HIT SCRAPE CLICK DRAG: ANALYSIS AND APPLICATION OF COMPOSITIONAL METHODS AT THE INTERSECTION OF CONSERVED AND EMERGENT TECHNOLOGIES

A thesis

submitted with a DVD in fulfillment of the requirements for the award of

the degree of

Doctor of Philosophy

at

James Cook University

by

MATTHEW HILL B.A (Macquarie Uni), B.A (Cont. Mus)(Southern Cross Uni),

Dip. Ed (Uni of Melbourne), B.Mus (Hons) (James Cook Uni)

2007

School of Creative Arts

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ACKNOWLEDGEMENTS

This research would not have been possible without the generosity and support of family, friends, colleagues and supervisors. Firstly, to my wife Lisa Jacka, for providing care, motivation and perspective throughout, listening with enthusiasm, introducing me to the wonderful world of computers, providing ongoing technical support for all manner of computer related troubles, editing video and creating the DVD, and proofreading. My children, Gabriella and Cassandra, for encouraging efficiency in my work practices, providing constant grounding and perspective, and (Gabriella) for being the sound source and inspiration for the Electronic Study.

I am very grateful to my mother Marie de Monchaux for enthusiastically supporting my interest in music making, for child minding, cake making, and for providing a most suitable rehearsal venue for the major works. To Martin and Gillian Jacka for providing the ideal 'finish your thesis' environment in Adelaide, including the seaside house, child minding, dinners, beetroot dip, and a daily interest in my progress. To my sisters Angela and Patricia for reading sections of the thesis, and providing support and perspective throughout my candidature. To my brother Barry, my first and ongoing musical collaborator, for contribution to the major works as a performer, coordinator of the NSW contingent, and assistance in ensuring the smooth running of rehearsals.

To all the musicians involved, for their commitment and energy, Ian Brunskill, David Brammah, Rebecca McHutchison, Cleis Pearce and Simon Self, and also to Matthew Curnock for Torakina and the use of Old Pucker. To Michael Worthington for sensitivity and expertise. To Vicki Salisbury at Umbrella Studio for offering the venue for performance and recording of the major works, publicity and support. I am grateful

to Michael Whiticker and Bob Passmore for enabling numerous performance opportunities over the past three years and supporting live improvised music, and to David Salisbury for the Nemo experience, motivation and interest throughout. To Jack Sweetman for the tasteful aesthetic and swift realisation of the DVD cover.

Finally, my supervisors: to Diana Davis for a passion for the right word and fondness for a good figure; to Steven Campbell for technical assistance, compositional inspiration and the pursuit of precision; and, to Malcolm Vick for eagerly stepping in and expertly expediting completion.

ABSTRACT

The creation of music incorporating emergent technologies has occurred throughout history across a range of styles. In the past fifty years advances in electronic and, more recently, digital technologies have led to a range of new music making practices. Most recently, rapid advances in computer technology have enabled the results of complex digital manipulations of sound to be heard in real time, allowing the computer to become a powerful live performance and composition tool. As new technologies emerge, new musical forms based on various levels of synthesis of pre-composed and improvisation based composition methods are developed. This research seeks to identify, define, categorise, explore and develop compositional methods in which traditional composition techniques and emergent technologies intersect.

The research has historical, analytical and personal practice components and is situated in the fields of music analysis, music technology and composition. The deficiencies of existing analytical methodologies are discussed with particular reference to emergent technologies, music creation, recording practice, and interdisciplinary theoretical issues. A text-based, parametric analysis method is developed and applied to thirty-six selected key works in electronic/electroacoustic, improvised, rock and electronic dance music (EDM) genres. The works analysed originate from the USA, Europe and the UK and span the past seventy years. The analytical method considers the processes, shaping factors (i.e., contextual or extramusical elements) and inputs (i.e., textual or musical elements) involved in the creation of works and is intended to address both conserved and emergent technological elements. Observations made by the researcher are included alongside those from the literature.

The detailed analyses of the thirty-six selected key works are included as an Appendix, with a summary mapping of genre terrain included in the thesis. Whilst some generalisations about works within genres and between genres are made, the compositional methods identified constitute a complex and diverse set of music making practices. In general terms, in electronic, rock and EDM genres, traditional roles of composer, performer, producer and engineer are blurred, with individual artists moving between such roles. In improvised works a distinction between performer/composer and engineer is apparent. In more specific terms, the use of historically emergent sound sources distinguishes most of the electronic works at a timbral level. In some cases in the electronic genre, the sound source is an important conceptual driver for the structure of the works. In other genres, emergent sound sources often lead to an expansion of existing forms or used to supplement, or substitute for, traditional instrumentation.

The research makes a direct and explicit link between music analysis and music creation. The insights gained from the analyses are applied to the creation of eight new musical works: four genre-specific studies and four major works. Recordings of the practical works are presented, alongside video documentation of the rehearsal, performance and recording of the major works, on an accompanying DVD. A compartmentalised and hybridised approach to composition is utilised, drawing directly from the parametric analysis method. The practical works feature both solo and group ensembles and incorporate traditional instrumentation and digitally sampled and synthesised elements. A range of individual and collaborative 'top down' and 'bottom up' processes are explored. A computer based performance instrument (CBPI) is developed using the software Max/MSP. The CBPI embeds compositional elements identified in the analyses (relating to sound source, sound processing, rhythm, pitch,

texture, and spatial elements), and is utilised in the creation of the major works. The compositional approach crystallises and extends many aspects of past personal practice. The eight practical works represent some of the possibilities of both the CBPI and the analysis/creation model.

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CHAPTER ONE

INTRODUCTION

1.1 Technology and Music Creation

Throughout history, technological developments have contributed to musical creation at the levels of production, storage and reception. At the level of production, technology has provided means for the creation, control and capturing of sounds through the development of acoustic, mechanical, electronic and digital musical instruments, amplification, sound processing and recording equipment. Furthermore, theoretical systems regarding particular aspects of music (for example, rules of harmony) have been developed to provide a framework for the creation of new musical works. In broader terms, a range of work practices surrounding music creation have developed, enabling, for example, the division of roles between composer, conductor and performer in the Western art music model, the collaborative producer, engineer and band model in rock, or the solo composer/producer model in electroacoustic or electronic dance music genres.

At the levels of storage and reception, technological developments have disrupted the physical, spatial and temporal aspects of music performance and reception. Since the advent of sound recordings, the presence of a performer is no longer required for a listener to experience music. With global distribution networks, much of the world's recorded music becomes accessible at any time given the appropriate means. Whilst various traditional forms of reception remain (e.g., the concert hall, festival stage, nightclub etc.), recorded music permeates much of life (at least in Western developed countries) in the form of musak, radio, television and internet or individualised by the

Walkman or more recently, the Mp3 player. From the perspective of a music creator, the impact and/or shaping of technological developments is directly apparent at the level of production and more indirectly apparent at the levels of storage and reception.

Over time, some of the developed technologies (at all levels) continue to be utilised in the creation of musical works and may be termed *conserved technologies*. Hence particular compositional and improvisational practices incorporate *conserved technological composition methods* (herein *conserved methods*). At the level of production, conserved methods can be broadly categorised as being either pre-compositional (predominant in Western art music, rock and electronic dance music), improvisational (predominant in jazz), or a fusion of the two (such as in *Third Stream* jazz, or works of art music composers that incorporate improvisation). At the levels of storage and reception, a distinction can be made between presentation as live performance or recording.

At any given time in history, *emergent technologies*[1] are developed that may be incorporated into the creation of musical works via *emergent technological composition methods* (herein *emergent methods*). Current emergent methods have stemmed from advances in digital audio technology. In the last fifteen years, rapid increases in computer processing speeds and storage capacities have enabled the results of complex digital manipulations of sound to be heard in real time, allowing the computer to become a powerful live performance and composition tool. With this technology, new electro-acoustic musical forms have emerged that are based on various levels of synthesis of pre-composed and improvisation-based composition methods.

[1] I am grateful to Andrew Brown for pointing out the particular scientific meaning of "emergent" relating to epiphenomena that arise indirectly out of dynamic conditions described as complex systems. The term is currently used in research in computer music, however, I use the term "emergent" in relation to its generic meaning, i.e., new, and/or becoming more widely utilised. The terms "emergent technologies" and "conserved technologies" were developed by Steven Campbell.

Musical works created with emergent technologies often incorporate conserved technologies and are thus considered to be at the *intersection* of conserved and emergent methods. A recent example is the work of Interface (Curtis Bahn and Dan Truman) (Bahn & Truman, 2001). Interface incorporate emergent technologies (e.g., forms of digital processing and instrument design) whilst utilising many conserved technologies (e.g., acoustic instrument technique, MIDI, free improvisation and chamber music presentation). An historical example is the work of Miles Davis (1926–1991). Davis, throughout his career, was often situated at this intersection, incorporating emergent technologies (e.g., bebop, cool jazz, modal jazz, fusion, use of electronic instruments, studio editing, studio effects and rhythm programming) whilst utilising many conserved methods typical of jazz (e.g., instrumentation, small combo ensembles, form – head and solos, live performance in clubs, concert halls and outdoor stages and recordings presented on record and compact disc). These emergent technologies utilised by Davis are now all considered conserved technologies.

Since 1997 my own composition and performance history has been situated at this intersection. My solo album *The Spider* (1997) featured a range of composition methodologies including conserved methods (e.g., acoustic and electronic instrumentation, modal pitch elements, solo and group improvisation and MIDI sequencing) in addition to emerging methodologies drawn from electronic dance music genres (e.g., breakbeat samples and use of a digital sampler). Since 1999, in the group amphibian (my collaboration with Barry Hill, Robert Walsh and Michael Worthington) traditional instrumentation (i.e., drumkit, double bass, keyboards) has been augmented by the use of digitally manipulated field recordings both in live and recorded presentations. My honours research (Hill, 2003) explored the combination of traditional

instrumentation with timbral, spatial and programmatic manipulations of field recordings using proprietary software developed within Max/MSP.

Examination of the compositional methods utilised in my own works discussed above has the potential to offer some insight into how selected emergent methods can be incorporated into musical works. However, a thorough examination of how conserved and emergent technologies have been, and can be, utilised requires a differently focused investigation and one which goes beyond personal practice. At this broader level, a key question emerges at this point: how do some emergent methods, over time, become conserved methods, augmenting or replacing previously conserved elements whereas others do not survive over time? More specifically, how does a composer/music creator incorporate emergent technologies into musical works that are of continued interest to other composers/music creators? In order to answer this, it is necessary to examine the links between music creation and compositional methods by investigating the factors that shape the creation of a musical work.

1.2 Music Creation and Music Analysis

The creation of a musical work is the result of a complex interplay of factors influencing the actions and decision-making processes of the individuals involved. These factors range from the particular techniques surrounding music making (e.g., music theory, technical performance issues and the limits/potential of equipment) to broad social, economic and cultural contexts which impact in some way on the nature of such creations. Figure 1.1 presents an overview of the *shaping factors*, *inputs*, *processes,* and *outcomes* involved in the creation of a musical work.

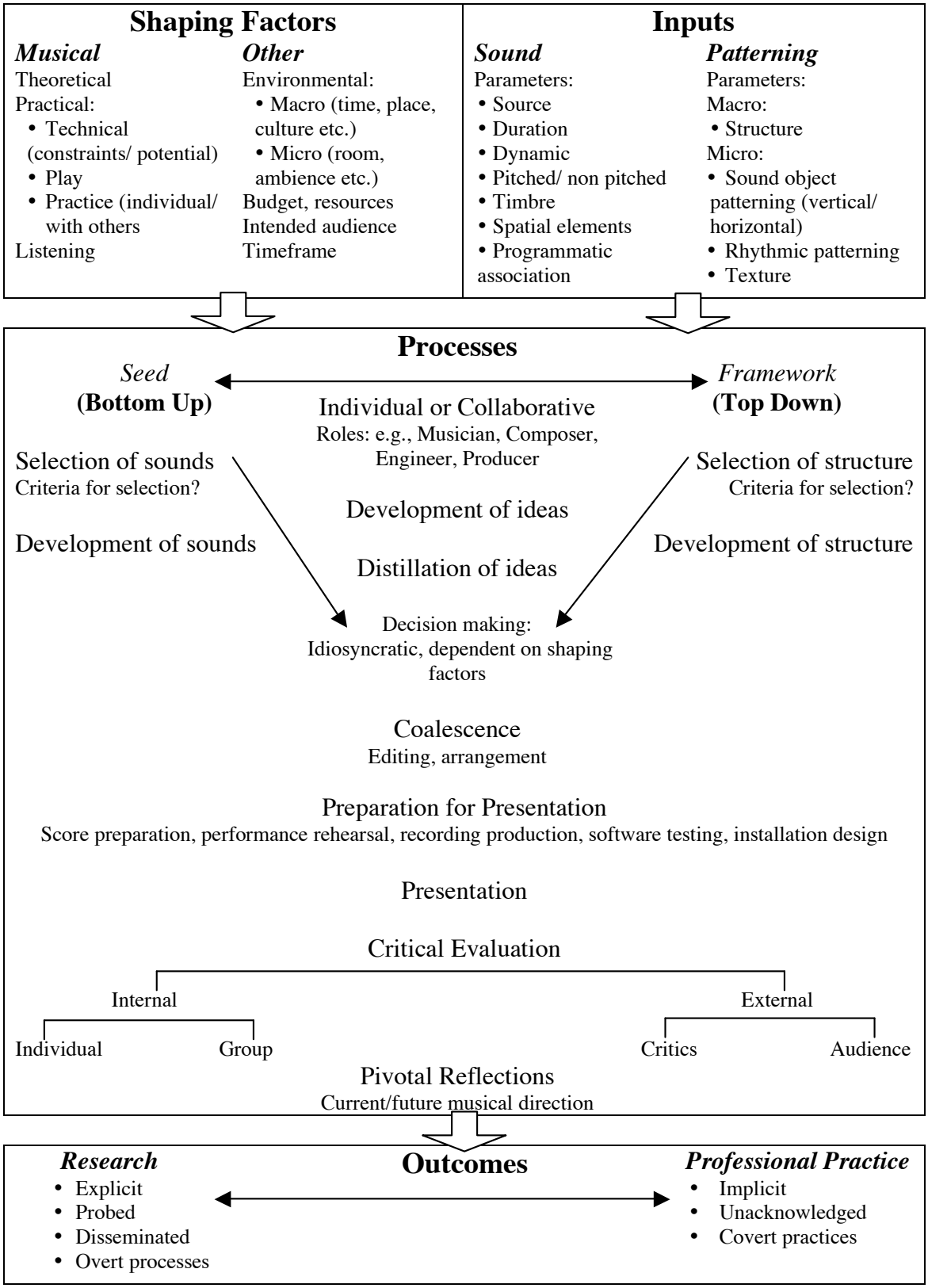

Figure 1.1. The creation of a musical work (Adapted from Davis, 1995).

The emphasis on particular shaping factors (top left of Figure 1.1) will vary according to a given work and is connected to musical style. While the shaping factors determine the process by which a musical work is created, it is the organisation of particular inputs (top right of Figure 1.1) which provide the primary surface of a completed musical work. As with the shaping factors, the emphasis of particular inputs will vary according to a given work and is also connected to musical style. The various processes listed are not discrete categories and there is often fluidity between, for example, a bottom up or a top down approach.

Figure 1.1 provides a useful starting point for the examination of the impact of technology on music creation. If the various shaping factors, inputs, and processes given in the figure could be identified for a range of works, an accurate and relatively comprehensive picture of conserved and emergent methods could be given. While this type of examination is the task of music analysis, it seems reasonable to ask to what extent extant music analysis practices provide insight into the range of factors listed in Figure 1.1. Further, are extant analytical practices appropriate for works incorporating emergent technologies? In the context of these questions, a survey of current literature (see Chapter Three) reveals the following issues:

- A lack of specific and/or explicit connection between musical analysis and musical creation;
- A tendency of musical analysis practice to become an end in itself, unrelated to other musical pursuits (e.g., production, performance, composition, education);
- An inadequacy of established analytical methods to deal with the processes and outputs of emergent technologies; and,

- Dispute as to the appropriate focus for analysis – musical work as an autonomous object and/or musical work within a broader context (e.g., psychological, sociological, cultural setting).

These issues present a challenge for the music creator/researcher seeking to identify, analyse, define, categorise and explore and develop composition methodologies at the intersection. Without suitable analytical tools compositional methods may be identified, analysed, defined and categorised, but the link to music creation, the exploration and development of such methodologies, may remain at a subliminal level. In other words, using existing analytical means develops an intuitive knowledge of how music works. However, an explicit and probed link between analysis and creation may remain unrealised. This is compounded by the difficulties presented by the proliferation of emergent methods (deriving primarily from electronic and digital technologies over the past seventy years) and the inability of many existing analytical methods to address such methodologies. This challenge constitutes the rationale for this research.

1.3 Rationale for Research

The rate of change and the proliferation of emergent technologies in the past seventy years have precipitated a need to identify, analyse, define, categorise, explore and develop compositional methods in which traditional composition techniques and emergent technologies have intersected. Existing means of musical analysis are inadequate for this task and require expansion due to an inability for many established analytical methods to deal with the processes and outputs of emergent technologies, and the lack of a specific and/or explicit link between analysis and music creation.

1.4 Research Questions and Aims of Research

In order to address the issues raised above the following questions focus this research:

1. What compositional methods have been developed via compositional and improvisation practices at the intersection between conserved and emergent technological compositional methods?
2. What is the potential for selected compositional methods, which exist at the intersection of conserved and emergent methods, to be applied to the creation of new musical works utilising current emergent technologies?

The aim of the research, then, is threefold:

1. To identify and analyse a range of compositional and improvisation practices at the intersection between conserved and emergent technological compositional methods as the basis for the development of an analytical methodology capable of application to the creation of new musical works.
2. To develop a series of works utilising selected compositional and improvisational strategies from this intersection that exemplify the application of analysis to music creation.
3 To develop a computer based performance instrument compatible with the exemplar works in (2) encompassing conserved and emergent technological compositional methods and improvisation practices.

1.5 Organisation of the Study

Chapters Two and Three constitute the literature review, and focus on technology, personal practice and analysis. The methodology for the research is presented in Chapter Four. The examination of compositional methods in four genres (electronic music, improvised music, rock and electronic dance music), including discussion of a practical study for each genre, is provided in Chapters Five and Six. Chapter Seven presents the development of the computer based performance instrument using Max/MSP. Chapter Eight presents a discussion of the development and realisation of the major works. Concluding remarks are presented in Chapter Nine.

A DVD and a CD accompany the written thesis. The DVD (DVD-Video format) contains audio recordings of the genre studies and major works alongside video documentation of the rehearsal, performance and recording of the major works. The CD contains three appendixes. Appendix A contains summary tables of fifteen analytical methods discussed in Chapter Three. Appendix B contains the detailed analyses of the thirty-six works discussed in Chapters Five and Six. Appendix C contains demonstration versions of the major works and the Max/MSP patches used in the electronic and improvised studies and for the computer based performance instrument with accompanying audio files (i.e., actual samples used in works).

CHAPTER TWO

FIELD AND PERSPECTIVE: TECHNOLOGY AND PERSONAL PRACTICE

In order to begin an examination of compositional methods at the intersection between conserved and emergent technological methodologies, it is important to define technology and to explore the nature of the interaction between music and technology. Central to this interaction is the role of the music maker. The first part of this chapter (2.1, 2.2 and 2.3) provides an overview of the *field* of technology: offering a definition of technology, and a model for understanding the interaction between music and technology. The second part of this chapter (2.4) presents an overview of the position of the researcher in relation to both music and technology, providing the *perspective* from which the research is conducted.

