro,* vinyl long player Columbia CS 9750, 1969.

———, *In a Silent Way,* vinyl long player Columbia CS 9875, 1969.

———, *Bitches Brew,* double vinyl long player Columbia GP 26, 1970.

Dave Douglas, *Convergence,* compact disc Soul Note 883366, 1999.

Brian Eno, *Discreet Music,* vinyl long player Obscure no. 3, 1975.

———, *Ambient 4: On Land,* vinyl long player Editions EG – EGED 20, 1982.

Bill Evans, *The Universal Mind of Bill Evans*, digital versatile disc Rhapsody Films B0002475P2, 2005.

Gundecha Brothers, *Darshan,* compact disc Sense World Music 026, 2003.

Arve Henriksen, *Sakuteiki,* compact disc Rune Grammofon RCD 2021, 2001.

———, *Solidification,* vinyl long player box set Rune Grammofon RLP 2137, 2012.

Ryoji Ikeda, *dataplex,* compact disc Raster-Noton R-N 068, 2005.

Håkon Kornstad, *Dwell Time,* compact disc Jazzland Records 270 971-0, 2009.

Arne Nordheim, *Electric*, compact disc Rune Grammofon RCD 2002, 1998.

Alan Lamb, *Primal Image,* compact disc Dorobo 008, 1995.

Unni Løvlid, *Vita,* compact disc Heilo B0009IVVWY, 2005.

Seán Mac Erlaine, *Long After The Music Is Gone,* vinyl long player Ergodos Records er8, 2012.

Toshimaru Nakamura, *No-Input Mixing Board,* compact disc Zero Gravity ZGV-026, 2000.

Alva Noto, *Prototypes,* compact disc Mille Plateaux MP 082 CD, 2000.

Greg Osby, *Symbols of Light (A Solution),* compact disc Blue Note 31395, 2001.

Oval, *94 Diskont,* compact disc Mille Plateaux MP CD 13, 1995.

Evan Parker, *Six of One,* vinyl long player Incus Records 39, 1982.

Les Paul, *The New Sound*, vinyl long player Capitol Records T-226, 1955.

Terry Riley, *A Rainbow In Curved Air,* vinyl long player Columbia Masterworks MS 7315, 1969.

Root 70, *Fahrvergnugen*, compact disc Intuition Records INT3397 2, 2006.

Bruce Springsteen, *Nebraska,* vinyl long player Columbia QC 38358, 1982.

David Tudor, *Rainforest IV,* vinyl long player Edition Block GR-EB 1, 1981.

Trihornophone, *Breathing Time,* compact disc Diatribe DIACD004, 2008.

Christian Wallumrød, Arve Henriksen, Jan Bang, Erik Honoré, *Birth Wish,* compact disc Pan M Records 74321 768 832, 2000.

Christian Wallumrød Ensemble, *The Zoo Is Far,* compact disc ECM Records ECM 2005, 2007.

Iannis Xenakis, *Electroacoustic & Instrumental Works from CCMIX Paris,* two compact discs Mode 98/99, 2001.

La Monte Young, *Sunday AM Blues / B♭ Dorian Blues / The Well Tuned Piano / Map Of 49's Dream,* double vinyl long player RRRip RIP 006, 1963.

Appendix A

This appendix goes into some technical detail concerning the software and hardware design used in this research. The software programming started in March 2010 and the bulk of it was completed by June 2012.[1] The initial software used Max/MSP 5.1.4 and migrated onto the next major update of the software, Max 6, in December 2011.

The nature and complexity of the software instrument is dependent on what level of parameter control a chosen interface provides. However, the availability of high power computers today means that many individual controllers can be simultaneously linked to the software instrument. Decisions regarding parameter control will ideally offer a performer sufficient control to interact with the software in a musically satisfying manner, without presenting an array of options so complex as to hinder spontaneous musical expression.

The final design includes two MIDI controllers: Code made by Livid Instruments and Softstep made by Keith McMillen Instruments. Both these MIDI controllers were released in 2011 and are USB bus powered.

Code features thirty-two encoders and forty-five buttons and also provides LED feedback indicating the current state of each of these seventy-seven parameters.[2] This piece of hardware operates as a blank canvas and is used to control programmed parameters within Max. It is manipulated by hand. The factory settings of Code have been erased in favour of a system which makes clear the division of eight channel strips with additional buttons around two of the edges.

[1] Upon reaching a finalised expression, the patch was named *Slender Sung*.

[2] *Code MIDI Controller* (http://lividinstruments.com/hardware_code.php, accessed 27 August 2012).

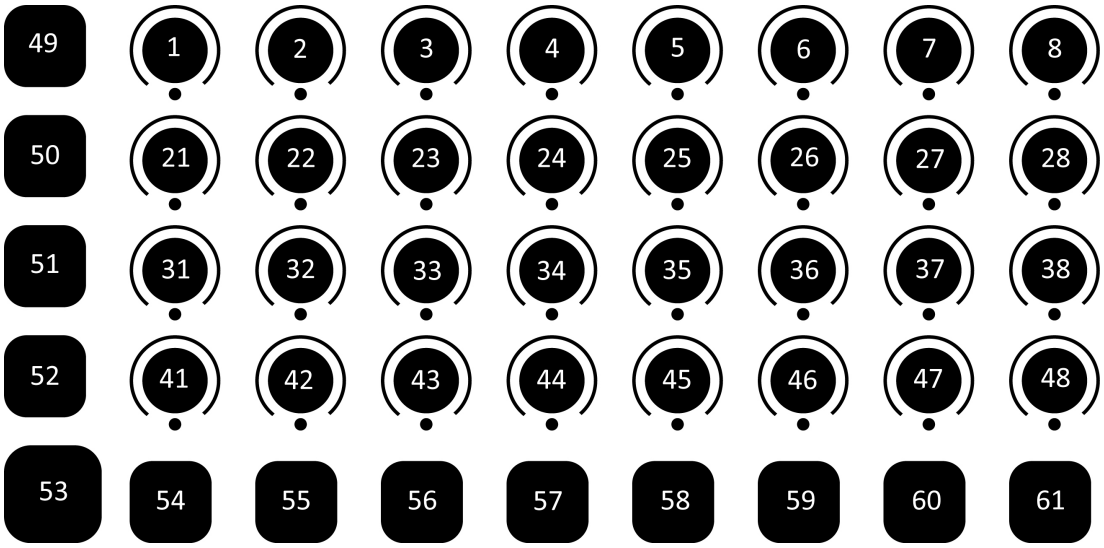


Figure A.1 Schematic of MIDI assigned messages on Code controller interface.

Figure A.1 identifies the personalised MIDI mapping for the Code controller. Each endless encoder (numbered here non-consecutively one to forty-eight) shares its MIDI number with its inbuilt button.

The KMI Softstep is a MIDI foot controller. Each of the ten foot pads can register pressure sensitivity, x axis movement, y axis movement, on/off. For the purposes of this research the Softstep is used for on/off toggle state only.

I chose a modular layout for the software processors so that the programming could be contained to each effect module. The grid layout of the Code (four rows by eight columns of encoders) suggested a division of eight separate effect modules which was adequate for my needs. In short then, each module benefits from four dedicated endless potentiometers and five push buttons (assigning the button below each column to each discrete module). In tandem with these nine parameters adjustable via Code, the Softstep's ten pads are assigned to each of eight modules leaving two extra for additional routing options. In total each module, then, has up to ten adjustable parameters.

On opening an unfamiliar Max patch, the viewer, even with some experience in programming, is not always presented with a clear visual picture of the exact workings of the patch. I have endeavoured to make this patch understandable in

terms of the functionality and programming decisions taken.[3] This appendix serves as an aid to understanding these inner workings. Each of the eight effect modules are itemised and further details are disclosed concerning routing designs, additional microphone inputs, compression settings, graphic user interface design and the multi-track recorder.