2.1 Defining Technology

Definitions of technology commonly broaden from a mere consideration of material products to include the ways in which human knowledge and activity evolves around such material products. From a sociological perspective, Earle and Fopp (1999) define technology as "the application of cultural knowledge through the creation of material items and processes to service the perceived needs of society" (p. 100). Writing in the field of science and technology studies (STS), McGinn (1991) outlines four possible meanings of technology which further develop the notion of technology as activities and knowledge:

- As Technics. … [i.e.,] material products of human making or fabrication. …

- As Technology. … [i.e.,] the complex of knowledge, methods, materials, and if applicable, constituent parts (themselves technics) used in making a certain kind of technic (at a certain point in time). …
- As a Form of Human Cultural Activity. … [i.e.,] a distinctive form or kind of human practice – e.g., technologists – a category including craftspeople and machinists as well as professional engineers – as practitioners. …
- As a Total Societal Enterprise. … [i.e.,] the complex of knowledge, people, skills, organisations, facilities, technics, physical resources, methods, and technologies that, taken together and in relationship to one another, are devoted to the research, development, production, and operation of technics (pp. 14-15).

Applying these understandings to the field of music, a range of meanings for the term 'music technology' can be given which encompass the material objects involved in the production, storage and distribution of music (e.g., instruments, recording equipment, storage devices such as scores, vinyl LPs, compact discs, etc.) at the narrow end, through to the incorporation of the development of knowledge and activities surrounding music making as a whole. Much of the literature in music and technology traverses this range of meanings. For example, Moore (1992) defines technology as "the sum total of ways by which practical and aesthetic goals are realised" (p. 329). He suggests that contemporary music technology rests on "the four pillars of music notation, music theory, psychoacoustics and sound recording" (p. 331). Music notation and sound recording are examples of a narrower definition, whereas music theory and psychoacoustics are concerned with broader knowledge and activities.

Frith (1996) and Théberge (1997) expand understandings of technology to include discussion of evolving social practices accompanying changes in the means of production, storage and distribution, most notably through the twentieth century. Frith (1996) begins with a 'most basic' definition of technology as "the ways in which sounds are produced and reproduced" (p. 226) and then considers various social practices which emerge for the listener. He identifies three social effects of the technology of sound recording: ubiquity (i.e., music is everywhere, no longer just for special occasions), quantity (i.e., music from all sources, past and present, equally available) and individualisation of experience (i.e., the 'Walkman' effect).

Théberge (1997) is primarily concerned with the perspective of the music maker and uses the term 'technology' in many ways. For example, he incorporates the notion of 'technique' to describe not only performance/compositional technique but "in its full sense as the organisation of means – material and social – employed for musical ends" (Théberge, 1997, p. 160). Following Frederickson, Théberge describes 'social technology' (i.e., hierarchies, hiring practices, conventions, patterns of work within particular parts of industry – symphony orchestras, recording studios etc.) and 'machine technologies' (i.e., musical instruments, recording devices etc.). Following Foucault's notion of a 'technology of sex', Théberge uses the term 'technologies of music' to encompass "discourses, institutions and practices – aesthetic, scientific, pedagogical, legal, or economic – that 'produce' representations of music that have concrete ideological or material effects on music-making" (p. 160).

For Théberge copyright law is an example a 'legal technology' which not only assigns authorship, defines legal and economic rights and impacts on profits of individuals and

companies “but also [defines] the limits of legitimate musical/creative activity” (p. 161). To such a wide panorama of ‘technologies’, Gilbert and Pearson (1999) add the ‘chemical technologies’ involved in the reception of music, for example in the production of the drug MDMA (Ecstasy) and the impact this had on the development of electronic dance music styles.

In this research, the emphasis is on the relationships between music making and emergent tools, processes and knowledge. To simultaneously capture and distinguish between both the narrower and more traditional understandings, referring to more material aspects of technology, and also the broader understandings, which include the more social aspects of technology, two terms are used. Firstly, the term ‘music technology’ is intended to refer to the material objects involved in the production, storage and reproduction of music. Secondly, the term ‘technologies of music’ (following Théberge, 1997) is intended to include consideration of the various processes, activities and knowledge involved in music making.

2.2 Technology in Music: Overview of History and Practice

From both perspectives, a narrow ‘technology as material object’ and a broad ‘technology as activities/knowledge’, technology has been inseparable from music creation and performance throughout human history. This history can be traced in relation to both the narrow sense of technology (with the first objects hit, scraped or blown) and the broader sense (with the social activities, structures and knowledge which have developed accordingly). Cutler (1984) and Frith (1996) divide the history of music technology into three stages marked by the oral, written and recorded

(corresponding to ‘folk’, ‘art’ and ‘popular’) modes of music production, storage and reproduction. At each stage major technological shifts, in both narrow and broad senses, occur. In the oral/‘folk’ mode, music is produced, stored and reproduced in the human body. In the written/‘art’ mode music is stored in the score, enabling an “imaginary existence” (Frith, 1996, p. 227) of the music and a division between composer and performer, fostering the rise of the Renaissance ideal of the artist as genius and the contemplative audience. In the recorded/‘pop’ mode music is stored and retrieved mechanically, electronically or digitally. This removes barriers of time and space for the listener and commodifies music.

Whilst these three stages provide a useful overview, Middleton (1990) suggests that such compartmentalisation overlooks the complexity of actual music practices through history where

> Western music as a whole, since at least the late Middle ages, is best seen as a ‘total system’. Diachronically there are no simple antitheses; rather there is a continuum with certain quantum jumps, often marked by – among other factors – changing relationships between oral and written inputs or by new kinds of notation (p. 82).

Middleton illustrates this point with two examples, highlighting the move from figured bass to completely written parts in the late eighteenth century, and noting Rossini’s scoring of previously improvised vocal ornamentation.

For Middleton (1990), the development of recording technology does not necessarily mean a return to 'oral' methods of music making; the situation is more complex and resists a totalizing historical schema. Middleton asks us to consider what differences follow from, for example, Elvis Presley initially working from printed song copies and reworking them in the studio, as opposed to Lennon and McCartney bringing orally worked out ideas that are then transformed/supplemented through literate means by producer George Martin (pp. 82-3). Such examples illustrate how the development of a particular set of music technologies (e.g., recording technologies) has led to a multiplicity of practices.

Another music technology, the digitization of means of production, storage and distribution, has accelerated the proliferation of various musical practices. As Born (2005) notes:

> If music notation and recording were the means by which musical ideas, and then sounds, became spatially mobile – released, or alienated, from both place and co-presence – then digital media have accelerated those processes. With centrifugal force, and more easily than in its commodity forms, music is scattered, flung via the internet in near-real time from any point of creation and departure to any number of points of destination (p. 25).

In terms of production (i.e., music creation) digitization offers new modes of collaborative creativity which derive from the "immaterial form of code" (Born, 2005, p. 26). Prior to the binary representation of music, material objects such as a score or recording provided a somewhat final notion of the 'work'. The reproducibility afforded by digital technologies

enables the "recurrent decomposition, composition and recomposition by a series of creative agents" (p. 26), a process she refers to as "relayed creativity" (p. 26). The use of vinyl samples or 'breaks' by hip-hop artists prior to the widespread adoption of digital samplers in the early 1990s provides a precursor to this practice.

As Gilbert and Pearson (1999) point out, it is not just the 'leading edge' items of technology that result in new or shifting musical practices. They argue that it is important to acknowledge and examine the way technology has 'permeated' various musical practices, including the innovative recycling and 'misuse' of 'low' technology items, for example the reclaiming of the turntable as an instrument in hip-hop, and the use of 1970s analogue synthesisers in the development of techno and house in the 1980s. A similar reappraisal of the potential of 'old' technology occurred in the eventual acceptance of guitar feedback as a desirable musical element in the realm of popular music. The invention of the solid body guitar in 1950 was a response to this problem of unwanted feedback in the original hollow-body design. However, by the time Jimi Hendrix performed his feedback laden version of "The Star Spangled Banner" at Woodstock in 1969 (on a solid body guitar) it was clear that a "social reconstruction" of feedback had occurred (McSwain, 2000).

2.3 Relationship Between Music and Technology

Prior to the application of electronics to music, Moore (1992) suggests that the development of music technology was evolutionary, with new instruments, forms of notation etc., emerging in response to perceived musical needs. However, with electronics, change became revolutionary as the range of possibilities for new sounds

rapidly exploded. This view is echoed by Wishart (1992) who suggests that the developments in electronic, and more recently digital technology throughout the twentieth century have led to "a much more intense relationship between music and technology" (p. 565). He points to various problems and possibilities for music and technology. Problems include commercial pressures, confusion between technical and musical excellence and scientific versus artistic imperatives. Possibilities include aspects of music education, score production, instrument building and the construction of 'meta-instruments', i.e., controlling a broader range of timbre/sound production in addition to pitch.

The potential for individual and/or collective music makers to negotiate such 'problems and possibilities' presented by changes in music technology can be viewed in terms of the broader theoretical notion of agency. Taylor (2001) describes agency as "an individual actor's or collective capacity to move within a structure, even alter it to some extent" (p. 35). According to Taylor, the notion of agency addresses the relationship between humans and technology in a more complex and useful manner than the traditional poles of technological determinism (i.e., technology directly transforming the user) and voluntarism (i.e., technology as a neutral tool).

Subsumed within the general notion of agency are debates surrounding traditionalist/revisionist approaches to technology and a structural/functional distinction between understandings of music software. Moore (1992) distinguishes the approach of the traditionalist and revisionist: the former seeks to maintain existing artistic goals/aesthetic whilst using new technologies, whereas the latter seeks to find new

artistic possibilities with new technologies.[2] According to Moore the commercial imperative for manufacturers of music technology has led to a proliferation of devices that serve a traditionalist approach. An example of this is the relative success of Robert Moog's keyboard interface for a voltage-controlled synthesiser in comparison to Donald Buchla's less familiar touch control surface.[3]

Regarding music software, a distinction can be seen in terms of the user having a structural or functional mental model of the software application. The structural approach emphasises knowledge of how a system actually operates whereas the functional approach emphasises knowledge of how to use the system (Kirk & Hunt, 1999). Favouring a structural approach, Jean-Claude Risset suggests that "the easier a system is to use, the more limited are its possibilities" (cited in Chadabe, 1997, p. 258). Barry Truax, who only uses software that he creates himself, claims "that most people are unaware of how commercial software colors their musical process and causes standardization" (cited in Chadabe, 1997, p. 258). Others, such as Laurie Spiegel see the benefits of the functionalist model offered by many 'off the shelf' products. She suggests that such products enable more people to enjoy and make satisfying music without the necessity of high levels of theoretical or technical knowledge. Furthermore without having to focus on minutiae of, for example, 'how to make notes', the music maker is freed up to address higher-level aesthetic concerns (Spiegel cited in Chadabe, 1997, p. 332).

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[2] There is a parallel between voluntarist and traditionalist perspectives, both incorporating the notion of technology as a neutral tool. However, it is difficult to draw a comparison between determinist and revisionist as these terms imply opposing levels of individual agency.

[3] The relative success of Moog's design and eventual market adoption of the synthesiser as 'glorified keyboard' model is seen by Pinch and Trocco (2000), in terms of a social construction of technology theory, as a result of Moog's role as an engineer, seeking to succeed commercially and responding to feedback from a range of musicians, whereas Buchla was primarily a musician and interested in the creation of new sounds.

Related to this structural/functional distinction is the issue of distinctive forms of practice emerging through the use of emergent music technologies. Théberge (1997) discusses the differences between a drummer and a drum machine programmer and argues that traditional instrument practice leads to the development of certain sensitivities which are otherwise bypassed when musical results are achieved quickly. Théberge (1997) suggests that many contemporary popular musicians are, therefore, 'consumers' of various technological products (drum machines, synthesiser presets etc.). This consumption model could also be extended to a range of more traditional musical practices. For example current models of jazz education encourage the learning of particular harmonic frameworks, scales, melodic patterns etc., and in the broader context of technologies of music the consumption of these is comparable to Théberge's contention. Furthermore, the selection of a traditional instrument (with a relatively fixed timbre) is analogous to the consumption of a particular synthesiser 'preset'.

Clearly then, the relationship between music and technology (or more importantly, for this research, music makers and technology) is complex and can be understood in a variety of ways and on a number of levels. Taylor's (2001) understanding of agency offers a theoretical framework which addresses this complexity. Following Ortner, Taylor adopts 'practice theory' as a useful model which enables the consideration of the 'positionality of individual agents' in relation to aspects such as "social class, age, geographical location, gender, sexual orientation, religion, race, ethnicity, cultural capital and so on" (p. 37).

In the context of this research, the notion of *positionality* provides a useful framework within which to consider an individual's (or group's) music making practices in relation to

technology. For example, the terms *emergent technology* and *emergent technological compositional method* (from section 1.4) are, to a certain extent, relative to the particular user. The use of turntables and other 'low technology' items by hip-hop and electronic dance music artists cited above reflects the particular positionality of certain music makers that contrasts, for example, the positionality of the electronic musician/researcher at *Institut de Recherche et Coordination Acoustique/Musique* (IRCAM). For the purposes of this research, both can be considered to be dealing with emergent technologies and creating emergent technological compositional methods. It is the intention of this research to investigate a number of particular music making positionalities, including my own, which is presented in the following section.

2.4 Research Position: Filter of Personal Practice[4]

In my own case, the contexts of life – upbringing, education, musical experience and work – appear to have shaped both my musical practice, and my practice as a musician-researcher in this thesis, in a wide range of complex ways. In order to explore my own positionality and to make explicit the perspective from which the research is conducted, I offer an overview of the following: my musical environment to date, previous musical education, performance and composition experiences. The section culminates in the development of a 'filter of personal practice' framework for the analytical and creative work to follow.

The rationale for such an exposition is grounded in practice-led research where the positivist paradigm (i.e., the notion of the detached, objective researcher) is rejected. As

[4] Steven Campbell invented the concept of the "filter of personal practice".

Gray (1996) suggests: "In the role of the practitioner-researcher subjectivity, involvement, reflexivity is acknowledged; the interaction of the research with the research material is recognised" (p. 13). Emmerson (2001) reinforces this notion from an artistic position: "Even scientists have long since abandoned the Newtonian idea that the observer is somehow outside the system observed. All artists have a point of view and cannot feign objectivity" (p. 20).

According to Davis (2003), for the creative artist-researcher the traditional literature review "also typically involves locating the genesis of one's practice, an identification of pivotal theoretical and other influences on practice, as well as a critical analysis of current dilemmas/stalemates etc., in the practice" (p. 19).

2.4.1 Environment

I grew up in a large middle class family, living initially in suburban Canberra before moving, at age seven, to a small farm on the outskirts. My parents both performed non-professionally, my father having a repertoire of about three stride-style arrangements for piano (including "Sunny Side of the Street" and "Ain't Misbehaving"), my mother a range of folk and popular songs sung with guitar accompaniment. Having lived in Colombia, South America for a large portion of her own childhood, some of her repertoire was in Spanish. The family all had private instrument lessons and I was thus exposed to the daily practice of elder siblings preparing for Australian Music Examinations Board (AMEB) exams on piano, clarinet and/or piano accordion. The listening preferences of my five elder siblings dominated the selection of music heard on the family stereo and included a steady diet of 1970s and 1980s mostly guitar driven

rock music (e.g., Crosby, Stills, Nash and Young, Bruce Springsteen, Bob Dylan, Rolling Stones, David Bowie, The Angels, Cold Chisel, Midnight Oil etc.). The popular music show *Countdown* was a prime fixture for weekend television viewing. Emerging from the shadow of my siblings, my own teenage and early twenties listening incorporated a more contemporary line-up of rock acts (including The Police, U2, The Smiths, REM, Talking Heads, The Pixies, Pavement, Fugazi, The Clash etc.) with some 'retro' 1960s rock interests (e.g., Hendrix, The Doors, Velvet Underground).

Attending live performances was an integral part of my own reception of music. While at high school I attended numerous 'big name' rock concerts at large venues (e.g., the Sydney Entertainment Centre and Canberra's equivalent, the Indoor Sports Stadium) and numerous smaller gigs at pub/club venues in Canberra. After finishing school I moved to Sydney for three years (1988-90) where I frequently saw local live rock bands in inner city pubs (e.g., Landsdown, Hopetoun, Sandringham and Annandale Hotels). This period saw the rise of the electronic dance music (EDM) scene in Sydney and although at the time this music/scene did not appeal, many friends attended rave parties and I thus received a second-hand view. At this time my listening expanded beyond mostly guitar-based rock, to include some EDM and *ambient* music (e.g., Brian Eno), the latter a result of listening to the eponymous JJJ radio program presented by Arnold Frollows.

For two years (1991-92) I lived in New York and experienced a major shift in my listening habits largely through exposure to recorded and live music at the venue and record label, The Knitting Factory, where I worked as an intern. Unbeknown to me the club was at that time a focal point for the 'downtown' experimental and improvised music scene and regular performers included John Zorn, Bill Frisell, Wayne Horvitz,

and The Jazz Passengers. In exchange for menial unpaid daytime work in the venue/label office I was able to attend concerts for free and was thus exposed to highly skilled improvising musicians, playing energetic and eclectic original music, which appealed to my indie-rock sensibilities. Tracking down recordings of these artists led me, unwittingly into the realm of jazz.

My recorded music listening for the ensuing seven years (1992-99) involved largely a chronologically reverse trawl through a potted history of jazz, beginning with the Knitting Factory artists, moving through contemporary jazz and fusion (e.g., John Scofield, Pat Metheny, Davis circa. *Bitches Brew*), 1950s and 60s Bop (e.g., John Coltrane, Sonny Rollins, Bill Evans, Herbie Hancock) and stopping at Charlie Parker. I attended numerous contemporary jazz gigs in Sydney (1993–94), such as those presented by the Sydney Improvised Music Association, in Lismore (NSW) and Brisbane (1995-97), and in Melbourne (1998-99).

In 1999 I began playing with the group amphibian with whom listening became a quasi research activity as the group deliberately sought to absorb elements of interest from a range of styles. Practicing with this group often involved playing along to various funk, rhythm and blues and EDM albums (e.g., James Brown, Stevie Wonder, Underworld, St. Germain and Destiny's Child). In 2003 I moved to Townsville and whilst researching an Honours degree I listened to a range of electronic and electroacoustic works in the art music tradition (e.g., by Stockhausen, Schaeffer, Xenakis, etc.). Teaching in orchestration and Western art music survey courses at university (2003–05) foregrounded this tradition and again listening became a research activity, this time necessary for teaching purposes.

2.4.2 Education

My musical education experiences have involved a combination of formal individual and group instrumental lessons, institutional and self-directed study/research and individual and small group aural/oral approaches. My formal music education began at age seven with private piano lessons, working through AMEB grades one to six, ending lessons at age seventeen. At fifteen I started playing drumkit and guitar, learning some basics on drumkit from a friend who played in the school band and from my brother on guitar. At this time I began to learn rock pieces aurally, finding standard rock lead sheets inadequate, particularly in respect to chord voicings (usually a generic version on the lead sheet) and guitar/drum rhythms (usually not indicated).

My musical education continued in a self-directed, mostly aural manner until 1994 (age 25) when I began taking singing lessons, attended a short popular music course (The Bondi Youth Wave), attended ensemble classes (Jazz Studies – external program at Sydney Conservatorium) and began private guitar lessons. The latter two were a response to my developing interest in jazz and the recognition of a particular pathway for an aspiring jazz musician, i.e., the requisite for an extended individual practice period. In 1995 I began a Bachelor of Arts (Contemporary Music) at Southern Cross University (Lismore, NSW) as a guitar performance major, studying with Jim Kelly. Although notionally a popular music course, a small group of guitarists, including me, focussed our instrumental efforts on jazz/fusion styles, becoming an informal 'jazz group' for the small group lessons with Kelly. At SCU I also studied contemporary/popular music theory and arrangement and audio production.

After graduating from SCU I moved to Melbourne to pursue a performance career on guitar, however after nine months of an intensive practice routine I developed an RSI-type injury in one arm that stopped my playing. Initially I used the subsequent available time (i.e., without practicing 4–6 hours per day) to practice sight singing but as the injury persisted I took up keyboard as an instrumental practice. Since that time I have pursued the task, in a mostly self-directed manner, of transferring my jazz-theoretical knowledge from guitar to keyboard/piano, having occasional one-off lessons with visiting jazz performers.