Module 1: Delay / Loop

This module is one of several in the patch which incorporates two discrete effects (the user can choose to toggle between either effect but cannot use both simultaneously).

The delay effect is a straightforward delay line using Max objects [tapin~] and [ej.vdb], which is a variable delay buffer designed by Emmanuel Jourdan at Ircam. The advantage of the [ej.vdb] object is that the delay length can be changed without noticeable clicks or transposition. The delay line range is from 100 milliseconds to an eight second delay line.

The loop effect is written in Gen~ an add-on for patching and code compiling. Gen~ was released in November 2011 at a time when I had completed the bulk of my programming. The Gen code in this loop effect was not written by me. This loop effect creates a loop length based on the duration between two foot taps, enabling me to easily create rhythmic cycles without my hands leaving the instrument. I have added four playback settings to the loop: normal, half-time, reverse, and half-time reverse.

Along with the majority of the effect modules, this module features a resonant filter (60 Hz – 4700 Hz) and a dedicated reverb unit (whose reverb time is governed by the *reverb* module).

Another common feature is the effects loop. This is based on hardware systems which can be patched into each other. This module has both a loop send and a loop

[3] I will use the conventional square brackets used within the Max community when talking about specific Max objects, e.g. [tapin~].

receive enabling the delay signal to be sent to any other module which has a loop receive and vice versa.

The real-time adjustable parameters include

1) On/off 2) Volume 3) Feedback amount

4) Delay time 5) Filter frequency (14Hz – 14kHz)

6) Fx loop send 7) Fx loop return 8) Reverb on/off

9) Module volume fade up/down 10) Toggle between delay / loop

Module 2: TransDelay

This is identical to the delay effect in Module 1 except that it features a transposing option. The pitch-shifter has seven presets (down an octave, down a perfect fifth, down a perfect fourth, up a minor third (316 cents), up a major third (384 cents), up a fourth, up a fifth). These presets can be overridden, providing a chromatic two octave range (down an octave to up an octave). Module 2 receives the delay time from Module 1 creating a synchronous delay line with Module 1. This module also includes a resonant filter, effects loop send/receive and a reverb send. The real-time adjustable parameters include

1) On/off 2) Volume 3) Feedback amount

4) Transposition preset 5) Chromatic transposition on/off

6) Fx loop send 7) Fx loop return 8) Reverb on/off

9) Module volume fade up/down 10) Filter frequency (14Hz – 14kHz)

Module 3: TripleDelay

TripleDelay builds on the first two delay lines but also adds in a further two elements: a reverse delay and a variable speed sampler.[4] These three processes are heard in all their combinations randomly, creating a shifting version of the original delay signal. An 'intensity' setting allows the user to choose how many of these processes occur simultaneously with six settings ranging from delay only to all three processes with random sample playback two octaves higher than live input. Module 3 receives the delay time from Module 1. The real-time adjustable parameters include

1) On/off 2) Volume 3) Feedback amount

4) Select intensity level (default automatic) 5) Filter frequency (14Hz – 14kHz)

6) Fx loop send 7) Fx loop return 8) Reverb on/off

9) Module volume fade up/down

Module 4: SpectralDelay I

Module 4 brings some of the design of the initial delay modules into the realm of spectral delay. At the module's core is [jg.spectdelay~] designed by John Gibson in 2008. The same transposition settings are used (with the optional preset override) as module 2. There are 18 presets which ascribe varying EQ and delay times providing a vast range of textures. These presets can be randomly chosen or chosen via an encoder on Code. The real-time adjustable parameters include

1) On/off 2) Volume 3) Feedback amount

4) Transposition preset selection 5) Chromatic transposition on/off

6) Fx loop send 7) Fx loop return 8) Preset selection

9) Randomise presets 10) Module volume fade up/down

[4] The variable speed playback object [elasticx~] is used. This is a commercial external object available from www.elasticmax.co.uk. For purposes of accessibility I have used [grainstretch~] by Timo Rozendal as a free substitute.