With the group amphibian, additional interests in synthesis and field recording emerged. Knowledge of the former developed via individual study of various 'how to' books and application of 'play' procedures with a digital analogue-modelling hardware synthesiser (Waldorf Q). I received instruction in field recording from the group's engineer (Michael Worthington) and drummer (Rob Walsh). Recording with the group provided initial contact with the digital recording, editing and mixing software Pro Tools. These interests were further pursued in my Honours research (2003) where I learnt the basics of the graphic programming software, Max/MSP, with direction from my supervisor. My education in relation to various other commercial music software applications (e.g., Pro Tools, Reason, Ableton Live and Cubase) has followed a 'bottom up' and/or 'need-to-know' pattern. A combination of software tutorials, help-manuals and experienced peers has enabled me to complete desired tasks.

2.4.3 Performance / Composition

Prior to the current research, rock, improvised music, electronic music, field recording and multimedia constituted the main musical terrain. I have engaged in a range of

compositional methods utilising both conserved and emergent technologies, with the sound of the works reflecting a pluralistic set of musical influences, discussed in 2.4.1 above. My initial performance experience was at the piano, limited to AMEB exams and yearly concerts at which all students of my piano teacher were required to perform. I began 'composing' on the guitar at age fifteen, partly due to the freedom I felt 'not knowing where the notes were' or having to play from notation, i.e., the opposite of my previous piano experience. These first compositions were short instrumental guitar pieces aligning with the 'folk'/oral mode (discussed in section 2.2, i.e., produced, stored and reproduced in the body). I recorded some pieces on cassette, including, what for me was a memorable experimental improvisation incorporating a sustained drone from a Casio keyboard and radio interference transmitted via an electric guitar pickup.

At around the same time I began composing (age fifteen) I began playing drumkit, initially jamming with my brother on guitar, and later with friends playing rock and blues covers. At eighteen I began performing publicly as a drummer and vocalist with a trio performing punk, ska and indie rock covers at parties, band competitions and functions. Whilst in New York I joined an indie rock group as a drummer, performing original material (written by the main vocalist/guitarist) at venues such as CBGBs and the Knitting Factory. At this time I was writing and recording songs with the aid of a four-track cassette recorder and drum machine and in 1992 produced a demo tape intended to showcase original material. The compositional process involved an oral/aural approach, usually beginning with a guitar riff or chord progression over which I would typically improvise melodies on guitar or vocal. The multi-track recorder enabled listening and refining before lyrics, bass and drum machine parts were added in a lounge room studio featuring a guitar amplifier and one microphone. Returning to

Sydney I assembled a band, in which I sang and played guitar, eventually performing this material at various inner city pub venues.

Attending music courses, first the Bondi Youth Wave (1994) and then at SCU (1995-97), increased my skills and expanded my musical-social network, and performance opportunities increased accordingly. In Sydney in 1994-95 I played bass in a funk/ska band, and in Lismore (whilst at SCU) I performed regularly on guitar in a jazz standards duo (with another guitarist) and in a funk/reggae/soul covers band. At SCU I led a jazz/fusion trio (guitar/bass/drums) that performed at various venues in the area, for which I wrote most of the material. For this group I wrote (by hand) 'head' charts, similar to those used in jazz 'fake books' and incorporated many of the harmonic elements, common to contemporary jazz that I was at the time studying with my guitar teacher.

For a major final year project at SCU (Hill, 1997), I recorded a series of compositions featuring a variety of compositional methods that included: free group improvisation, free solo improvisation, scored works and MIDI based studio works. The solo improvised works and the MIDI based works featured a range of electronically generated timbres achieved by adding various effects processing devices to instrumental, vocal and synthesized sounds. Diverse influences shaped the resultant compositional processes and sonic outcomes. For example, "Snake Oil", an undergraduate music theory assignment intended to utilise Messiaen's *Modes of Limited Transposition*, is a study for solo guitar using pitch materials derived from an octatonic, scale. "The Spider" and "Glipti" reflect my fascination with *drum 'n' bass* style rhythms and combine breakbeat samples, analogue synthesisers, and processed guitar and vocal

sounds. These two tracks were co-written with fellow student Rob Walsh and assembled with sequencing software with all sounds being triggered within an external sampler.

Since its inception in 1999, the ensemble amphibian has explored a number of processes to create musical works. These include: structured group practice, free improvisation, studio creation of soundscapes from environmental field recordings, studio creation of works utilising overdubbing and cut and paste techniques, and the creation of works in collaboration with contemporary dancers. A core instrumentation of drum-kit, double bass and piano/electric piano has been augmented by vocals, flute, saxophone, vibraphone, guitar, harmonica, synthesisers and treated and untreated field recordings. Many amphibian works feature elements typical of jazz including the instrumentation (drum-kit, double bass and piano), form (head, solos, head), and harmony (chord voicings typical of jazz piano). However, other influences are notable, particularly those of classical minimalism and certain sub-genres of electronic dance music including *ambient*, *trip-hop* and *drum 'n' bass*.

From 2000-02 amphibian performed at various venues in Melbourne, Sydney, Bellingen, Wollongong, Adelaide and the UK with highlights including performances at the Basement (Sydney), The Big Chill Festival (Salisbury, UK) and Global Carnival (Bellingen, NSW) and collaborations with dance companies Independent Movement (SA) and CandoCo (UK). In performance I played up to three keyboards (digital/acoustic piano, Wurlitzer electric piano and a MIDI keyboard controlling a synthesiser) and triggered pre-recorded soundscapes and other samples on a portable CD player. Live arrangements usually replicated the CD recordings and featured pre-composed and improvised sections.

My Honours research at JCU (Hill, 2003) pursued interests developed in amphibian and explored the combination of timbral, spatial, and programmatic manipulations of environmental sounds with conventional instruments. The predominantly improvised musical works were realised both in live performance and as studio recordings with real-time manipulations of environmental sounds achieved by utilising proprietary software developed in Max/MSP. In this study various communication techniques were explored in order to convey the musical intent of each work to the improvising instrumental musicians. These ranged from a traditional score to verbal descriptions of relevant programmatic elements. The sonic outcomes can be characterised in the context of works in electro-acoustic and electronic genres.

Concurrent with the present research I continue to perform and compose in various settings. Recent performance projects include: performance (keyboards) with free improvisation group Transmission, a collaboration with bassist Barry Hill and violinist Cleis Pearce; performance (keyboards and laptop) and collaborative composition with a contemporary jazz/world/fusion group Torakina; and performance (keyboards) with local Townsville jazz groups Captain Nemo and others. Recent composition projects include: producing a series of surround-sound soundscapes from processed field recordings for future use with the group amphibian; composition and production of a short film soundtrack in collaboration with Robert Walsh and Michael Worthington; and producing beat-oriented electronic works with Byron Bay DJ and producer David Brammah.

2.4.4 Filter of Personal Practice Summary

Table 2.1 provides a summary of personal practice detailed in 2.4 above. The table enables some general trends and major themes to be identified. For example, dominant listening genres include rock, jazz, EDM and most recently electroacoustic and electronic styles. An interest in live performance is evidenced by concert/gig attendance for over twenty years and my own live performance career since 1988. Traditional instrumental performance (on piano, guitar and drumkit) has been a central feature throughout and this has been pursued via both private tuition and self-directed study/practice. A range of individual and collaborative music making processes has been explored within rock, jazz/improvised and electroacoustic genres. The combination of live instruments and sampled/synthesized elements in composition has been apparent since 1997. Further self reflection could probe, for example: motivation, receptiveness to other processes, musical styles, environmental or psychological factors impacting on musical preferences, in addition to broader factors such as class, gender and race etc. However, the characterisation of 'the researcher' offered here provides an adequate account of the musical territory covered to date and constitutes the 'filter of personal practice': the perspective from which I approach both analysis and music creation activities.

Table 2.1. *Personal Practice Summary*

Years	***1969-76***	***1977-87***	***1988-90***	***1991-2***	***1993-4***	***1995-7***	***1998-2002***	***2003-7***
Location	Canberra (suburban)	Canberra (rural)	Sydney	New York	Sydney	Lismore	Melbourne	Townsville
Listening	Family radio/stereo (predominance of guitar rock), TV (e.g. *Countdown*), and instrument practice. Live rock (1982 onwards)		Live and recorded, mostly guitar rock/pop, ambient.	Live, recorded: guitar rock, hip-hop, experimental jazz, latin.	Live, recorded rock/jazz.	Live, recorded: jazz, EDM – drum 'n bass.	Live, recorded jazz, EDM, electronica funk, r'n'b, 'world'.	Mostly recorded (all previous, add electro-acoustic).
Education	1976 - Private piano lessons, AMEB grades 1 - 6. 1983 - Drumkit/guitar, self taught.		Self directed, aural/oral.	Self directed, aural/oral.	Private guitar/ vocal lessons, *Bondi Youth Wave,* Sydney Con. extension studies program.	SCU (BA, Cont. Music) Guitar performance major.	Self directed, aural/written modes, group/individual study.	JCU (BMus Hons, PhD) Technology focused research. Occasional individual jazz piano/impro lessons.
Performance	1980 - Piano exams, community concerts with other piano students.		Drums/vocals with punk/indie-rock covers band.	Drums with indie-rock band.	Guitar, vocals, bass with own indie-rock quartet and funk covers band.	Guitar in jazz trio (originals), duo (standards), funk/soul covers	Keyboards, synthesiser, samples with instrumental trio. Collaboration with dancers/film-makers.	Keyboards, synthesiser, computer. Individual, group settings. Jazz standards, original instrumental, experimental computer/multimedia.
Composition	1983 - Mostly instrumental guitar pieces, oral/aural mode.		Guitar/vocal songs.	Songs, arranged for guitar/bass/ drums.	Songs, arranged for guitar/bass/ drums.	Instrumental pieces (head charts) for jazz trio, free impro, MIDI/ sampled, group collaborations.	Collaborative original instrumental. 'Bottom up' jamming, editing/refining.	Individual and collaborative. Aural/oral, written/score, computer realisations, 'bottom up' and 'top down' approaches.
Music Technology	1982 - Casio keyboard (with drum/chord accompaniment etc.). 1984 - cassette recording.		Guitar effects, analogue synth.	Four-track cassette recorder.	Guitar effects, studio recording.	Guitar effects, live studio recording (ADAT), MIDI sequencing (Cubase).	Field recording (DAT), Digital recording/editing (Pro Tools), hardware synth.	Field recording, Digital processing (Max/MSP), recording/editing (Pro Tools, Reason, Live), hardware/ software synth.

CHAPTER THREE

MUSIC ANALYSIS: DIMENSIONS AND DIRECTIONS

3.1 Introduction

At a fundamental level, all forms of music analysis seek to structure an understanding of and even illuminate music. The extent and form of this understanding, and what constitutes *music*, is determined by the implicit or explicit philosophical and theoretical underpinnings of the proponents of particular analytical methodologies. This chapter provides an overview of key analytical perspectives and consequent practices of existing analytical methods in order to inform the development of an analytical methodology for this research. In addition it will afford a reference point for analyses, facilitating the consideration and evaluation of particular music and musical practices from a range of perspectives before selecting appropriate analytical tools. Figure 3.1 presents a set of analytical perspectives of existing analytical methodologies ordered in terms of the level of formality implicit in the underpinning theoretical bases and explicit processes[5].

Rationalist	**Psychological**	**Semiological**	**Sociological**	**Relativist**
• Enlightenment • Romantic • Formalist	• Cognitive • Perceptual	• Structuralist • Semantic	• Anthropological • Poststructuralist • Feminist	• Phenomenological • Hermeneutics • Postmodernist

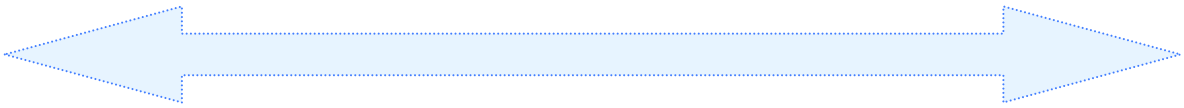


Figure 3.1. Analytical perspectives of existing analytical methodologies.

[5] I acknowledge the assistance of Diana Davis and advice from Andrew Brown in developing Figure 3.1.

While these categories are broadly indicative and obviously not discrete, nevertheless they do provide a useful overview of the potential range of philosophical/theoretical drivers for analysis. For example, included under the banner of *semiological* are structuralist and semantic perspectives (a distinction made by Cumming, 2005). Nattiez (1990), an example of the former, seeks scientific objectivity via the analysis of the immanent aspects of the music (i.e., akin to the notion of the autonomous artwork). In contrast, Hubbs (2000) and Middleton (2000), examples of the latter, seek to identify the referential aspects of musical experience at a range of contextual levels (e.g., societal, visual, gestural). Similarly, a wide range of conflicting theories is encompassed within the *psychological* category. For example, Meyer (1956) posits a conflict theory of emotion to build an expectation/fulfillment model of music perception. Elliot (1988) is critical of Meyer's approach and proposes a regulative hierarchy model of cognition. Other psychological underpinnings include information processing (Brown, 1997) and Jungian and archetypal psychology (Hubbs, 2000). Clearly then, there is a complexity to the notion of analytical perspective that can not easily be represented spatially as in Figure 3.1. However, the macro perspective Figure 3.1 provides, offers a framework within which to both evaluate existing analytical methods and develop an appropriate methodology for this research.

The manifestation of a particular analytical perspective becomes apparent when the following questions are considered:

1. *What* is to be analysed?
2. *Where* will the analysis be conducted?
3. *How* and *for whom* will the analysis be presented?
4. *What authority* does the analysis claim?

Answers to these questions provide the key dimensions of the issues surrounding extant musical analysis practices. Figure 3.2 outlines these dimensions in relation to the range of analytical perspectives listed in Figure 3.1. The first three questions *(what? where? how and for whom?)* represent the pragmatic dimensions of analysis. The fourth *(what authority…?)* addresses the claims made, often implicitly, for particular analytical methodologies.

Musical Frame	***What* is to be analysed?**	Text *Autonomous artwork* e.g., score, recording, performance	Context *Extramusical* parameters: e.g., social, psychological, visual, gestural, economic, technical, etc.
Spatial Frame	***Where* will the analysis be conducted?**	At desk Traditional Musicology	In field Traditional Ethnomusicology
Specialist Knowledge	***How* and *For whom* will the analysis be presented?**	Essential *Experienced listener* Musicologists · Music students · Musicians · Listeners	Non-essential *Everyday listener* Interested general public
Validity	***What authority* does the analysis claim?**	Objectively defined Neutral	Subjectively accountable Personal

Analytical Perspective	**Rationalist**	**Psychological**	**Semiological**	**Sociological**	**Relativist**
	• Enlightenment • Romantic • Formalist	• Cognitive • Perceptual	• Structuralist • Semantic	• Anthropological • Poststructuralist • Feminist	• Phenomenological • Hermeneutics • Postmodernist

Figure 3.2. Issues in musical analysis: The continua.

An approximate vertical correspondence exists within each of the four top rows and with the *analytical perspective* spanning the bottom of the figure. For example, an analytical methodology with a rationalist analytical perspective is likely to operate *on a score* (an autonomous artwork), *at a desk*, with somewhat complex terminology, *for a specialist audience*, and make claims about the analysis as an *objective and authoritative account*. In contrast, a sociologically informed analysis might examine a range of *contextualising*, *extramusical*, dimensions, *in the field*, using *everyday language* (perhaps with the inclusion of a basic glossary of terms), *for a general audience*, and claim to offer one perspective (amongst many possible readings) of a particular music.

Figure 3.2 presents an appropriate model for many traditional analytic methods. For example, Schenker (1935/1979), Forte (1973) and Solomon (2002) have strong formalist underpinnings and their analytical practices can be mapped vertically along the far left of the figure. Similarly, traditional ethnomusicological practices can be mapped vertically towards the right of the figure. In some cases this can be an oversimplification. For example, Lomax's (1968) ethnomusicological cantometrics project is not written for a general audience. However, as illustrated by the examples included on Figure 3.3, many contemporary analytical methodologies do not align in a simple vertical fashion. This is clearly indicted by the dotted line on Figure 3.3 representing Ferrara's (1984) phenomenological analytical methodology.

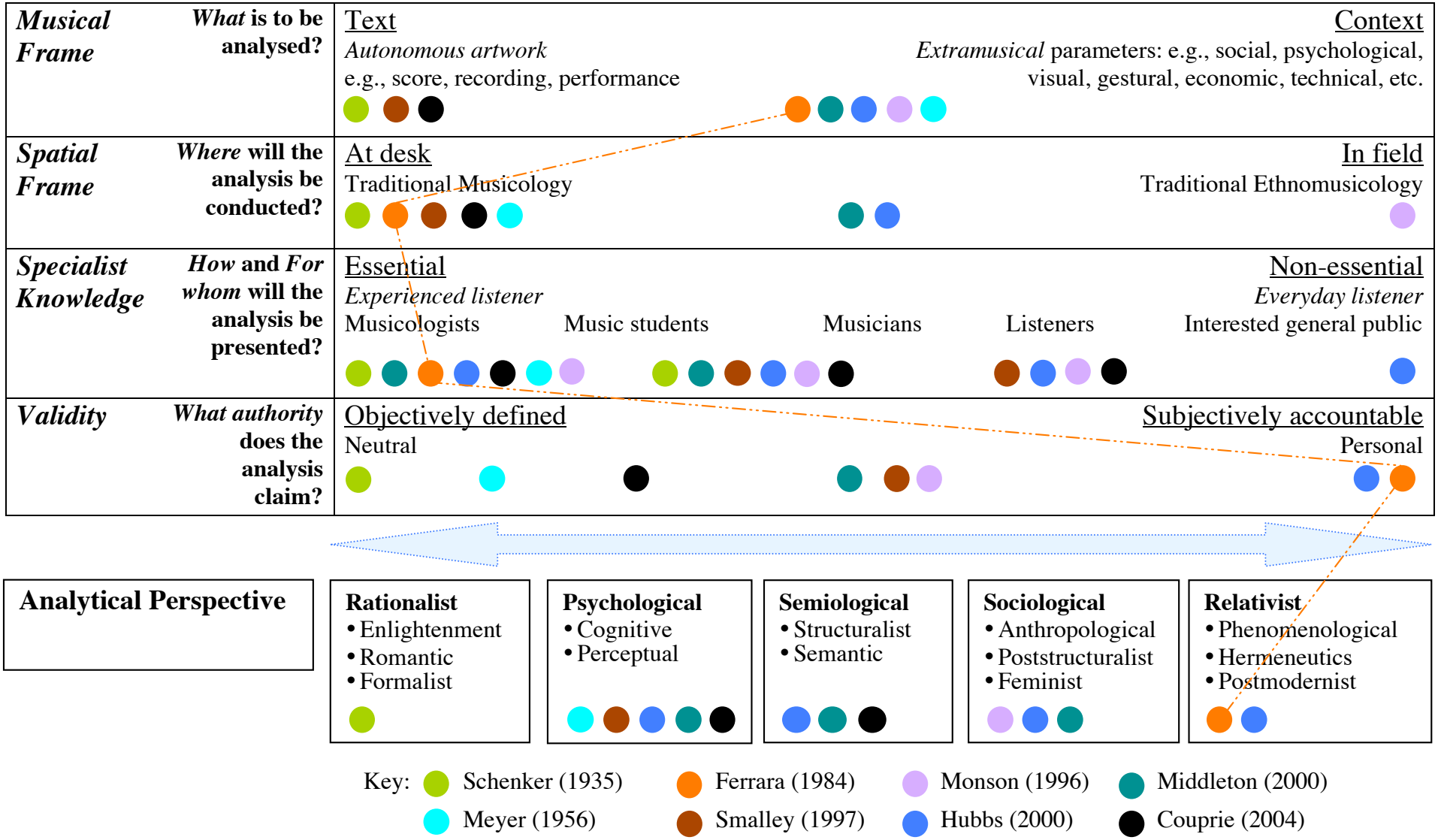


Figure 3.3. Issues in musical analysis: Key dimensions in relation to selected analytical methodologies.

As can be seen in Figure 3.3, many contemporary analytical methods operate across the range in the horizontal axes. For example, Middleton (2000) draws on a range of psychological, semiological and sociological perspectives to support his method. Hubbs (2000) seeks to present an analysis suitable for the entire spectrum of possible audience listed in the figure (i.e., from *musicologist* to *interested general public*). Ferrara's (1984) phenomenological analysis of Varèse's "*Poème Électronique"* requires specific modes of listener attention (i.e., specialised knowledge); is written for musicologists; and claims to offer a subjective, experiential account. Furthermore, Ferrara works under the assumption that "what one hears is affected by how one hears" (p. 356) and the *how* has various psychological, sociological and theological (i.e., contextual) aspects. In this way the text/context distinction becomes problematic. Although the analysis is of a recording (a *text*), from the phenomenological perspective, the contextual elements (the human presence in both composition and perception) cannot be separated. Many contemporary analytical methods, particularly those dealing with pop and rock styles, echo this concern (e.g., Hubbs, 2000; Middleton, 2000; Tagg, 2000) and are situated accordingly in Figure 3.3. Sections 3.2 to 3.5 examine each of the dimensions given in Figure 3.2 in detail. Sections 3.6 and 3.7 examine existing analytical practices in terms specifically relevant to this research, emergent technologies and music creation.

3.2 Dimension 1: Musical Frame

In answering the question *what is to be analysed?* the issue of *text* and/or *context* emerges. Analytical methodologies that advocate analysis of a text only (e.g., a score, a recording) are either formalist (e.g., Schenker, 1935/1979; Reti, 1960; Forte, 1973; Solomon, 2002) or consider the interim separation of music and context as valid for

analytical purposes (e.g., Moore, 1993; Smalley, 1997). Proponents of analytical methodologies inclusive of contextual elements (e.g., Treitler, 1982; Ferrara, 1984; Monson, 1996; Tagg, 2000; Middleton, 2000; Hubbs, 2000; Hawkins, 2002) are critical of the analytical perspective of formalist approaches and consider the separation of text and context as artificial and incompatible with the human experience of music.

Bent (1987) sums up the formalist approach succinctly:

> The primary impulse of analysis is an empirical one: to get to grips with something on its own terms rather than in terms of other things. Its starting-point is a phenomenon itself as it does not necessarily rely on external factors (such as biographical facts, political events, social conditions, educational methods and all the other elements that make up the environment of that phenomenon) (pp. 4–5).

Fundamental to the formalist approach is the notion of the *autonomous artwork*, the "something on its own terms" to which Bent refers (p. 4). The importance placed on understanding music on its own terms separates music from the context from which it emerges and in which it is received. Tagg (2000) refutes this approach by arguing that

> … no analysis of musical discourse can be considered complete without consideration of social, psychological, visual, gestural, ritual, technical, historical, economic, and linguistic aspects relevant to the genre, function, style, (re-) performance situation, and listening attitude connected with the sound event being studied (p. 74).

Numerous authors (e.g., Cook, 1998; Middleton, 2000; Williams, 2001) suggest that the text only approach is locked into the values of 19th century Europe, and in particular to the idea of music as a *pure* form of personal expression, and of the artist as genius (as exemplified by Beethoven). Cook (1998), Gilbert and Pearson (1999), Middleton (2000), Butterfield (2002) and Tomlinson (2003) have advocated a reassessment of such musical values and their subsequent application in the field of musicology. Indeed Cook (1998) suggests that

> … we have inherited from the past a way of thinking about music that cannot do justice to the diversity of practices and experiences which that small word, 'music', signifies in today's world (p. 15).

Gilbert and Pearson (1999) highlight the problematic nature of the body/mind distinction that has dominated Western thought since Descartes (1596-1650) and, in particular, the impact of this on the understanding of meaning and affect in music. In particular, music is qualitatively different from language and "it is this non-verbal aspect of music's effectivity which has given rise to its strange status in Western thought" (Gilbert & Pearson, 1999, p. 39). Furthermore they argue that

> Music is understood by this tradition as being problematic in its capacity to affect us in ways which seem to bypass the acceptable channels of language, reason and contemplation. In particular, it is music's apparent physicality, its status as a source of physical pleasure, which is problematic (p. 42).

Following from this, the development of an analytical methodology needs to embrace the totality of musical experience, ranging from *meaning* to *affect*. Indeed, numerous analytical methodologies address these concerns. Ferrara's (1984) phenomenological analytic methodology places the subjective musical experience, on syntactic, semantic and ontological levels, at the centre of the analytical task. Middleton's (2000) theory of gesture contains affective, cognitive and kinetic aspects and seeks to identify somatic responses at various levels. Butterfield (2002) raises the concern that many analytical practices end up determining the nature of the musical experience in a pre-emptive fashion. By privileging certain forms of listening (isolated and from recordings) the analyst encourages separation from the performance event and all the contextualising aspects this entails. Butterfield (2002) views this as prejudicial to the continued practice of jazz; something he considers should involve a *carnival* atmosphere, rather than an isolated experience (i.e., the analyst or student alone with a recording). Tagg (2000) draws on the fields of semiology and sociology to connect the "sound event being studied" (p. 74) with broader *extramusical* aspects. Underpinning these methodologies is the notion that music cannot be considered an object in itself as it is only via the listener's experience, and with broader contextualising elements, that *music* comes into being.

However, rejecting the analytical perspective of traditional analytical methodologies does not entail the wholesale rejection of traditional techniques. Different musical styles present different analytical problems. Musicologists working in the fields of popular music, electronic and electroacoustic styles have highlighted the inadequacies of score-based, and hence mostly pitch-based, analytical methods for these styles (e.g., Cook, 1998; Moore, 1993; Norris, 1999; Smalley, 1997; Wishart, 1996). However, recent analyses (including Brown, 1997; Hubbs, 2000; Larson, 2002) have utilised tools

associated with formalist methodologies (in particular Schenkerian techniques) as one element of a broader analytical methodology. Similarly Ferrara (1984) advocates the use of procedures of Schenker (1935/1979) and La Rue (1992) in analysing the syntactical level of the musical experience. In these instances it is the particular music that dictates the appropriateness or otherwise of particular techniques and hence a decision as to which aspects of text and context are to be analysed.

3.3 Dimension 2: Spatial Frame

The decision as to the physical location of the analysis is dictated by the extent to which text and context are to be examined. As illustrated in Figure 3.2, desk-based analytical methods (*traditional musicology)* tend to align with the concepts of the *autonomous artwork* and *objectivity,* whereas field-based methods (*traditional ethnomusicology*) focus on the various social and cultural activities embedded within the production and reception of music. It must be acknowledged, however, that the analytical perspectives listed in Figure 3.2 do not align as readily with the desk/field distinction. For example, the formalist approach of Schenker (1935/1979) and the phenomenological approach of Ferrara (1984), whilst at opposite ends of the *analytical perspective* spectrum, are both desk bound.

However, the distinction between the desk-based practices of *musicology* and the fieldwork of *ethnomusicology* remains and the divergence of the two is linked by Tomlinson (2003) to the emergence of history (with a focus on writing) and anthropology (with a focus on orality) as separate disciplines. This coincided with the

development of post Enlightenment thought in Europe regarding concepts of music as fine art. Tomlinson suggests that the opposition of musicology and ethnomusicology is

> … a disciplinary artifact arising in musical thought from a new stage, attained not much before 1800, in the evolution of European conceptions of self and others. In this light, modern musicology itself, and not only ethnomusicology, appears as a discipline erected on propositions of cultural difference, European versus non-European. In founding itself on such propositions, it was from the start ethnographic through and through – though the conditions of its local culture led it to found itself in such a way as to conceal its sources. Meanwhile ethnomusicology arose, ambivalently, as a reaction to musicology's concealment of the truth that it was always already a particular instance of ethnomusicology (p. 41).

By repositioning *traditional musicolog*y within the broader field of *ethnomusicology* Tomlinson canvasses the possibility of

> … a sweeping *neocomparativism*, that could explore the broadest questions about the place of musical activities in human experience, aspiration, and achievement (p. 42).

Tomlinson suggests that, in order to address such broad questions, it is necessary to embrace a range of historiographic and ethnographic approaches; i.e., desk and field approaches are complementary, not oppositional.

Justifications of (solely) desk-based methodologies are rarely explicit; instead there is a presumption that a text-only approach precludes the need for ethnographic study. However, proponents of ethnographic methodologies tend to make explicit the validity of their methodology. For example, in their respective studies in jazz, Berliner (1994), Monson (1996) and Ake (2002) argue that it is the musicians, not the analysts, who are the experts. Advocating an ethnographic approach, Monson suggests that

> The idea that improvisation should be analysed and evaluated on its own terms and that the musicians themselves are the most authoritative source of knowledge about the music joins the concerns of both ethnomusicologists and members of the jazz community (p. 4).

While not entirely discounting the value of various books, articles, dissertations, etc., Berliner (1994) suggests that

> Despite the importance of all these sources, it seems to me that, taken together, they gave but discrete glimpses into the individual and collective processes of learning, transmitting and improvising jazz (p. 3).

However, debate as to the validity of particular ethnographic methods, in view of feminist and poststructuralist concerns, and issues of authenticity, remain. Berliner (1994), Monson (1996) and Ake (2002) all claim a degree of *insider* knowledge as former or current musicians themselves. Ake suggests that

> Although performing ability is not essential to critical writing on music and its relationships to the broader social and cultural spheres, a scholar possessing practical knowledge of the field will certainly bring a different outlook on musical practices than will a nonmusician. This combined perspective of scholarship and performance (still fairly rare in jazz studies) creates new possibilities, ideally joining the invaluable insights of a player writing about his experiences in music with those opened by working through a variety of academic discourses (p. 5).

The scholar/performer model presented by Ake implies a further blurring of desk/field distinction: a model where the two modes can be seen to enrich an understanding of particular musical cultures.

3.4 Dimension 3: Specialist Knowledge

A variety of presentational modes utilised in music analysis includes text, graphics, tables, musical notation and sound (See Cook, 1987, for an historical overview and Appendix A for more recent examples). The chosen mode reflects both the particular music being analysed (e.g., a Schenkerian graph may be applicable to certain tonal works but irrelevant to a noise-based soundscape) and also the analyst's assumptions as to the relationship between music and communication about music or, in the case of text only analyses, the efficacy of language as a means to understanding music. Walser (2003) raises and counters the often-quoted remark, *talking about music is like dancing about architecture*, by suggesting that it "might be very illuminating, if we all danced as much as we use language." (p. 22). This raises two key questions: Firstly, to what extent

does music inhabit a realm independent of literate or visual communicative modes? Secondly, and regardless of how the first question is answered, what might language (for example) say about music anyway? The wealth of literature, not only of music analysis, but also criticism, theory, biography and history, suggests there is indeed something to be said for writing about music and it is therefore the task of the analyst "to bridge the gap between musical discourse and musical experience" (Hubbs, 2000, p. 8).

As noted in 3.2, traditional analytical methods have been criticised for restricting analysis to those aspects of music that are most easily quantifiable, divisible and finite; particularly pitch. Methods for the presentation of such analyses are well established in convention; however the deconstruction of the analytical perspective and the expansion of analysis to include aspects such as *meaning*, *affect, social* and *psychological* have necessitated an expansion of communicative devices. Whereas analytical methodologies that presuppose the importance of a written score can safely present a discussion of the score with a linguistic reliance on particular agreed music theoretical rules, an analysis of qualitative, infinite or subjective aspects (such as timbre, texture, meaning etc.) requires the incorporation of broader theoretical frameworks. Researchers in ethnomusicology, popular music, electronic and electroacoustic music have contributed a range of theoretical frameworks that incorporate, amongst others: theories of phenomenology (Ferrara, 1984); biology (Rinzler, 1988); cognition (Brown, 1997); perception (Giomi & Ligabue, 2001; Smalley, 1997); psychology (Hubbs, 2000); semiotics (Middleton, 2000; Tagg, 2000); ecology (Windsor, 2000); feminism, poststructuralism and postmodernism (McClary, 1991; Goodheart, 2001). Such expansions of theoretical underpinnings reflect the reach of analysis beyond the realm

of Western art music and have led to a wealth of analytical practices upon which this study can draw.

Many analytical methods are grounded in particular music theoretical frameworks and thus require particular knowledge on the part of the audience. Some analyses require specific specialised knowledge (e.g., Schenkerian graphs) whereas others require no specialised knowledge or contain an extensive glossary of terms. As noted in Figure 3.2 a spectrum of possible audience ranges from musicologists, through music students, musicians, listeners and, finally, to the interested general public. Correspondence between intended audience and presumed knowledge occurs in many instances, although many recent academically oriented analyses eschew complex terminology and are critical of the insular nature of traditional musicology (e.g., Couprie, 2004; Fast, 2000; Hubbs, 2000). At issue here are questions of the value, purpose and application of musical analysis. To what extent does music analysis constitute a self-contained, even insular field of study? To what extent is it integral to other musical activities? Cook (1987) observes that:

> Personally I dislike the tendency for analysis to turn into a quasi-scientific discipline in its own right, essentially independent of the practical concerns of musical performance, composition or education. Indeed I do not believe that analysis stands up to close examination when viewed in this way: it simply doesn't have a sufficiently sound theoretical basis (p. 3).

In other words, analysis is meaningless unless considered in relation to the ways that the insights gained can be applied to other musical endeavours, e.g., performance. Hubbs

(2000) echoes this concern, identifying the lack of congruence between much academic analytical and theoretical discourse and the experiences of enthusiastic undergraduate music students:

> Discourses on music, we might reasonably suppose, should hold greatest appeal for those persons most interested in and engaged with music (assuming some contemplative proclivity); but in fact musicians and music lovers often seem rather at odds with much of the pedagogical and professional discourse of music theory and analysis. Those of us who teach music theory may notice that certain of our students who make music most adeptly, who live most intimately within music, may find our ways of analysing and talking about music most alien or inimical…one important fact is an apparent disconnect between the nature of these students' previous musical experiences and the nature of the musical experience that technical music-theoretic discourse may suggest to them (p. 6).

One aspect of this disconnect is the presupposition of many analytical methods of the concept of the *experienced listener* which permeates early methodologies such as those of Schenker (1935/1979), and Meyer (1956) and, more recently, Lerdahl and Jackendoff (1983), and Giomi and Ligabue (2001). Related to this, and of concern to methodologies adopting semiological and sociological frameworks (e.g., Field 2000, Tagg 2000), is the concept of *shared extramusical experiences* of music creators, analysts and audiences to whom the term *encultured listener* applies. Both concepts require (and thus privilege) a particular mode of listening and cultural standpoint that needs to be made explicit if issues of power and authority are to be addressed.

In contrast to such methods, analyses that are intended for a more general audience privilege the perspective of the *naïve listener*. Tovey (1949) could be considered to be at the extreme:

> The naïve listener already possesses the right musical sensations. These are as direct as the colours of a sunset or the tastes of a dinner. Connoisseurship comes from experience, not from verbal explanations (cited in Bent, 1987, p.57).

Analysts in the pop/rock field acknowledging the importance of contextual elements (e.g., Middleton, 2000; Tagg, 2000) tend to write for and from the perspective of the *encultured listener* and present analyses suitable for both specialists and the interested general public. Hubbs (2000) justifies analyses (or using her preferred term, *music criticism*), for a general audience as follows:

> Pop-rock music and the facts of its reception, its cultural stature, call for nothing less than a criticism of engagement and necessity. I envisage here such a criticism as one that examines musical experience in an integrative and extradisciplinary way – drawing in the various musical and 'extramusical' dimensions of meaning in pop-rock performance, and drawing forth a discourse and approach that can include and engage scholars, fans, and listeners from both within and without the music academy (p. 5).

Presumably the same level of engagement could be applied to other genres, perhaps those with significantly less *cultural stature* (e.g., electronic and electroacoustic

genres), addressing a similar range of *extramusical* aspects, yet to differing degrees relevant to the particular music being analysed.

3.5 Dimension 4: Validity

Claims to authority for particular analyses are made via reference to particular theoretical frameworks that emerge from the analytical perspectives listed in Figure 3.1 (i.e., rationalist, psychological, semiological, sociological, relativist). Advocates of the first, second and third categories could be considered as operating either within a rationalist scientific paradigm and/or from the perspective of the *experienced listener*. Whilst some maintain the perspective of the *experienced listener,* advocates of the fourth and fifth categories are critical of concepts of objectivity being applied to music, emphasising instead idiosyncratic response at various levels of meaning.

A key example of the first category (rational/formalist) is Schenker (1935/1979) whose methodology is tied to philosophical notions that bind music to nature (the tonic triad as the horizontal representation of the harmonic series; the *origin, development* and *presence* of life as the *background, middleground* and *foreground* in music, etc.) and the composer as the genius who carries "a soul predisposed to accept the background" (p. 3). It is the task of the analyst to uncover this *background* (or *fundamental structure)*, and requires a particularly high order of listening and the capacity to perceive polyphony, a capacity "which must forever remain alien to the masses" (p. 4). Furthermore, Salzer (1969) suggests that Schenker's abilities as a pianist enhanced his analytical capacities:

> This kind of analysis can only be taught by one who has clarified for himself the analytical problems of a particular work. I shall never forget the highly persuasive and artistic manner in which he explained particular sections or passages, playing them on the piano, sometimes in 'slow motion,' so as to make their voice leading clear. Thus it appeared that the explanations and analytic readings grew, so to speak, out of the most inspired and lucid playing (p. 20).

In other words Schenker's analyses claim a high degree of authority with reference to both objective and aesthetic criteria; the method is primarily about uncovering the work of genius and the analyst is a highly competent listener (and, in this case, also performer). However, by juxtaposing the *experienced listener* concept (i.e., those capable of perceiving polyphony) with the methodology, Schenker (1935/1979) discounts the musical experiences of the everyday listener. As Cook (1990) suggests, "Schenker, then, was not in the least interested in explaining how people ordinarily perceive music; what he wanted to do was to demonstrate how music *ought* to be heard" (p. 21).

Schenkerian and other traditional methodologies rely on the concepts of the *autonomous artwork* and objectivity. These concepts stem from a particular rational, scientific paradigm born in post Enlightenment Europe, a model that has been subjected to sustained critique from numerous theoretical perspectives. Kerman (1985) is perhaps the central figure in advocating a retreat from the scientific paradigm, instead proposing a music criticism grounded in the analyst's subjective experience of music. Ferrara (1984), however, rejects the notion of objectivity entirely:

> Underlying musical analysis is a fundamental yet obscured premise. This is the implicit belief that the knowledge that is acquired as a result of analytical methods

> is and ought to be objective. The 'ought to be' half of that belief is rooted in generations of scientific methodology in which the a priori separation between subject and object was a tacit axiom. The method utilised by scientists (and by musical analysts) is tacitly thought to cleanse the experiment (or analysis) of the confounding variables that a too involved subject might cause. That knowledge *is* objective is of course a myth, whether it refers to music, the other arts, or the sciences (p. 355).

Ferrara suggests that the analyst can be either closed or open to various meanings of a musical work depending on the *mode of orientation* of the analyst and proposes that the traditional view of analyst as subject and music as object should be reversed:

> A distinctive phenomenological tactic is that, rather than manipulate a work through a formal grid of analytical questions or positions, one responds to questions posed by the work. The interpreter discovers that, in the traditional sense of the terms 'subject' and 'object', he *is now object;* the music, *as subject*, questions the analyst (p. 356).

The notion of analyst as *object* is central to the *open listenings* (where the analyst presents a reflective description of what is heard at any level of meaning) that are part of Ferrara's phenomenological method. However, as Ferrara makes clear, this *objectivity* remains within the bounds of the analyst's own world and culture and emphasises the importance of the human element in analysis.