Module 5: Reverb / Reverse Sampler

This module houses two effects which *can* be run simultaneously. The reverb is run by [nw.gverb~] built by Nathan Wolek. The reverb time is adjustable from ten milliseconds to eight seconds.[5] This reverb time governs the reverb time of a number of other individual reverb units in many of the modules.

The reverse sampler uses [groove~] and a range of stochastic processes which change playback direction, octave disposition and include occasional microtonal bending of pitch.

The real-time adjustable parameters include

1) On/off 2) Reverb volume 3) Reverb time

4) Fx loop send 5) Fx loop return 6) Reverse sampler volume

7) Filter frequency (14Hz – 14kHz) 8) Secondary reverb send on/off

9) Module volume fade up/down

Module 6: Harmonizer

The harmonizer in the patch is built around four instances of the [gizmo~] object allowing for four note chordal voicings. This module has nine harmonizer presets all of which use just intonation for intervallic calculation based on the live input. The presets (given in cent deviation from 'root' note) are: one 3.15; two -12, 3.15, -4.98; three 3.15, 4.98, 7.02; four 3.86, 4.27, 4.98; five 3.86, 7.02, 8.84; six 3.15, 7.02, 8.84; seven 4.98, 9.96, 15.15; eight 0, 4.98, 7.02; nine 0, -4.98, -7.02.

The real-time adjustable parameters include

1) On/off 2) Volume 3) Preset selection

[5] Freely available www.lowkeydigitalstudio.com/2006/11/gverb-object-v0/

4) Fx loop send 5) Fx loop return 6) Filter frequency (14Hz – 14kHz)

7) Module volume fade up/down

Module 7: Ring Modulator + Tremolo / SpectralDelay II

This module is unique in that it contains three effect processes. The first two share the same control state, the spectral delay effect must be toggled on and cannot be used at the same time as the others.

The ring modulator is a simple subpatch with frequency control and effect loop send. The tremolo effect has an adjustable rate control and effect loop send and returns. *SpectralDelay II* is another iteration of Module 4 but features a different range of presets.

The real-time adjustable parameters include

1) On/Off

2) Volume

3) Ring modulator frequency / Spectral Delay II feedback amount

4) Tremolo volume / Spectral Delay II transposition

5) Ring Modulator + Tremolo / Spectral Delay II toggle

6) Fx loop send / Spectral Delay II chromatic transposition on/off

7) Fx loop return / Spectral Delay II preset selection

8) Fx loop return / Spectral Delay II randomise presets

9) Module volume fade up/down

Module 8: Extreme Time-Stretch + SpectralConway

The eighth and final module combines two powerful effect processes. *Extreme Time-Stretch* is built around [vb.stretch~] which is based on the popular non real-time software time stretcher Paulstretch.[6] This subpatch slows down audio (sampled in a 3,400 millisecond buffer) to 1/12th of its original speed. The effect also allows for chordal harmonisations of the processed signal; five presets are included with a random override also built in. The relative amplitudes of the voices (up to six) are regulated by a stochastic process. Extreme time-stretch can be 'frozen' removing all movement through the buffer.

SpectralConway is a specialised effect created by Pierre Alexandre Tremblay and Scott McLaughlin using an algorithm based on John Conway's Game of Life, a self-generating cellular automaton.[7] It is used here with McLaughlin's kind permission. Its implementation here is as a continuously sampling effect which emits a constant stream of reactive audio, with only a volume parameter for the performer to interact with.

Both these effects are sent to dedicated reverb objects. The real-time adjustable parameters include

1) On/Off 2) Volume 3) Chordal preset

4) Freeze time-stretch 5) Filter frequency (14Hz – 14kHz)

6) Fx loop send 7) SpectralConway volume

In addition to these eight modules I include some brief notes about other significant aspects of the patch.