Echoing Ferrara's notion of *mode of orientation*, Becker (2001) uses the term *habitus* to describe both the performer's, and listener's (and hence analyst's) implicit cultural point of reference:

> Habitus is an embodied pattern of action and reaction, in which we are not fully conscious of why we do what we do; not totally determined, but a *tendency* to behave in a certain way. Our habitus of listening is tacit, unexamined, seemingly completely 'natural'. We listen in a *particular* way without realizing that it even is a particular way of listening. Most of our styles of listening have been learned through unconscious imitation of those who surround us and with whom we continually interact (p. 138).

Logically then, an analysis of musical works is inevitably largely the product of a singular cultural viewpoint and cannot therefore assume universality.

Proponents of analyses with sociological or relativist underpinnings advocate a methodology grounded in the human experience of music (e.g., Ferrara, 1984; Hubbs, 2000; Kerman, 1985; Middleton, 2000) and claim authority of a different nature - on the basis of analysis that genuinely and comprehensively reflects the nature of subjective musical experience on a range of levels. Hubbs (2000) suggests that

> … if a compelling music criticism should be commensurable with its object, resonation with the aesthetic qualities of music and thus exciting imagination, feeling, and other capacities, then a compelling criticism of popular music should possess these musical qualities, but crucially should also address its object in

> conversance with pop and rock's more particular emphases – including (though by no means limited to) musical elements such as texture, timbre, and groove; dramatic elements such as irony, tongue-in-cheek, and playfulness; and each of these in concert with the various verbal, visual, social, and other elements with which they are intertwined in practice and reception (p. 10).

Middleton (2000) sees an important role for the *participant analyst* who

> … can double as 'informant' from within the culture – laying out the gestures through participation- and as 'critical outsider', cross-checking the information against schemas drawing on a wider body of musical data. The role of the 'scholar-fan' becomes vital (p. 108).

In contrast to the objective/aesthetic criteria through which many traditional analytical methods seek validity, the participant analyst model suggested by Hubbs (2000), Middleton (2000) and others seeks validity via the resonance between musical experience and analysis. This resonance, although keenly felt by the analysts themselves, has authority only if also felt by the reader. Obviously such analyses, when presented in scholarly journals, books and other such documentary sources, will bear the authority of a refereed publication. However, as examples such as Fast (2000) attest, specific disclaimers as to the possible authority of the analysis can be made within the academic framework. For example, in introducing her analysis of U2, Fast states that

> There are many live performances of the songs that I have neither seen nor heard and so cannot comment upon, but which when considered may change the shape of these arguments, perhaps even significantly (p. 34-5).

Underpinning such a statement is the belief that no single analysis can provide a definitive account. Hubbs (2000) cogently outlines this perspective, suggesting that instead of seeking narrow and unified explanations, the contemporary analyst needs to move "…in a generative direction, expanding and multiplying musical meanings, images, and apprehendings" (p. 20). Norris (1999) echoes this view, suggesting "no analytic investigation is ever complete. There may be a sense of comprehensiveness, but never a sense of completion" (p. 4). Viewed in this way, music analysis becomes dynamic and offers an ever-expanding storehouse of knowledge which musicologists, music students, musicians, listeners and the interested general public might access.

Analytical methods drawing on psychological or semiological approaches include those of Meyer (1956, 1973), Reti (1960), Lerdahl and Jackendoff (1983), Elliot (1988), Brown (1997) and Giomi and Ligabue (2001). Such analysts seek justification and authority in relation to theories regarding the psychological mechanics of music perception. Such theories rely on the notion of the *experienced listener*, familiar with particular musical styles and able to *make sense* of previously unheard sounds. Lerdahl and Jackendoff (1983) and Giomi and Ligabue (2001) explicitly acknowledge the idealised nature of the *experienced listener,* whilst regarding this concept as fundamental to developing an understanding of musical cognition.

Another important debate surrounding claims for authority is the contrast between musicology and ethnomusicology in terms of regard for musicians and participants in music cultures. It has been noted by Stokes (2003) that many pop/rock analysts assume that musicians know very little about what they are doing whereas many ethnomusicologists proceed on the assumption that the participants in any given musical culture are the experts. Analysts of the former variety claim authority by virtue of particular theoretical knowledge (both musical and philosophical). On the other hand, detailed ethnographic analytic accounts of musical cultures (e.g., Berliner, 1994, and Monson, 1996), which draw on interviews and observation of participants, claim an authority grounded in data. Stokes (2003) concludes, however, that such methodological distinctions are unhelpful and there is, in fact, much to be gained by embracing both approaches.

3.6 Direction 1: Music Analysis and Emergent Technologies

The majority of current analytical practices examine tonal and atonal music of the Western art music tradition (Bent, 1987; Cook, 1987). These practices usually focus on the written score and rely on notation that, as Wishart (1996) observes, "demands a finite set of pitch levels which we can permute and combine" (p. 23). Thus, the role of notated pitch is privileged above other elements in music. In much of the Western art music tradition this is entirely appropriate. However, musical works that incorporate emergent technologies often emphasise elements other than pitch. For example, in many electronic, electroacoustic and electronic dance music works, timbre and spatialisation are important elements, transcending pitch elements. As Norris (1999) suggests,

> The limits of Schenkerian and Fortean analysis tend to be shown up by much music written since the middle of the twentieth century. Most musicologists, therefore, tend to leave well alone. This is nowhere more evident than in the context of electroacoustic music. The fine degree of sonic control afforded by digital sound processing – such that permutations of pitch and duration can be rejected in favour of direct timbral manipulations – points to the crux of the problem (p. 1).

Similarly, in jazz and rock styles, subtle pitch and rhythmic nuance (extending beyond the bounds of standard notation) interaction and individual/group expression, are important characteristics in defining these styles. Furthermore, the degree to which contextual aspects of such music are examined necessitates a further expansion of analytical techniques.

Numerous genre specific analytical techniques have been developed in order to address these issues; in the fields of *electronic* and *electroacoustic music* (Couprie, 2004; Giomi & Ligabue, 2001; Smalley, 1997); in *rock* (Brown, 1997; Hubbs, 2000; Middleton, 2000; Moore, 1993; Tagg, 2000); in *jazz* (Goodheart, 2001; Potter, 1990; Rinzler, 1988); and in *electronic dance music* (Hawkins, 2003). Details of these analytical techniques (and also those utilised in Fast, 2000 and Ferrara, 1984) are given in Appendix A.[6] Figure 3.4 positions these selected examples in relation to the key dimensions discussed in 3.1. In order not to duplicate, Smalley (1997), Hubbs (2000), Middleton (2000) and Couprie (2004) are included in Figure 3.3 and excluded from Figure 3.4.

[6] In Appendix A, each analytical method is presented in tabular form with eight key areas considered: purpose; applicable music; subject of analysis; theoretical basis; techniques of analysis; mode of presentation; relevance to emergent technologies; and, relevance to music creation. These key areas are intended to cover the dimensions and directions discussed in Chapter Three.

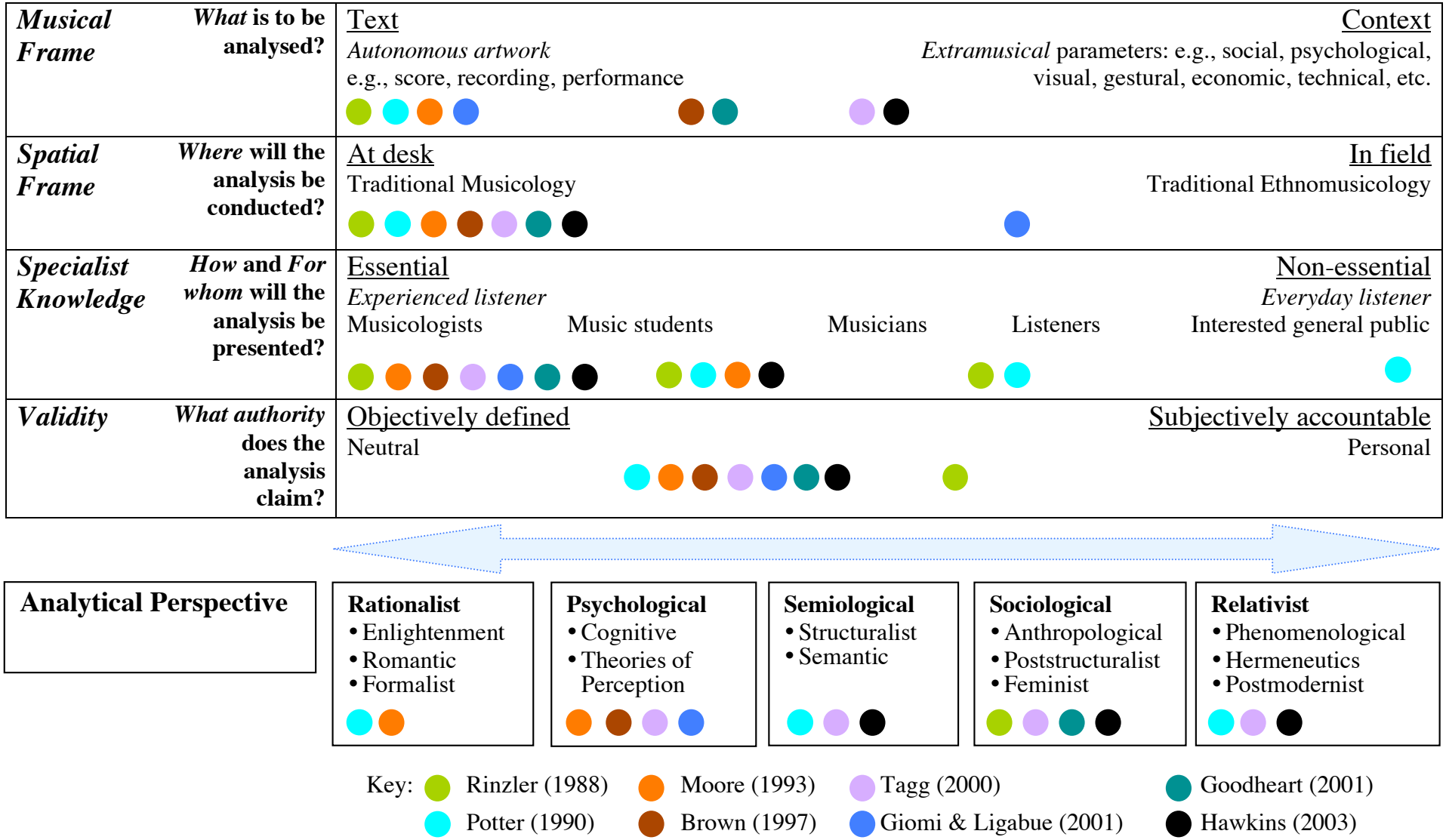


Figure 3.4. Issues in musical analysis: Key dimensions in relation to selected contemporary analytical methodologies.

The selected examples are relevant to the analysis of musical works incorporating emergent technologies either directly or via extension. Analytical methodologies aimed at electronic/electroacoustic music (e.g., Couprie, 2004; Giomi & Ligabue, 2001; Smalley, 1997) explicitly address aspects of timbre, texture and spatialisation at a level appropriate for such music. Methodologies aimed at rock/electronic dance music (e.g., Hawkins, 2003; Hubbs, 2000; Middleton, 2000; Moore, 1993; Tagg, 2000) consider similar parameters with reference to amplified and recorded instruments and also address issues of meaning and affect. Such methodologies can easily be extended and applied to other musical styles incorporating emergent technologies. For example Moore (1993, p. 106) uses the term *sound box* to refer to the virtual textual space of recordings with axes corresponding to register, perceived depth and stereo image. Although developed for rock styles, Moore's sound box provides a useful model for the examination of these aspects of all recordings, regardless of style.

A similar extension is possible with analytical methodologies aimed at jazz styles (e.g., Goodheart, 2001; Potter, 1990; Rinzler, 1988) addressing issues of expression and interactivity. For example, in examining interaction, Rinzler (1988, p. 155) draws an analogy with the game of chess; i.e., there are rules of the game but individuals make moves according to the particular context. Rinzler discusses general categories of interaction pertinent to jazz styles such as *call and response, accenting the end of formal units* or *responding to the peaks of a soloist*. Having established such categories as general rules, a text description of such occurrences in the music is offered. Clearly then, if general rules of interaction in musical styles incorporating emergent technologies could be ascertained, then Rinzler's methodology would provide a useful tool for the analysis of such interactions.

As can be seen in Figure 3.4, selected contemporary analytical methodologies with relevance to emergent technologies are situated across the range of analytical perspectives, with few confined to a single category. The selected methodologies also range across the various dimensions with the exception of *spatial frame*. However, Giomi and Ligabue (2001), the one example listed towards the right of the *spatial frame* dimension in Figure 3.4, specifically target electroacoustic music and seek to deduce compositional method from analysis. This suggests that although Giomi and Ligabue (2001) direct their attention to artificial intelligence applications, the approach offers the potential to provide a point of derivation for the current research.

3.7 Direction 2: Linking Analysis and Creation

Much musical analysis asks the question "How does it work?"(Bent, 1987, p. 5), rather than 'How was it made?' In ascertaining the answer to the first question a composer becomes equipped with knowledge that may be applied to musical creations, and in this way, musical analysis can input to the creation of a new musical work. According to Bent (1987), Cook (1987) and Smalley (1997), this is the main link between extant analytic tools and composition. In their overviews of musical analysis, Bent and Cook posit the connection between musical analysis and musical creation in similar ways. Bent (1987) argues that

> The concerns of analysis as a whole can be said to have much in common on the one hand with those of musical aesthetics and on the other with those of compositional theory. The three regions of study might be thought of as occupying positions along an axis which has at one extreme the placing of music

> within philosophical schemes and at the other the giving of technical instruction in the craft of composition (p. 1).

Cook (1987) similarly argues that

> … when you analyse a piece of music you are in effect recreating it for yourself; you end up with the same sense of possession that a composer feels for a piece he has written…you develop an intuitive knowledge of what works in music and what doesn't, what's right and what isn't, that far exceeds your capacity to formulate such things in words or to explain them intellectually. This kind of immediacy gives analysis a special value in compositional training, as against the old books of theory and stylistic exercises that reduced the achievements of the past to a set of pedagogical rules and regulations. No wonder, then, that analysis has become the backbone of composition teaching (pp. 1-2).

Clearly then, the realms of musical analysis and musical creation are related, although neither Bent nor Cook articulate the links explicitly. For Cook, the practice of analysis develops an *intuitive knowledge* of music that cannot be subject to intellectual scrutiny.

Smalley (1997) makes a more explicit link between the acts of musical analysis and musical creation. Discussing the contexts of his own analytical method, *spectromorphology*, Smalley points to the influence of the analytical act on composition:

> Although spectromorphology is not a compositional theory, it can influence compositional methods since once the composer becomes conscious of concepts

> and words to diagnose and describe, the compositional thinking can be influenced, as I am sure my own composing has been (p. 107).

The notion that analysis influences composition is straightforward enough. However, the question as to whether analysis has the power to identify the compositional methods utilised in a particular work has only recently been addressed. From the small number of examples available in the extant research, two directions can be discerned. Firstly, Brown (1997) and Giomi and Ligabue (2001) address the cognitive aspects involved in individual aspects of composition. Brown draws on an *information processing* model of mental cognition to examine Hendrix's creation of the song "Little Wing". Giomi and Ligabue (2001) analyse the perceptions of numerous listeners in order to deduce the compositional methods employed. Secondly, Tagg (2000) and Goodheart (2001) discuss the influence of, and relationship between, cultural context and specific musical creations. Tagg's (2000) model is particularly detailed, considering the relationship between the *emitter, SCFS (sociocultural field of study), analytical object*, and *receiver*. Goodheart (2001) makes reference to the extramusical context surrounding Coltrane's creation of "Giant Steps" (1959) in a narrative style. Taken together, studies of cognitive processes and the examination of the means by which sociocultural aspects are embedded in musical creations, provide a platform for links to be made between music analysis and creation.

3.8 Summary

This chapter has provided an overview of the analytical perspectives and identified the key dimensions of a range of existing analytical methodologies. The links between analysis and emergent technologies and analysis and music creation have been

examined in order to provide directions for the current research. Existing analytical methodologies, focusing on electronic, electroacoustic, electronic dance music, jazz, and popular music provide useful analytical tools relevant to the current research. However most of these analytical methodologies address musicological, and not practice-based concerns and hence need to be recast in order to address the context of the current research.

CHAPTER FOUR

METHODOLOGY

4.1 Directions from the Literature

The preceding chapters have synthesised the extant literature in the three key areas of the current research: *music and technology* is the field and *personal practice* the filter of perspective, whilst *music analysis* provides the conduit for the examination of compositional methods at the intersection of conserved and emergent methods. Figure 4.1 illustrates the relationships between these three key aspects from the literature review and situates them in relation to music creation and research outcomes. It thus presents an overall schema for the current research. The shaded areas in Figure 4.1, *music analysis* and *music creation* indicate the areas in which methodological decision making is required.

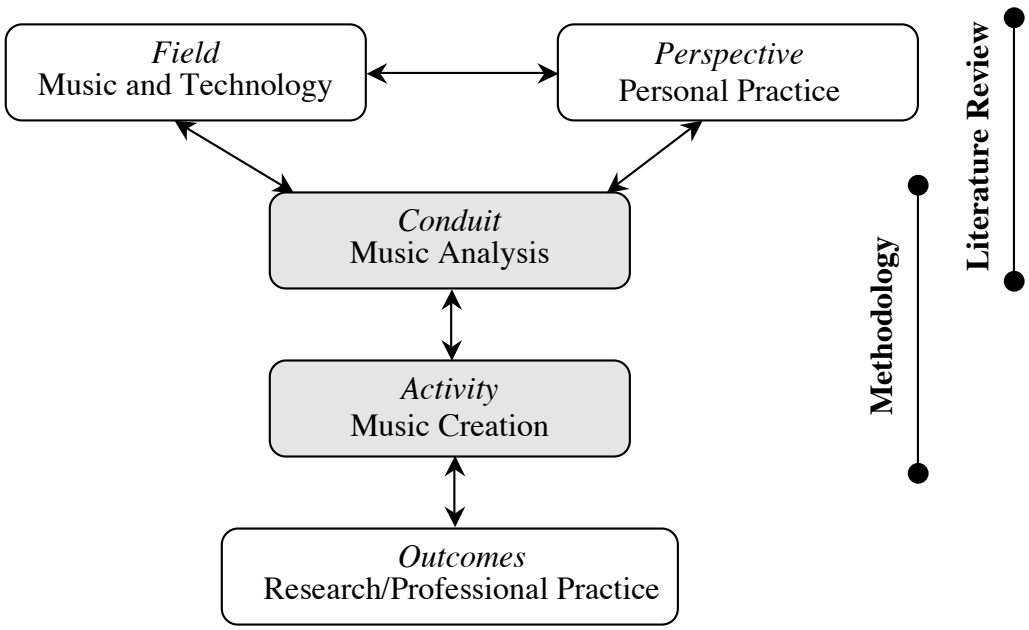


Figure 4.1. Research schema.

A twofold definition of technology was presented in Chapter Two with 'music technology' referring to material objects and 'technologies of music' referring to the range of processes, activities and knowledge developed. An historical overview of the relationship between music and technology posits three stages of development marked by the changing means of production, storage and distribution of music. These stages are referred to as 'folk', 'art' and 'popular' corresponding to 'body', 'score' and 'mechanical' means. However, as Middleton (1990) suggests, the 'popular' stage has seen a complex interplay between all three means. Since the advent of electrical and digital technology (i.e., the most recent advances in mechanical means) the relationship between music and technology has involved revolutionary changes in modes of production, storage and distribution of music. Taylor's (2001) emphasis on the "positionality of any individual agent" (p. 37) in relation to both emergent music technologies and technologies of music provides a useful framework from which to investigate various music making practices, including my own.

Chapter Three reviewed existing analytical methodologies in the context of the current research and raised the following issues:

- A lack of specific and/or explicit connection between musical analysis and musical creation;
- A tendency of musical analysis practice to become an end in itself, detached from other musical pursuits (e.g., performance, composition, education);
- The inadequacy of established analytical methods to deal with the processes and outputs of emergent technologies; and,

- Dispute as to the appropriate focus for analysis – musical work as an autonomous object and/or musical work within a broader context (e.g., psychological, sociological, cultural setting).

Existing analytical methodologies, focusing on electronic, electroacoustic, electronic dance music, jazz, and popular music provide useful analytical tools relevant to the current research. Thus the proposed analytical method developed herein includes reference to the key authors of existing methodologies as appropriate. Of particular importance is Middleton's (2000) notion of a *participant analyst*, discussed as part of an analytical model encouraging analysis of musical works on a range of levels from meaning to affect, or to use Middleton's terminology, "gesture, connotation, argument" (p. 120). However, Middleton does not make explicit links between music analysis and music creation, which is the key focus of this research. It is the premise of this research that extending the role of Middleton's participant analyst beyond that of the musicological domain, to encompass a *participant analyst/creator*, has the potential to facilitate a more comprehensive investigation into the compositional/musical creation domain.

4.2 Scope of Research

An examination of the compositional methods utilised in personal practice has the potential to offer some insight into how selected emergent methods are incorporated into musical works. However, a thorough examination of how conserved and emergent technologies have been, and can be, utilised requires a differently focused investigation and one which extends beyond personal practice. By viewing individual musical works as representative of particular musical genres, the scope of this research can be

broadened from a consideration of musical works of personal preference to a range of musical works as part of a particular genre. Thus a three-stage process determines the scope of this research:

1. Identification of key influential works/artists.
2. Categorisation of influential works/artists according to genre.
3. Rationalisation of genre selection according to prevalence of emergent technological compositional methods in particular genres.

Figure 4.2 provides an overview of the first two stages: personal influences categorised according to genre. Section 2.4 discussed in detail influential environmental and educational factors and included a discussion of when and where many of the individual influential artists listed in Figure 4.2 were encountered.

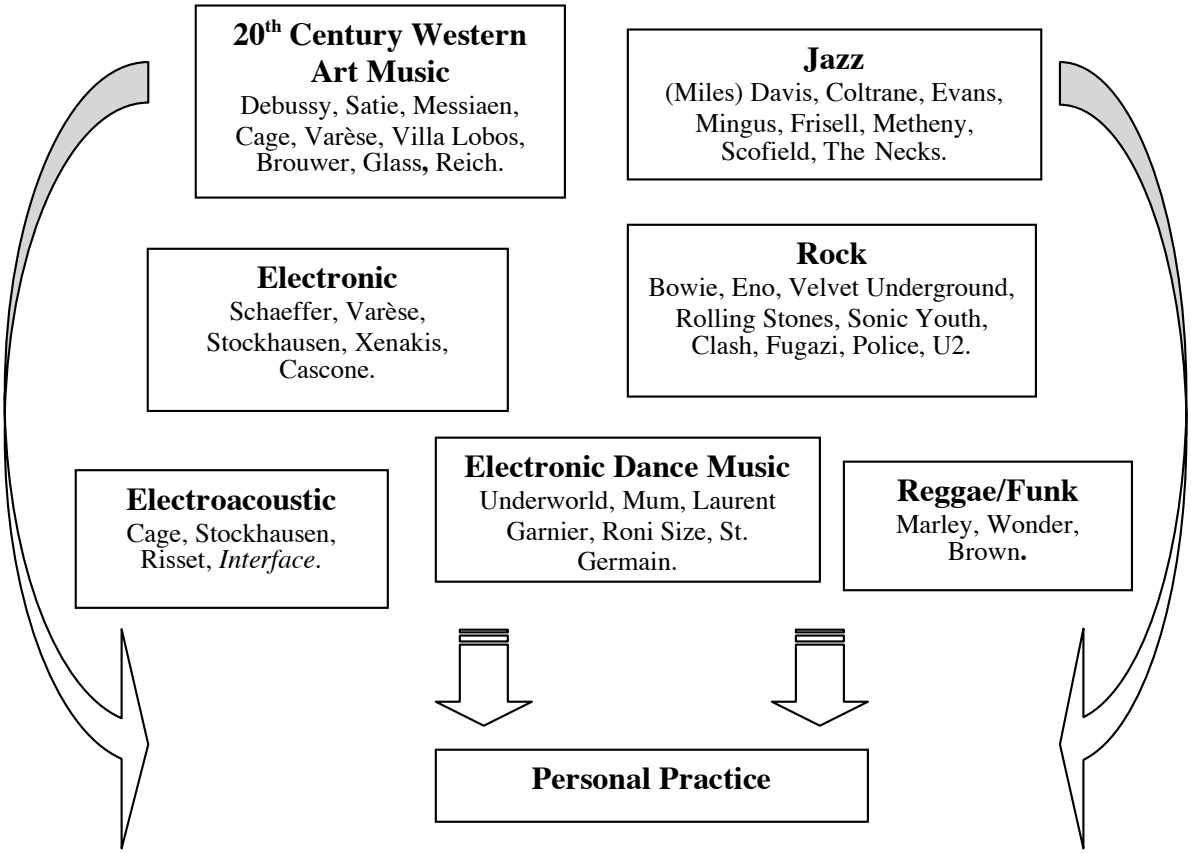


Figure 4.2. Overview of personal influences categorised according to genre.

In order to complete the third stage an assessment needs to be made as to the prevalence of works incorporating emergent methods in each of the genres identified in Figure 4.2. A broad classification system can be applied to describe the level of overlap into the realm of emergent methods as follows:

- Minimal overlap: jazz, reggae/funk, Western art music.
- Moderate: electronic dance music, rock.
- High: electroacoustic, electronic.

The rationalisation of genre selection is achieved in the following manner: Relevant works in genres with minimal overlap can be subsumed into other genres. For example, relevant works in reggae/funk (e.g., some works by Wonder) can be subsumed under rock. Relevant works in Western art music (e.g., some works by Varèse and Cage) can be considered as part of the electronic genre. Relevant works in jazz present a special case due to the difficulty of inclusion within other genres listed here. However, given that a number of relevant works in other genres, particularly electroacoustic works, can arise as a result of improvised performance, the creation of a separate genre, *improvised*, combining relevant works from both the jazz and electroacoustic genres provides a suitable alternative.

These four genres, rock, electronic dance music, electronic music and improvised music, afford a focussed and manageable scope for this research. These genres are more broadly grouped herein as either *popular music* (rock and electronic dance music) or *art music*

(electronic music and improvised music). An analysis of nine key works from the selected genres representative of the compositional practices in each genre was undertaken.[7]

Whilst I accept the somewhat arbitrary nature of genre boundaries, the rationale for a genre-based approach is grounded in the genre-specific subject matter of much of the historical and analytical literature. For example, Gilbert and Pearson (1999), Reynolds (1999) and Shapiro (2000a) focus on electronic dance music; Chadabe (1997), Holmes (2002) and Manning (2004) on electronic and electroacoustic music; Berliner (1994) and Monson (1996) on jazz; Middleton (1990), Moore (1993) and Stephenson (2002) on rock.

The methodology for this research is designed to address the aims of the research sequentially. The first aim (i.e., the identification and analysis of compositional and improvisational practices at the intersection of conserved and emergent methods and the development of a suitable analytical methodology) provides the theoretical aspect of the research and is addressed in Section 4.3 below. Section 4.4 constitutes the practical aspects of the research, and addresses the second and third aims of the research (i.e., the development of a series of exemplar works and the development of a computer based performance instrument encompassing compositional methods at the intersection).

[7] The division of popular and art music in a musicological context is discussed in Middleton (1990), Moore (1993) and Covach (1999). These authors focus on the emergence of popular music studies as an area of academic research and the inadequacies of existing musicological/analytical methods to deal with popular music. However, the art music discussed is primarily Western classical (i.e. tonal music) and thus not of relevance to this research. The art music genres listed here present many of the same problems for traditional musicology as popular music. Nevertheless the distinction can still be drawn, perhaps most clearly in terms of the source of funding for the production and distribution of works in each: popular music is largely the result of private enterprise, whereas art music is largely the result of public funding.

4.3 Theoretical Underpinnings

4.3.1 Identification of Key Works in Selected Genres

The selection of works, from those available to me as recordings, for analysis in each genre required the development of the following criteria: Firstly, the research context required that selected works incorporate emergent technologies. Secondly, in order to create a well developed and complex discussion of different analytical perspectives of the works, the selected works needed to have a high profile in the literature. Thirdly, the selection of works had to be representative of a pivotal development in the genre enabling an historical overview of compositional methods. Finally, to make explicit the 'filter of personal practice' (Section 2.4) the selected works needed to have a high level of personal interest. The criteria for the selection of works in each genre are summarised below:

1. Incorporation of emergent technology.
2. High profile in the literature.
3. Representative of a pivotal development in the genre.
4. High level of personal interest.

4.3.2 Development of Analytical Methodology

In Chapter Three, the relevance of existing means of musical analysis to this research was discussed and the rationale for a more developed analytical methodology presented. The analytical methodology for this research was developed through the selection and adaptation of various analytical tools encountered in the extant literature. The purpose

of the analytical methodology is to explore compositional methods at the intersection and to enable some of them to be applied to the creation of new works. The dimensions of *musical frame, spatial frame, specialist knowledge* and *validity* provide a useful starting point for the presentation of a more developed analytical methodology.

The decision as to what to analyse (musical frame) is based on both the 'positionality of individual agents' (Taylor 2001, discussed in 2.3) and the critique of the notion of the 'autonomous artwork' (presented in 3.2); thus the current research seeks to analyse both text and context. The text, in the case of works selected herein, is primarily the original recording (or currently available digital version) as most of the works relevant to the study are not available as scores or performances. The context to be analysed is somewhat dependent on my own particular spatial frame. Given the historical and geographic spread of works analysed, a desk-based methodology for the analysis was adopted. This precludes a range of contextualising elements from analysis, most importantly the possibility of being 'in the field' in particular places and times. However, the notion of a participant analyst/creator enables the concerns of Berliner (1994), Monson (1996) and Ake (2002) regarding the importance of an ethnographical approach (i.e., giving primacy of expertise to musicians, not analysts) to be partially addressed.

The notion of a participant analyst/creator also impacts on the dimensions of specialist knowledge and validity. Notwithstanding the academic audience of the current research, it is intended that the knowledge presented should be relevant for other music creators, students and educators and, to a lesser extent, listeners and the interested general public. Thus the analytical methodology assumes a certain degree of specialist knowledge commensurate with the intended audience. In terms of validity, the musicology/

ethnomusicology methodological distinctions raised by Stokes (2003) (see 3.5) are somewhat nullified by positing the analyst as creator. However, this is only partially achieved as the analyst, in this case, remains an observer during the analytical phase of the research. Following the concerns of those critical of a rationalist/formalist approach (including Ferrara, 1984; Hubbs, 2000; Kerman, 1985; Middleton, 2000), I seek to ground the analysis of works in a manner which reflects a subjective experience of music, whilst comparing personal insight to the experience of others. Subjective experience also reflects the notions of positionality and agency in relation to technology, as raised in 2.3 (Taylor 2001). The current research follows the view of Norris (1999) and Hubbs (2000) in suggesting that the analytical investigation is ongoing and never complete.

As discussed in 3.4, a variety of presentational tools exist in the field of music analysis, including text descriptions, traditional and graphic scores, form diagrams, sonograms and sound. The pertinence of particular means varies according to the actual music being analysed. The selection of a representational mode reflects an analyst's explicit or implicit assumptions regarding music and communication about music (see 3.4). For this research, it was necessary to create an analytical methodology that enabled comparison between works and genres that could be utilised in the creation of new works. To this end, the creation of a largely text-based summary template, applicable to all works across each of the genres, was developed. The template incorporates, or is augmented by a variety of presentational tools, such as traditional notation, form diagrams and sonograms. However, given the varying parameters of different musical styles, graphic representations are not necessary or included for every work.

4.3.3 Analysis of Selected Key Works

The transcription of recorded works in traditional or graphic notation, the generation and analysis of sonograms, creation of form diagrams etc., constitutes the initial analytical endeavour. The distillation of such information into a concise summary template, applicable to all works, enables the identification and comparison of compositional methods between individual works and genres. Solomon's (2002) *Music Parametric Analysis*, (an example of a formalist approach to analysis mentioned in 3.1) provides a useful template for encompassing a range of various musical parameters in a concise text based form. However, given its emphasis on tonal works and the consideration of musical 'text' without reference to 'context', Solomon's template requires expansion for the purposes of this research.

By considering the range of parameters involved in the creation of a musical work (as presented in 1.2, Figure 1.1), a connection between analysis and creation is established. The completed analyses enable comparisons to be made between works through presentation, in an element-specific manner, of aspects of the compositional methods employed in the creation of those works. Thus a storehouse of compositional methods, from which new works can be developed, is created. Table 4.1 presents the analysis template developed for this research. The statements and questions in italics are intended to focus the discussion in each parameter and provide references to key authors where appropriate.

Table 4.1. *Analysis Template*

Shaping Factors:

Parameter			
Musical	**Theoretical**		*Philosophical, music theoretical.*
	Practical	**Technical**	*Tools for realisation e.g., equipment, studios (constraints/potential).*
		Play	*Bottom up - type approaches, e.g., jamming, software/synthesiser exploration.*
		Practice	*Instrumental/vocal/studio etc.*
	Listening		*Influences, musical or other.*
Other	**Environmental**	**Macro**	*Time, place, culture etc.*
		Micro	*Room, ambience, etc.*
	Budget/ Resources		*Source of funds, amount.*
	Intended Audience		*Explicitly stated? Implications due to marketing?*
	Timeframe		*Time for realisation.*

Inputs:

Parameter		Experiential	Literature
Sound	**Sources**	*E.g., electronic, concrète, instrumental, vocal.*	
	Objects	*Individual elements – e.g. durations/amplitude envelopes, frequency ranges/pitches, wave types, description of samples, text fragments, composite objects (e.g., additive synthesis).* *(Roads, 2001, following Schaeffer)*	
	Object processing	*Types, e.g., delay, chorus, reverb, compression, gate, filtering, distortion, speed variation, LF modulation.*	
Rhythm	**Pulse**	*Present? Constant/variations?* *Tempo – constant/varied, sudden or gradual changes? (Solomon, 2002).*	
	Metre	*Ametric, polymetric, multimetric? Regular meter? Constant or changing? (Solomon, 2002)*	
	Patterning	*Description of patterns, changes, note values, accents, effects on other parameters (e.g. pitch) (Solomon, 2002).*	
Pitch	**Selection**	*Tonal, atonal, microtonal, polytonal, modal, chromatic, aleotoric? (Adapted from Solomon -"Tonality", 2002)*	
	Vertical structures	*Chord structures, voicings, intervals (Solomon – "Harmony", 2002).*	
	Vertical patterning	*Chord sequence/repetition/ variation/ rate of change/ root movement/ pedal point/drone. (Solomon - "Harmonic Motion", 2002)*	
	Horizontal structures and patterning	*Melody/Phrase/motive/riff – structure/contour/range/length. Description of patterns. Repetition/variation? (Adapted from Solomon - "Thematic/motivic structure", "Thematic/motivic development" and "Pitch range", 2002).*	
	Dynamics	*Constant/Changing? Independent of texture? (Solomon, 2002)*	
	Texture	*Monophonic, homophonic, polyphonic, contrapuntal, heterophonic? Homorhythmic? Thin/thick? Changing? Polarization (melody/accompaniment, solo/tutti, antiphony. etc.) (Solomon, 2002).*	
	Timbre	*Quality(ies). Static/evolving.* *Sound combinations/blending (Solomon, 2002).* *Vocal timbre – throat/head/chest and gender construction (Shepherd, 1991, p. 163).*	
	Spatial elements	*Nature of perceived acoustic space. (Wishart, 1996, p. 140)* *Stereo - left/right, near/far, static/dynamic, local/diffuse (Wishart, 1996, ch. 10).* *Reference to "Sound box" (Moore, 1993, p. 106)* *Multispeaker – placement, static/dynamic, trajectories, local/diffuse (Wishart, 1996, ch. 10).*	
	Programmatic Association	*Perceived meaning/connotation. Implicit/explicit, Intrinsic/contextual recognition (Wishart, 1996, p. 150).* *Sound image as metaphor? (Wishart, 1996, p. 165)* *Reference to physical gesture? (Middleton, 2000, p. 108)* *Signification/coding (Middleton, 1990, ch. 6).* *Syntax/semantics/ontological levels (Ferrara 1984, p. 359).*	
	Structure	*Form type(s). Small and large scale relationships. Derivation of structure – principle? (Solomon, 2002).*	
	Interaction	*Description. Rules? Standard types of interaction? (Rinzler, 1988)*	
	Score	*Existing? Type?*	
	Presentational Format	*Recording (format?)/ Live performance (venue?)*	

The analytical model derives to some extent from category analysis as described by Bent (1987), but extends from his quantitative models (LaRue, 1970 and Lomax, 1968) to encompass my own experiential responses as well as those of others observed in the extant literature. The first section of the template addresses the shaping factors in the creation of a musical work. According to numerous authors (e.g., Brown, 1997; Ferrara, 1984; Hubbs, 2000; Tagg, 2000), the consideration of a broad range of extramusical parameters is necessary for any comprehensive analysis and the current research incorporates this principle. The consideration of shaping factors also enables an investigation of positionality and individual agency in relation to technology (as discussed in 2.3).

The second section of the template addresses the inputs of a particular work and includes a range of traditional parameters (e.g., *pulse, metre, dynamics, pitch selection, texture*, etc.) in addition to parameters more suited to electronic and electroacoustic works such as, *sound objects*, *spatial elements*, and *programmatic association*. The range of parameters is intended to include those that impact on the creative process. For example, visual elements, such as CD covers, photographs, videos etc., whilst important elements in the construction of meaning at a broad level of reception, do not figure prominently in the production of the works considered herein. The parameter *programmatic association* is intended to include subjective responses from both others and me that may or may not align with the intentions or response of the music creators themselves.[8]

[8] It is beyond the scope of this research to address the issues of reception and meaning to such a broad extent as to include, for example, detailed discussion of psychological and cultural or cognitive and semiotic aspects of sound and works. Whilst I acknowledge the importance of such aspects from a musicological/analytical perspective, the inclusion of such detail requires a differently focused study in which personal practice/composition is not the central driver. Whereas in the other analysis parameters a certain degree of objectivity is possible, my conclusions in relation to programmatic association are grounded in the subjectivity/positionality presented in 2.4 as the filter of personal practice.

My own observations, viewed necessarily through the filter of personal practice (see 2.4), are given in the *experiential* column. My discussion of the literature on the works, including comments by the creators of the works themselves, is given in the *literature* column. The references, examples and questions in the experiential column are intended as a guide for comments and provide connections to definitions and descriptions in the literature. The work of authors such as Fast (2000), Ferrara (1984), Middleton (2000), Smalley (1997), Solomon (2002) and Wishart (1996), provide useful models for the text-based descriptions of such elements. As mentioned in 4.2.2, text alternatives can be incorporated within, or in addition to, the template where appropriate. For example, the description of *rhythm patterning* or presentation of a chord voicing in a tonal work can be more easily conveyed with traditional notation.

The criteria for selection of works stated above (section 4.2.1) include the need for works to have a high profile in the literature. I acknowledge that, although setting such criteria is necessary in order to provide a well developed and complex discussion of different analytical perspectives on the work, this does reinforce the canonisation of a limited number of works in each genre. For example, there are numerous works which satisfy the remaining criteria but do not have a high profile in the literature. However, this does not preclude the analytical methodology presented here being utilised for such purposes outside the current research, for example, in various educational settings on student compositions or works without a high profile in the literature.

4.4 Development of Creative Works

4.4.1 Creation of Genre Specific Studies

For each genre, various compositional and/or improvisational practices have been selected according to the following:

1. Having completed the analysis of selected key works, the predominant shaping factors, inputs and processes have been identified in each particular genre, a process enabling the mapping of genre terrain.
2. Particular resonances at the shaping factors level and elements of personal interest at the input level have been identified and categorised according to the parameters listed in Table 4.1 (Analysis Template).
3. Various compositional and/or improvisational practices pertinent to the particular genre and of personal interest have been selected to form the basis on which the studies were developed.
4. For each study current emergent technologies relating directly, or via extension, to the particular genre have been incorporated alongside the selected compositional and/or improvisational practices.