A compressor [omx.comp~] is used with its default settings. This is on as a default and can be bypassed.

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[6] Paul's Extreme Sound Stretch (http://www.paulnasca.com/open-source-projects#TOC-Paul-s-Extreme-Sound-Stretch, accessed 29 March 2013).

[7] Scott McLaughlin, Pierre Alexandre Tremblay, 'SpectralConway: Cellular Automata Off The Grid,' *Proceedings of the International Computer Music Conference* (New York: ICMA, 2010), 68-71. See also Chapter Five, 102.

Slender Sung is also adaptable to use in group situations, processing other musicians. It is configured to process a second microphone by toggling key 9 on the Softstep.

All outputs from the patch can be simultaneously faded out (or in) using the global fade button on Code. This is a common method used to end performances.

Every signal which passes through the patch including up to two microphone inputs can be recorded as a twenty-four bit uncompressed .aiff file at 44.1 kHz. A twelve channel recorder within the patch is fed sends from each module and creates three multichannel audio files.

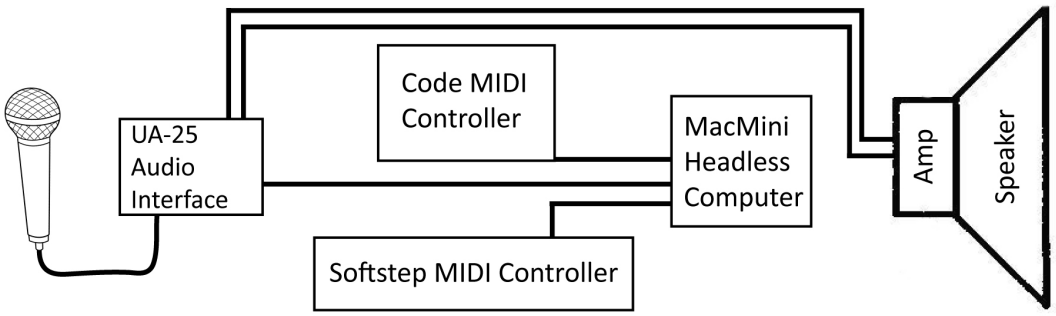


Figure A.2 Outline schematic of hardware workflow.

Figure A.2 maps out the hardware workflow. The audio interface provides a direct output from the microphone (avoiding any software latency) which amplifies the woodwind signal (if necessary). The second output from the interface is the mono signal provided by Max (housed in a Mac mini computer). The two controllers and the audio interface connect to the computer via USB.

The computer is used 'headless,' without monitor, mouse or keyboard. It is configured to initialise Max when booted up. Once the patch loads it automatically selects the external audio interface, initialises the Softstep controller and loads custom settings, and initialises the Code controller. This has proven to be an extremely stable and lightweight solution and removes all need for a monitor and the usual interface with a computer.

The patch can also be used with a monitor and features a graphical user interface (GUI), through which the user can use all the features of the patch without controllers.