The development of each study was intended to provide a synthesis of the subjective and objective elements identified in the analyses of the selected key works in each genre.

4.4.2 Development of a Computer Based Performance Instrument

The development of a computer based performance instrument (CBPI) is the third aim of the current research. The need for such an instrument is directly attributable to my interest in performance and improvisation, aspects fundamental to my preferred sphere of music creation and presentation (see 2.4). The creative insights gained from exploration of various compositional methods in the studies provide the basis for the design of the computer based performance instrument. The performance instrument incorporates elements of interest identified from the analysis of selected key works and selected aspects of emergent technologies, including the hardware and software and modes of presentation utilised in the studies.

4.4.3 Creation of Major Works

The CBPI was utilised to develop a series of major works exploring selected compositional and improvisational practices at the intersection of conserved and emergent technological compositional methods. The works are intended to represent a range of possible sonic outcomes for the CBPI and constitute, on a practical level, the culmination of the participant analyst/creator model.

4.4.4 Analysis – Creation Model

The creation of musical works, utilising the compositional methods identified in the analysis of the selected key works, constitutes the practical outcome of this research. The relationships between compositional methods identified via analysis and those

utilised in the creation of new works occur on a range of levels and are particular to the subjective position of my role as participant analyst/creator. At the shaping factors level, some parameters are beyond my control. These include certain *technical, environmental, budgetary* and *timeframe* considerations. By framing my position at the shaping factors level in terms of resonance, links can be made both between works analysed and to the new creative works developed. For example, whilst not having the specific technical limitations involved in a particular work, the general notion of 'technical limitation' affords a point of departure for a discussion of such in the creative process. Similarly, the comparison of the shaping factors between works and to my own position offers the possibility of insight into aspects of continuity and/or disruption both within and across musical genres.

Some inputs can be directly incorporated into new works whereas others can be utilised at a more general conceptual level. For example, the use of a quadraphonic spatial arrangement can be directly transferred to a new work, whereas a concept such as the absence of a gestural connotation for the generation of sounds in an electroacoustic work can be transferred at a general level, regardless of the particular sound utilised in a new work. Similarly, certain inputs identified in the selected key works may provide a point of departure for the development of inputs for new works. The development of integral serialism in the 1940s and 1950s, whereby serial procedures were applied to a range of parameters (e.g., rhythm and dynamics) beyond pitch, provides one such example.

The incorporation of new technologies in the development of the creative works provides a crucial dimension relating directly to the aims of the research. Whilst many music software packages enable the efficient replication of older analogue techniques,

the potential for development of emergent methods remains an important feature of many digital technologies. It is the intention of the current research to explore both these aspects of emerging technologies through the replication of specific techniques alongside the extension of conceptual elements identified in the selected key works.

CHAPTER FIVE

ANALYSIS OF COMPOSITIONAL METHODS IN SELECTED ART MUSIC GENRES

5.1 Electronic Works

5.1.1 Identifying Key Works

The selected key works analysed in the electronic genre are listed in Table 5.1, the chosen works meeting the selection criteria outlined in 4.2.1. The key aspect(s) of each work is given in the right hand column.

Table 5.1. *Selected Key Works in Electronic Genre*

	Composer	**Work**	**Year**	**Key Aspect(s)**
1.	John Cage	"Imaginary Landscape #1"	1939	Phonograph as sound source; intended for radio broadcast.
2.	Pierre Schaeffer	*"Etude Aux Chemins de Fer"*	1948	Early *musique concrète* exemplar.
3.	Karlheinz Stockhausen	*"Studie 1"*	1953	*Elektronische musik* exemplar. Additive synthesis.
4.	Karlheinz Stockhausen	*"Gesang der Jünglinge"*	1956	Multichannel work, recognized as breaking Cologne/Paris division.
5.	Edgard Varèse	*"Poème Électronique"*	1958	Major electronic work for key composer from art music tradition with history in non-pitch based works; multi-channel, multimedia event.
6.	Iannis Xenakis	*"Concret PH"*	1958	Short textural work based on single sound source. Early work from key electronic composer/theoretician.
7.	Morton Subotnik	"Touch"	1969	Voltage controlled synthesis exemplar.
8.	John Chowning	"Stria"	1977	Frequency modulation synthesis exemplar.
9.	Jonathan Harvey	*"Mortuos Plango, Vivos Voco"*	1980	'Microsound' construction via digital processes; spectral analysis/resynthesis of recorded sounds.

5.1.2 Applying Analytical Methodology

The analyses of the electronic works are presented in Appendix B. The acousmatic nature of most of the works necessitated careful consideration of parameters such as *sound source*, *sound objects, sound object processing* and *programmatic association*. The descriptions given in the analysis template of such parameters, whilst not providing exhaustive detail, are intended to provide an overview. Some of the works are the subject of detailed scholarly analysis and aspects of these analyses are included in the *literature* column, providing different analytical perspectives to the various parameters. In many instances, the composers of the selected key works in the electronic genre have provided detailed commentary of the processes undertaken, enabling thorough descriptions of many of the parameters in the analysis template.

With the exception of Subotnick's "Touch", the original mode of presentation of the works differs from my own experience of the work. This is of particular relevance in the works from 1956 onwards where important *spatial elements* resulted from multi-speaker concert presentations. Thus, in most cases, the perception of the original spatial elements can only be imagined. The *experiential* column of the analyses contained herein considers the spatial elements apparent in the currently available recorded versions.

5.1.3 Ascertaining Compositional Methods / Mapping Genre Terrain

The examination of selected key works in the electronic music genre revealed numerous compositional methods. These are presented in an elemental form in the individual analyses (see Appendix B). However the following general comments can be made. At the shaping factors level, *theoretical* and *technical* considerations figure prominently.

Most of the composers, with the notable exception of Schaeffer, were schooled in a Western art music tradition with Messiaen and Schoenberg cited as key influences, either via direct tuition or through particular compositions. Detailed exposition of compositional method is available for many of the works. Examples of this include Stockhausen's (2001) detailed rationale of the serial procedures undertaken in the creation of "*Studie I*" and Harvey's account of processes for "*Mortuos Plango, Vivos Voco*" (1980).

Regarding *technical* considerations, the exploration of new sound sources is a primary focus in all of the works. Such explorations usually began at a conceptual level, with the implementation/production phase completed over a timeframe of some months. It is possible that the relatively short duration of works analysed from the 1950s was a result of the labour intensity of tape processes and the timeframe available to the composer. The composers themselves do not discuss this constraint; instead this perhaps forms a tacit boundary on duration.

With the exception of Subotnick's "Touch", the path from conceptualisation to realisation was largely unmediated, in terms of the resultant sounds, by the particular technologies involved in the production of such sounds. For the majority of works, the sonic outcomes were the result of one of the following: a deliberate predetermined selection of source material (e.g., Cage, Schaeffer, Varèse and Xenakis); a predetermined synthesis operation (e.g., Chowning and Stockhausen, "*Studie I*"); or, a combination of both (Harvey and Stockhausen, "*Gesang der Jünglinge*"). The notion of *play* was an acknowledged factor in the case of Subotnick's "Touch" where the exploration of a new instrument (the Buchla Voltage Controlled Synthesiser) preceded the development of the work.

The *budget* and *resources* for the electronic works, where disclosed, were via substantial public institutional backing (Chowning, Harvey, Schaeffer and Stockhausen,) or commercial enterprise (Subotnick and Varèse). Although "*Concret PH"* was presented at the Philips Pavilion at the World's Fair in Brussels, the work was completed in Xenakis' spare time, "in rather primitive facilities" (Harley, 2002, p. 37), whilst he supervised construction of the Pavilion itself. Most of the works were produced in well equipped, electronic music studios with the aid, in some cases, of numerous technicians (e.g., the works by Stockhausen and Varèse).

At the *inputs* level, the individualised nature of *sound sources* is a significant marker for each of the works. Four of the works utilise a particular means of synthesis (see Table 5.1) as the only sound source. The remaining works feature either solely *concrète* sounds (works by Schaeffer and Xenakis) or combinations of (either all or some of) synthesised, *concrète*, vocal and instrumental sources. As a result of the various sources, many of the works feature complex and individualised *sound objects*. The distinction between what constitutes a *sound object* and what results from *sound object processing* is, in most cases in the electronic genre, difficult to ascertain, making the latter category somewhat superfluous.

Most of the works, with the exception of Cage's "Imaginary Landscape #1", contain no conventional (i.e. traditional notational) rhythm and pitch elements. Where applicable, *rhythm* is considered in terms of either patterning of successive sound objects or is a function of object duration. *Rhythmic patterning* tends to be complex with minimal repetitive elements. Some of the works with harmonic pitch elements (e.g., works by

Chowning, Harvey, Stockhausen and Varèse) feature complex frequency components derived from non-standard tunings and/or overtone structures.

The occurrence of significant *spatial elements* in works from 1956 onwards has been noted above (5.1.2), however, in only two of the works (Harvey and Stockhausen, "*Gesang der Jünglinge"*) was any rationale for the placement and movement of sounds presented in the literature. In "*Gesang der Jünglinge"* Stockhausen applied serial procedures to spatial elements (Stockhausen 2001). Harvey (1981) relates the spatial elements to the programmatic theme of the work where the placement of sounds was intended to give "the listener the curious sensation of being inside the bell" (p. 24). The importance of *spatial elements* in terms of *programmatic association*, whilst not explicitly acknowledged by the composer, is apparent in many other works and is documented as such from both *experiential* and *literature* perspectives in the analyses.

In the five works where detailed commentary from the composer is available (Cage, Chowning, Harvey and both by Stockhausen) the description of a formal structure is given. Stockhausen (2001) provides the most detail in this regard. For example, discussing the structure of "*Studie I"*: "A 'serial system' for sensorially evaluated frequency differences will begin in the middle of the auditory range and extend to the limits of pitch audibility" (p. 102). Possible formal structures for the remaining works are presented in the extant literature. This includes, for example, the recognition by Di Scipio (1998) of the 'self similar' nature of large and small-scale features in Xenakis' "*Concret PH"*. The existence of formal structures reflects both the top down processes (whereby the creation of a formal structure precedes the realisation of the work) and the preoccupation with formalism in the composition and analysis of the electronic works considered here.

A summary of the predominant *shaping factors, inputs* and *processes* for the electronic music genre is given in Figure 5.1 with the predominant elements highlighted.

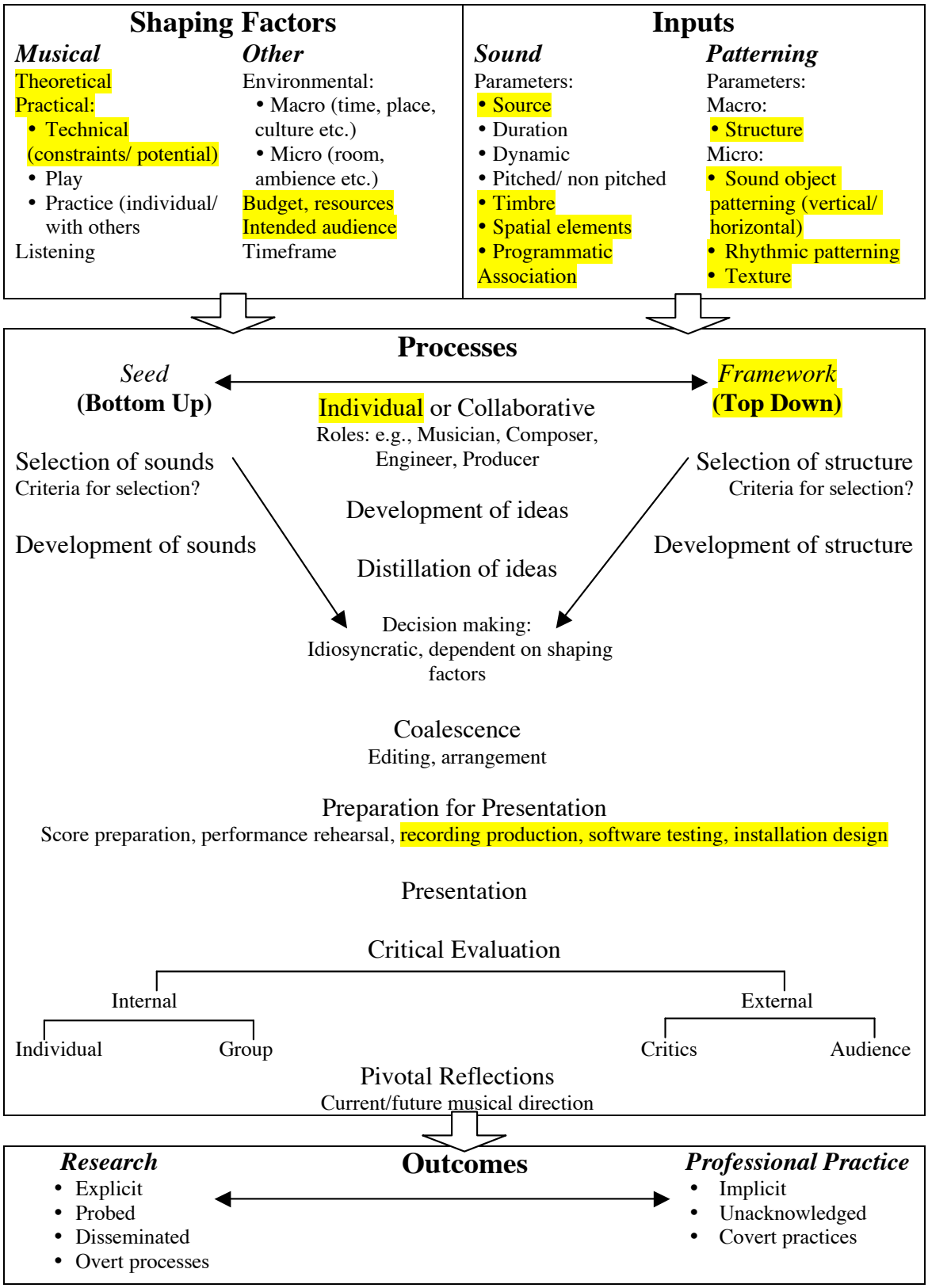


Figure 5.1. The creation of a musical work: Features of electronic works highlighted.

5.1.4 Applying Compositional Methodols / Development of Genre Study

Working within the frame of the predominant *shaping factors*, *inputs* and *processes* identified for the electronic music genre, selected methodologies were utilised in the creation of the Electronic Study. Particular *resonances* observed in shaping the creation of the Electronic Study are listed in Table 5.2. The aspects of compositional methods, *elements of personal interest*, are identified in the second column of Table 5.3 below. The third column in Table 5.3 provides the detail of the study developed. The selection of *inputs* in the third column is made by combining of the key aspects of genre terrain with the subjective components of the filter of personal practice (see 2.4)

Table 5.2. *Resonances Observed Between Factors Shaping Selected Key Works and Factors Shaping the Creation of the Electronic Study*

Parameter			Resonances
Musical	**Theoretical**		• Integral serialism (Stockhausen). • Need for expanded sound palette (Cage, Schaeffer, Varèse).
	Practical	**Technical**	• Use of control tape for presentation (Varèse). • Tools for realisation include digital version of early tape studios. E.g., microphone, recorder, mixer, tape editing, etc. (Schaeffer, Stockhausen, Varèse, Xenakis).
		Play	
		Practice	
	Listening		• Electronic works (Chowning, Stockhausen).
Other	**Environmental**	**Macro**	• Institutional support for new technologies (Chowning, Harvey, Schaeffer, Stockhausen, Subotnick, Varèse, Xenakis). • Aesthetic shaped by environmental sounds (Harvey, Xenakis).
		Micro	• Realised in studio environment (All).
	Budget/ Resources		• Use of public institutional studio (Chowning, Harvey, Schaeffer, Stockhausen).
	Intended Audience		
	Timeframe		• Months (Schaeffer, Stockhausen, *Studie 1*).

Table 5.3. *Elements of Personal Interest and Elements of Electronic Study*

Parameter		Elements of Interest	Elements of Study
Sound	**Sources**	• Electronic: Frequency recordings (Cage), sine waves (Stockhausen). • *Concrète*: Train sounds (Schaeffer); burning charcoal (Xenakis) bell sounds (Harvey). • Combinations: Sine waves, coloured noise and boy's voice (Stockhausen "*Gesang der Jünglinge"*); sine waves, white noise, recordings of instruments, solo and choral voices (Varèse). • FM (Chowning).	• *Concrète*: baby vocalisations.
	Object patterning	• Application of serial procedures (Stockhausen "*Studie I").* • Timbrally evolving pitched sounds (Chowning). • Amplitude envelopes of individual partials of one sound applied to another (Harvey).	• Combination of discrete sound objects to form larger sound objects (vertically). • Number of sound objects combined vertically determined by control signal. • Short grains of similar timbre form longer sound objects (horizontally). • Selection of grains determined by control signal.
	Object processing	• Variable speed: Turntable (Cage).	• Parameters determined by control signal.
Rhythm	**Pulse**	• Multiple tempos (Subotnick).	• Range - slow to fast, determined by control signal.
	Metre	• Nil.	
	Patterning	• Short repeated sections of *concrète* materials create rhythmic patterns (Schaeffer). • Application of serial procedures (Stockhausen, "*Studie I").*	• Range - single sound (drones) to irregular rhythmic patterns, determined by control signal.
Pitch	**Selection**	• Application of *Golden Mean* to octave ratio and division, providing cohesive microtonal elements (Chowning). • Based on resonant frequencies of bell tone (Harvey).	
	Vertical structures	• Combination of discrete frequencies to form larger 'note groups' (Stockhausen, "*Studie I"*).	
	Vertical patterning	• Nil.	
	Horizontal structures	• Nil.	
	Horizontal patterning	• Nil.	
	Dynamics	• Application of serial procedures (Stockhausen, "*Studie I").*	• Range - *pp* to *ff*, determined by control signal.
	Texture	• One continuous texture (Xenakis).	
	Timbre	• Timbre continuum – sine waves to white noise, inclusive of boy's voice (Stockhausen, "*Gesang der Jünglinge"*). • Exploration of minimal sound sources (Harvey, Schaeffer, Xenakis). • Evolving timbres (Chowning, Harvey). • Transformation and blending between electronic and *concrète* sources (Harvey).	• Timbre continuum - range from simple sounds (made from one grain) to complex sounds (made from many grains). • Exploration of one sound source (baby vocalisations).
	Spatial elements	• Multiple speakers: Four (Chowning and Subotnick,); Five (Stockhausen, "*Gesang der Jünglinge"*); Eight (Harvey); 350 (Varèse, Xenakis). • Sound trajectories in multi speaker system (Stockhausen, "*Gesang der Jünglinge",* Varèse, Xenakis).	• Multiple speakers; four. • Discreet placement of sounds within quad field.

		• Discreet placement of sounds within spatial field (Chowning, Harvey, Stockhausen, "*Gesang der Jünglinge*", Subotnick, Varèse, Xenakis). • Evolving timbres suggesting evolving spatial movement. E.g., local to diffuse (Chowning). • Same or similar sounds placed in different parts of spatial field (Harvey).	
	Programmatic Association	• Speech continuum – varying degrees of comprehensibility (Stockhausen, "*Gesang der Jünglinge*"). • Absence of gestural connotation due to perceived randomness of sounds (Stockhausen, "*Studie I*"). • Vocal fragmentation (Harvey, Subotnick). • Lack of perceived formal development reinforces textural/ambient aspects of work (Chowning).	• Agitation continuum – range of baby sounds - from most contented to most agitated. • Tension between a lack of gestural connotation, due to perceived randomness of sounds, and primal nature of baby sounds. • Vocal fragmentation. • Lack of perceived formal development reinforces textural/ambient aspects of work.
	Structure	• Rhythmic patterning forms basis of structure (Cage). • Sectional (Cage, Harvey, Schaeffer, Stockhausen, "*Gesang der Jünglinge*", Subotnick). • Serial procedures applied to pitch, duration and dynamics (Stockhausen, "*Studie I*"). • Structure of work in place prior to recording of *concrète* elements – electronic model used for vocalist (Stockhausen, "*Gesang der Jünglinge*"). • One constant texture with development occurring through layering and spatial aspects (Xenakis). • Overall structure of piece evolved from notion of microstructure (Chowning).	• Based on baby's waking cycle – crying, eating, playing, crying. • Audio recording of these activities used as control signal for various sound generation parameters including: source sound selection, number of simultaneous source sounds, timbre, dynamics, rhythmic patterning and spatialisation. • Micro (individual sound files selected from contented-agitated spectrum) related to macro (control signal; baby's waking cycle).
	Interaction	• Nil.	
	Score	• Graphic score (Stockhausen, "*Studie I*").	
	Presentational Format	• Radio broadcast (Cage). • Purpose built hall (Varèse, Xenakis).	• DVD, 5.1 Surround.