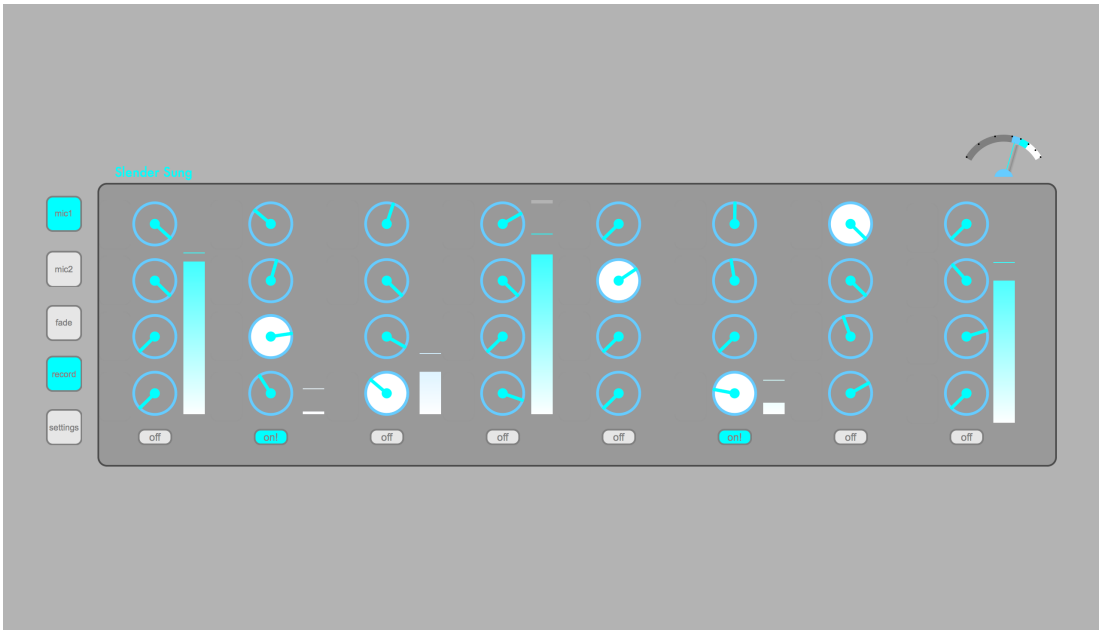


Figure A.3 Screenshot of graphical user interface during audio activity.

The GUI is based on the layout of the Code controller, with each dial representing one of the eight by four encoders. A level meter shows each module's audio output level. This GUI is a useful tool for testing and programming and also serves as a safety measure should any hardware controllers fail.

A final safety feature built into the patch enables it to be used without the foot controller. Pressing the bottom left hand button on Code reconfigures the lower row of buttons, substituting those on Softstep.

Appendix B

This appendix details the date, location, promoter, instrumentation, performance duration and estimated audience attendance of each performance which formed part of this research. These are treated chronologically.

3 September 2010
Body & Soul Stage, The Electric Picnic, Stradbally, Co. Laois
Presented by The Electric Picnic | alto saxophone | 25 minutes | 100.

4 December 2010
The Throne Room, Dublin Castle, Dublin 2
Presented by Music Network | alto saxophone, xaphoon | 35 minutes | 80.

8 March 2011
Sensorium, Project Arts Centre, Dublin 2
Presented by Sensorium Festival | clarinet | 20 minutes | 60.

20 October 2011
The Bottlenote Festival 2011, Block T, Smithfield Square, Dublin 7
Presented by Bottlenote | clarinet, bass clarinet | 35 minutes | 30.

27 October 2011
Dublin Contemporary, Earlsfort Terrace, Dublin 2*
Presented by Dublin Contemporary | clarinet, xaphoon | 45 minutes | 60.

21 December 2011
Trailblazers & Aha Moments, Smock Alley Theatre, Temple Bar, Dublin 2
Presented by The Trailblazery | clarinet | 30 minutes | 80.

6 March 2012
New Theatre, Temple Bar, Dublin 2
Presented by Beyond The Bookshelf | clarinet | 11 minutes | 50.

17 May 2012
The Back Loft, Dublin 8
Presented by Ergodos | clarinet, bass clarinet | 40 minutes | 20.

30 May 2012
The Irish Museum of Modern Art - launch at Earlsfort Terrace, Dublin 2
Presented by IMMA | clarinet| 40 minutes | 40.

06 June 2012
Night Town Project, The Workman's Club, Dublin 8
Presented by Dublin Writers Festival | clarinet | 6 minutes | 35.

15 June 2012
Bloomsday Festival, Banquet Hall, Smock Alley Theatre, Dublin 8
Presented by The James Joyce Centre | clarinet | 10 minutes | 55.

28 July 2012
Mitchelstown Cave, Co. Cork*
Presented by Cork Opera House | bass clarinet, xaphoon | 28 minutes | 120.

16 August 2012
Long After The Music Is Gone, Radio Launch, Donal Dineen's Alternative, 2FM
Presented by RTÉ 2FM | clarinet, xaphoon | 9 minutes.

7 September 2012
Half Moon Theatre, Co. Cork**
Presented by Cork Opera House | clarinet | 5 minutes | 30.

8 September 2012
Lir Theatre, Dublin 2**
Presented by Dublin Fringe Festival | clarinet | 5 minutes | 130.

21 September 2012
The Contemporary Music Centre, Dublin 2
Presented by Culture Night | clarinet | 13 minutes | 30.

25 September 2012
Long After The Music Is Gone, Album Launch, Odessa Club, Dame Court, Dublin 2
Presented by Ergodos | clarinet, bass clarinet | 41 minutes | 50.

28 September 2012
The Joinery, Arbour Hill, Dublin 7*
Presented by Donal Dineen's Neighbourhood Wash | bass clarinet | 26 minutes | 25

16 November 2012
Bottlenote Festival, BLOCK T, Smithfield Square, Dublin 7
Presented by Bottlenote | clarinet, bass clarinet | 15 minutes | 70.

21 December 2012
Rave at Close of Day, Bandstand, East Pier, Dun Laoghaire, Co. Dublin
Presented by DLR Arts Office | alto and soprano saxophones | 51 minutes | 35.

24 December 2012
Donal Dineen's Christmas Radio Special, 2FM
Presented by RTÉ 2FM | alto saxophone, clarinet | 27 minutes.

9 February 2013
St. Audoen's Church, Cornmarket, Dublin 8
Presented by Bottlenote | clarinet | 25 minutes | 45.

19 February 2013
Ballerup, Denmark**
Presented by Baltoppen | clarinet | 5 minutes | 100.

20 February 2013
Portalen, Denmark**
Presented by Portalen | clarinet | 6 minutes | 110.

23 February 2013
UmeFolk Music Festival, Umeå, Sweden**
Presented by UmeFolk | clarinet | 4 minutes | 140.

28 February 2013
The Joinery, Stoneybatter, Dublin 7
Presented by Fallow Records | clarinet | 30 minutes | 30.

6 March 2013
St. Andrews, Scotland
Presented by StAnza Poetry Festival 2013 | clarinet | 3 minutes | 40.

17 March 2013
The Boys School, Smock Alley Theatre, Dublin 2*
Presented by St. Patrick's Day Festival | clarinet, bass clarinet | 42 minutes | 80.

22 March 2013
The Model, Sligo*
Presented by The Model | clarinet, bass clarinet | 26 minutes | 20.

23 March 2013
Nun's Island Theatre, Galway*
Presented by Galway Arts Centre | clarinet, bass clarinet | 37 minutes | 35.

13 April 2013
Kevin Barry Room, National Concert Hall, Dublin 2
Presented by Deserted Village | clarinet, bass clarinet | 32 minutes | 25.

30 April 2013
The Fumbally, Clanbrassil Street, Dublin 8**
Presented by Happenings | clarinet | 5 minutes | 150.

1 May 2013
Siamsa Tíre, Town Park, Tralee, Co. Kerry**
Presented by Music Network | clarinet | 4 minutes | 35.

3 May 2013
St. James's Church, Main Street, Dingle**
Presented by Music Network/Bealtaine Festival | clarinet | 7 minutes | 85.

4 May 2013
All Saints Church, Phibsboro Road, Dublin 7
Presented by Phizzfest | clarinet | 11 minutes | 35.

11 May 2013
Ardtarmon House, Ballinfull, Co. Sligo
Presented by The Pilgrimage Project | clarinet | 11 minutes | 20.

22 May 2013
Sugar Club, Dublin 2
Presented by The Dublin Writers Festival | clarinet | 3 minutes | 55.

20 July 2013
Saint Patrick's Church, Hill of Tara, Co. Meath*
Presented by Solstice Arts Centre | clarinet, bass clarinet | 42.

2 August 2013
Town Hall, Skibbereen, Co. Cork*
Presented by Skibbereen Arts Festival | clarinet, bass clarinet | 32 minutes | 52.

* Performances with collaborator Donal Dineen (live visuals).
** Solo performances as part of group 'This is How we Fly' concerts.

Appendix C

Compact disc (data CD) one: Software.

Slender Sung Max patch (Distributed Version)[1]

This folder is a package folder for Max 6.1.3 and up. To install a package, simply copy it to your 'packages' folder found in your Max folder. To uninstall a package, simply remove it from your 'packages' folder.[2]

Slender Sung Application

This application is designed for use with MIDI controllers KMI Softstep and Livid Code (with MIDI channels assigned as per Figure A.1, 155). It is also fully functional using a computer mouse navigating the graphic user interface. Hovering over the on screen controls indicates functionality in status bar.

[1] The primary difference between the Distributed Version and the version I have used for this research is the substitution of [grainstretch~], a free granular time stretching object, for [elasticx~] a proprietary software object.

[2] For use with earlier versions of Max copy externals into MSP externals folder.

Appendix D

Compact disc two: Audio Examples

1. Example 3.1 (3:00) | Project Arts Centre
2. Example 3.2 (2:22) | Project Arts Centre
3. Example 5.3 (0:45) | Donal Dineen's Christmas Radio Special, 2FM
4. Example 5.4 (0:55) | The New Theatre
5. Example 5.5 (1:02) | Smock Alley 2013
6. Example 5.6 (1:59) | The Lir Theatre
7. Example 5.7 (1:08) | The Joinery 2013
8. Example 5.8 (3:40) | Contemporary Music Centre
9. Example 5.9 (2:05) | Nun's Island Theatre
10. Example 5.10 (1:08) | Donal Dineen's Christmas Radio Special, 2FM
11. Example 5.11 (1:15) | Irish Museum of Modern Art
12. Example 5.12 (1:06) | Contemporary Music Centre
13. Example 5.13 (1:35) | Smock Alley 2013
14. Example 5.14 (1:02) | Smock Alley 2013
15. Example 5.15 (0:21) | Mitchelstown Cave
16. Example 5.16 (2:24) | Donal Dineen's Christmas Radio Special, 2FM
17. Example 5.17 (2:05) | Nun's Island Theatre
18. Example 5.18 (2:40) | Smock Alley 2013
19. Example 5.19 (1:39) | Album Launch, Odessa Club
20. Example 5.20 (1:42) | Album Launch, Odessa Club
21. Example 5.21 (2:15) | Album Launch, Odessa Club
22. Example 5.22 (3:25) | The Back Loft
23. Example 5.23 (2:29) | Album Launch, Odessa Club
24. Example 5.24 (0:32) | Mitchelstown Cave
25. Example 5.25 (0:56) | Dun Laoghaire Pier
26. Example 5.26 (2:16) | Nun's Island Theatre
27. Example 5.27 (1:58) | Smock Alley 2013
28. Example 5.28 (2:02) | Nun's Island Theatre
29. Example 5.29 (1:02) | Mitchelstown Cave
30. Example 5.30 (0:54) | Mitchelstown Cave
31. Example 5.31 (0:23) | Irish Museum of Modern Art
32. Example 5.32 (0:48) | Album Launch, Odessa Club
33. Example 5.33 (2:20) | The Joinery 2013
34. Example 5.34 (2:46) | National Concert Hall
35. Example 5.35 (5:00) | Half Moon Theatre

Total length 1:04:11

Compact disc three: Performance Documentation

1. *Xmas Special* (4:50)
2. *National Concert Hall* (18:08)
3. *New Theatre* (10:25)
4. *Album Launch* (5:54)

Total length 39:25

Compact disc four: Performance Documentation

1. *Culture Night* (12:36)
2. *The Joinery* (30:00)
3. *Nun's Island* (7:38)
4. *Skibbereen Town Hall* (3:40)

Total length 54:01