In terms of *shaping factors*, at a *theoretical* level resonances observed in the creation of the study include a desire for an expanded sound palette (expressed explicitly by Cage, Schaeffer and Varèse), and integral serialism (Stockhausen, "*Studie I*"). These are manifest in the selection of the source sound for the study (baby vocalisations) and the development of a formal structure for the work whereby an initial principle is used to determine the nature of selected *inputs*. In the study, amplitude variations in a control signal determine the values of selected musical parameters. Thus, although the use of integral serialism is cited, it is only at a conceptual level (i.e., a principle determining nature of selected *inputs*) where the resonance occurs. The row in integral serialism

becomes the amplitude values in a control signal and is related to the sonic output in a concrete way, unlike the abstraction of mathematical value in a row. The selection of baby vocalisations also reflects an aesthetic shaped by environmental sounds, identified as a *shaping factor* in the work of both Harvey and Xenakis. Further resonances occur where the *budget* and *resources* for the realisation of works are via institutional support for new technologies.

In terms of the *inputs* for the study, as mentioned above (5.1.3) the nature of *sound source* and thus the *timbre* of the work are key markers of genre terrain. Numerous sound sources heard in the electronic works were of interest and are identified in the second column of Table 5.3. However, given my interest in field recording (see the filter of personal practice, 2.4) the selection of a *concrète* sound source represents a convergence of genre terrain and personal interest. With the exception of Varèse's "*Poème Électronique"*, the electronic works featuring *concrète* sounds utilise minimal sources and thus a single source is used for the study.

The importance of a formal structure is evident in the electronic genre (see 5.1.3) and the derivation of such from a particular *theoretical* basis is discussed above. In addition to Stockhausen's use of integral serialism in "*Studie I"*, the formal structure for the study also draws on Chowning's notion of structure evolving from the microstructure and the speech continuum developed by Stockhausen for "*Gesang der Jünglinge"*. In the study, a thirteen-minute audio file (a series of recordings compiled to mirror a baby's waking cycle - crying, eating, playing and crying) is used as a control signal to trigger a range of short baby sounds, which are sorted according to a pleasure-agitation continuum. Following Stockhausen's application of serial procedures to all parameters

(i.e., in "*Studie I*"), the control signal is utilised to determine the *dynamics*, *rhythm* and *spatial elements* of the triggered sounds and provides the duration of the study. Whilst the structure of the work does not evolve from the microstructure, as in the Chowning example given here, the relationships are maintained between the macro and micro.

In the study, the pleasure-agitation continuum firmly links *programmatic association* to the *structure* of the study. The composers of the selected key works themselves do not present such a link; instead, given the acousmatic nature of the works, elements of programmatic association are mostly subject to individual interpretation. The rationale for the link is based on the filter of personal practice (see 2.4, in particular the use of Messiaen's *Modes of Limited Transposition*). By employing the human element of baby vocalisations within an abstract formal conceptual frame (i.e., integral serialism) my own interest in, and yet unease with, abstract formalism can be explored.

5.1.5 Realisation of Electronic Study

The *top down* process of early tape music, whereby the design of a formal structure preceded the realisation of the work, was followed in the realisation of the study. A range of baby vocalisations was recorded using a portable DAT recorder with emphasis placed on capturing a variety of sounds associated with the baby's activities including playing, eating and a range of crying. An individual sound file was created for each short utterance. These files were then sorted in terms of relative agitation – creating a spectrum from most contented to most agitated sounds. In addition to these short sound files, longer files (for example a two minute recording of the baby eating) were combined into the thirteen-minute control signal that provided the structure of the work.

Using abstractions developed in Max/MSP, changes in amplitude in the longer control signal files were mapped to various sound generating parameters demonstrated in Figure 5.2 below. Figure 5.3 presents a basic flow chart of the abstractions and includes key Max/MSP objects where appropriate.

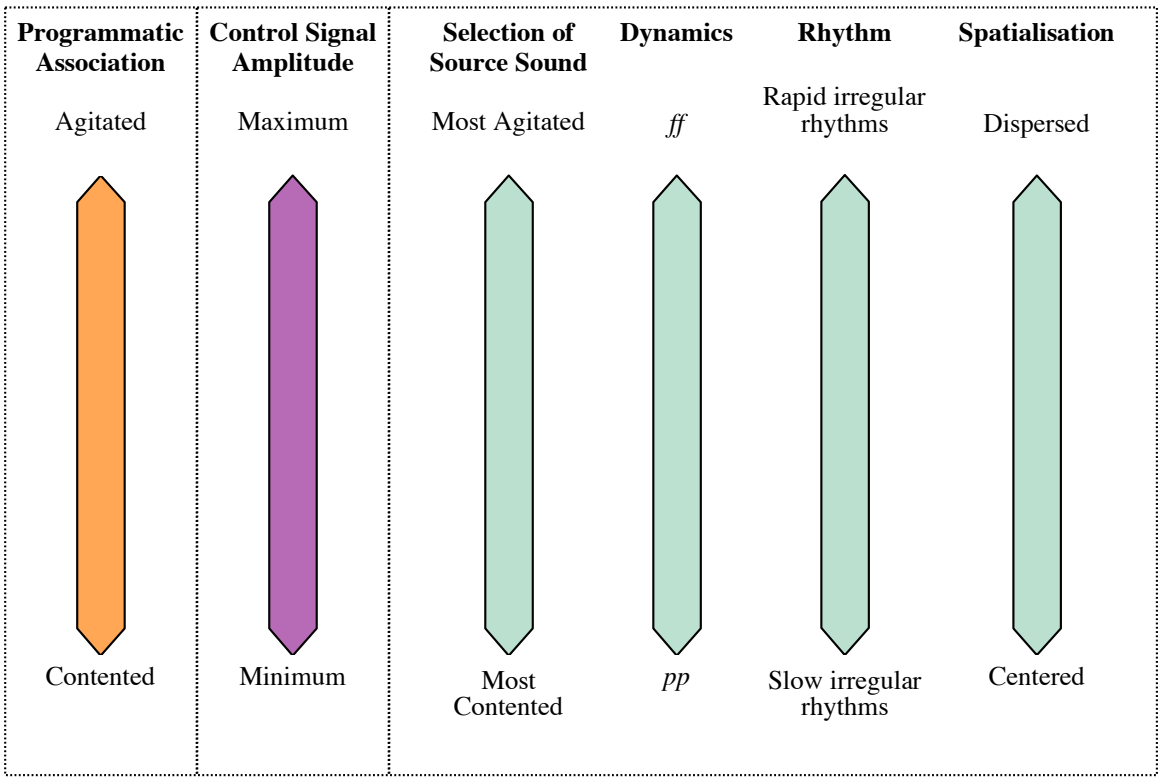


Figure 5.2. Electronic Study: Relationship of various parameters to control signal and programmatic association.

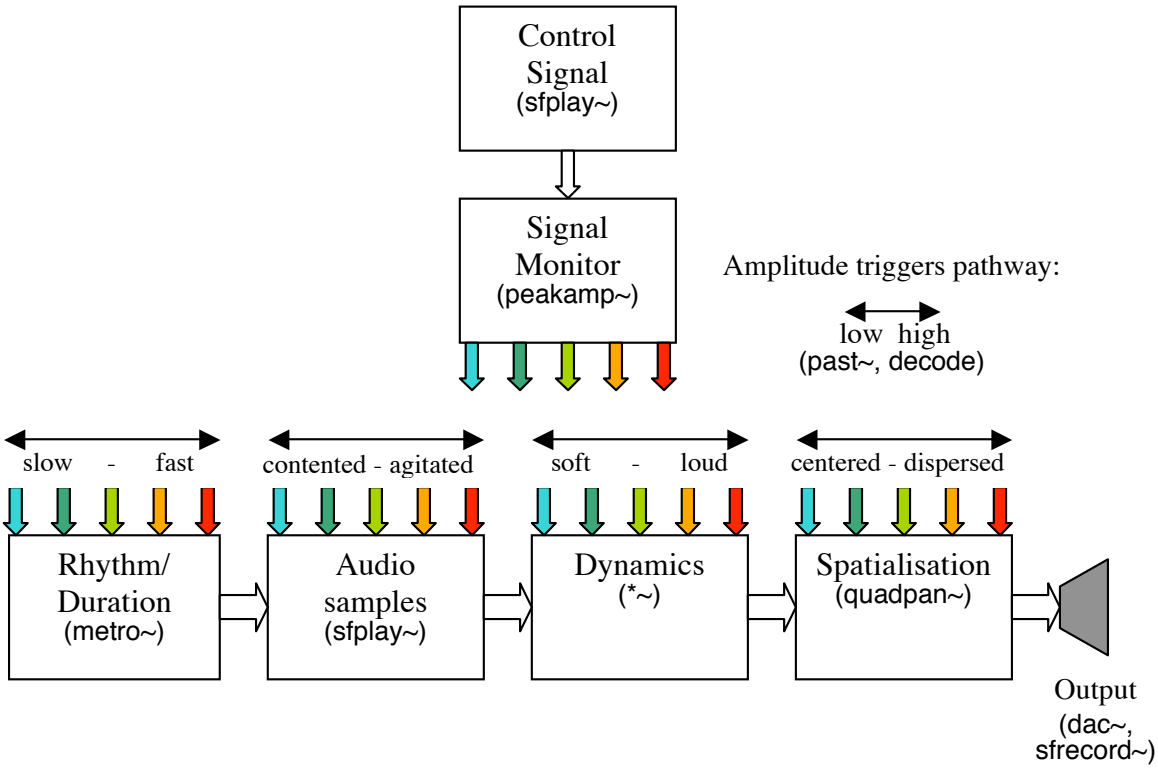


Figure 5.3. Electronic Study: Max/MSP realisation flow chart.

The output of the Max/MSP abstraction was recorded as a four-channel audio file using the sfrecord~ object. This file was transferred into Pro Tools, split into four mono files then encoded in AAC format within A.Pack. The work is presented on the accompanying DVD in a 4.0 quad configuration. The Max/MSP abstraction contains a number of random objects, thus future presentations of the work, direct from Max/MSP, will differ from the version presented on the accompanying DVD. This 'non-final' presentation differs from the mode of presentation for most of the selected key works and reflects aspects of personal practice emphasising performance.

5.2 Improvised Works

5.2.1 Identifying Key Works

The selected key works analysed in the improvised genre are listed in Table 5.4.

Table 5.4. *Selected Key Works in Improvised Genre*

	Artist	**Work**	**Year**	**Key Aspect(s)**
1.	Pauline Oliveros	"Bye Bye Butterfly"	1965	Live studio performance, use of tape loop delays.
2.	Miles Davis	"Bitches Brew"	1969	Post performance editing and effects in studio. Key figure in development of fusion.
3.	Herbie Hancock	"Chameleon"	1974	Key figure in use of commercial synthesisers/electric pianos.
4.	David Behrman	"On the Other Ocean"	1978	Early interactive microcomputer work. Key figure in interactive works and instrument building.
5.	Joel Chadabe	"Valentine"	1987 - 94	Use of interactive software M. Key figure in interactive works and software development.
6.	George Lewis	"Voyager"	1987 - 95	Key figure in interactive computer works.
7.	Courtney Pine	"Oneness of Mind"	1997	Use of turntable, key figure in hip-hop/jazz hybrid.
8.	*Interface*	"Scrb"	2000	Self made instruments and speaker systems, use of Max/MSP.
9.	Dave Douglas	"November"	2003	Incorporation of 'electronica' style elements in jazz, including vinyl, synthesised and sampled rhythm parts.

5.2.2 Applying Analytical Methodology

The analyses of improvised works are presented in Appendix B. In many of the analyses alternative forms of presentation are used to supplement the text-based descriptions. Given the prominence of standard pitch elements in many of the works (all except "Bye Bye Butterfly", "Voyager" and "Scrb"), traditional notation is utilised

where appropriate. Traditional notation can also effectively convey broad rhythmic parameters, however given that such notation quantizes rhythmic performance, supplementary text descriptions (in both the *rhythm* and *programmatic association* parameters) can provide a more thorough account of particular aspects of rhythmic 'feel'. For example, in Douglas' "November" both the tempo and rhythm suggest a slow (gestural) sway and this description is included in the *programmatic association* parameter supplementing quantized rhythmic values presented in the *pitch/horizontal structures and patterning* parameter.

Most of the works analysed are recordings of live performances, with the exception of "Bitches Brew", "Chameleon", "Oneness of Mind" and "November" where some degree of overdubbing and/or editing of performance has occurred in the production of the recording. The limitations of a desk-based (i.e., using the recording as analysis object) approach to analysis are discussed above in Chapter Three and include Butterfield's (2002) objection to the lack of context, or in the case of jazz performance, the 'carnival atmosphere' surrounding the event. Given that most of the works analysed were recorded live in a studio, not in front of an audience (except "Voyager" and "Scrb"), the 'carnival' is somewhat restricted to the happenings within the studio. In some cases these are well documented, for example, the performers John McLaughlin and Dave Holland (both cited in Carr, 1998) provide insight into the creative processes and events surrounding the recording of Davis' *Bitches Brew* (album). Their comments are included in the *shaping factors* section of the analysis. However such commentary is not the norm and the detailed examination of studio processes remains an area where ethnographic research is required.

The reliance on a recording for analysis also presents difficulties in the analysis of interaction. Firstly, the ability to identify sound source with a performer is crucial for any discussion of interpersonal/machine interaction. However, in the case of Chadabe's "Valentine", the situation is further complicated because the composer deliberately sought to obscure the differentiation between the computer and human performances. Secondly, in the case of ensemble interaction, visual cues can provide insight into levels of interaction that may not be apparent aurally. For example, the recording of "Bitches Brew" offers a tantalising glimpse of leader/ensemble interaction when Davis' voice is faintly heard giving instructions to the performers. Given these limitations, the descriptions in the *interaction* parameter remain somewhat conjectural.

It is possible to group the nine improvised works into two sub-groups: (a) works emerging from a 'jazz' tradition (including "Bitches Brew", "Chameleon", "Oneness of Mind", and "November"), and (b) works emerging from an 'art music' tradition (including "Bye Bye Butterfly", "On the Other Ocean", "Voyager", "Valentine" and "Scrb"). This division is made primarily on the basis of the stylistic history of the artist and is useful in the consideration of genre terrain.[9]

5.2.3 Ascertaining Compositional Methods / Mapping Genre Terrain

In terms of *shaping factors*, a somewhat diverse range impacts upon the creation of the improvised works analysed herein. At a *theoretical* level, one broad similarity between the composers/performers of the works is university or conservatorium study. Whilst

[9] I acknowledge the problematic nature of this division, particularly the blurring of such boundaries by, for example, George Lewis' involvement with many artists working in a 'jazz' tradition, and also Joel Chadabe's album of reworked 'standards' - *After Some Songs* (1987-94).

most citations in the literature of such study pass unremarkably, neither Davis nor Oliveros view such study as particularly instrumental in developing their own careers. Oliveros, for example, identifies the disjunction between her own creativity and the instruction occurring in academia:

> I had a struggle for years fending off the structures that were being brought forward by instructors in academia … they had no relationship to what I was hearing. I resisted following the instructors' models. Somehow or other, the listening inwardly created the space to go ahead and the courage to do what I felt was important to do (Oliveros, 1993, p. 377).

Davis echoes this disjunction, withdrawing from the Julliard School of Music as he was finding more value in playing with and listening to New York jazz artists such as Freddie Webster, Dizzy Gillespie and Charlie Parker (Carr, 1998).

The need for some degree of performer autonomy is prevalent amongst the composers/performers of the improvised works. Remarks to this effect are found in the *theory*, *play* and/or *practice* parameters of the analyses. The notion of a 'shared creation' is posited by Behrman (1997) as a contrast to the composer/performer division common to the European art music tradition.

> There's the model especially in the European tradition of the Creative Superperson (the Composer), and the lesser worker musician (the performer) which I've wanted to get away from. I like the idea of sharing in the creation of something and don't mind getting less than 100% of the credit for it. I like designing software

> which can be lifted off the ground, so to speak, by a wonderfully imaginative musician who does something with it that I never would have dreamed of… The tradition of 'unfinished composition' of course is not new. Much of Jazz and other musics primarily designed for live performance have a lot to do with that kind of idea. You could say that when the composition is unfinished, authority is being questioned (Behrman cited in Gross, 1997).

Chadabe suggests that he composes ‘activities’ rather than ‘pieces’:

> A 'piece', whatever its content, is a construction with a beginning and end that exists independent of its listeners and within its own boundaries of time. An 'activity' unfolds because of the way people perform; and consequently, an activity happens in the time of living; and art comes closer to life (n.d.).

The degree to which performer autonomy is embedded within each of the improvised works discussed herein varies and appears to correlate with the extent to which such autonomy is discussed by the artists themselves in the literature. For example, in “Voyager”, Lewis is explicitly interested in creating a non-hierarchical environment where the computer ‘performer’ displays a similar degree of autonomy to that of the human performer. On the other hand, in comments from Davis, from musicians playing with him, and from those influenced by him (e.g., Douglas), a picture emerges of an artist (‘creative superperson?’) whose whole ‘musical conception’ (Douglas, 2002) included the careful selection of side-people and musical materials alongside a “knack of pulling things out of musicians that they might not normally be aware of” (McLaughlin cited in Carr, 1998, p. 263-4). Thus although the performance of Davis’ ensemble was

experimental and improvised, there is a sense that Davis was in control over the direction of the sonic outcomes. This is at odds with both the non-hierarchical approach of Lewis and the clear delineation of roles outlined by Chadabe and Behrman above.

An interest in performance at a moment-to-moment level often runs parallel to an interest in the deliberate incorporation of a range of current and contemporary musical and extra-musical influences. Courtney Pine perhaps most explicitly outlines this in the liner notes to his *Underground* (1997) album:

> I truly believe that jazz music should reflect the social climate of the current times. It does this by being influenced by the past which enables the user (the musician) to see the future with a clear insight… I have been fortunate enough to have met enough people (and critics) around the world that have expressed their understanding of this mixture of the traditional (blues, bebop, soul, jazz, avant garde, etc.) and modern day musical communication (hip-hop, drum and bass, acid jazz, trip-hop, etc.) forms of music (Pine, 1997, liner notes).

Similarly, Davis, Hancock and Douglas all acknowledge the influence of particular current popular musical styles on their own work. Oliveros extends the field of influence to the whole range of musical styles (e.g., including country and western, Cajun, folk and Dixieland) and the panoply of environmental sounds heard via her own early field recording experiences (Scaruffi, 1993).

In addition to the above range of contemporary musical and extra-musical influences, many improvising musicians also explore the potential of new technologies. Amongst the works

analysed for this study, the rationale for, and nature of that exploration are quite disparate. Behrman and Lewis present a similar attitude towards the development of interactive computer works. For example, for Behrman, technology as such is amoral and dependent on the motivation of the user/developer (Behrman cited in Gross, 1997). Lewis (2000b) echoes this by linking broader social and cultural structures to software development:

> Musical computer programs, like any texts, are not 'objective' or 'universal', but instead represent the particular ideas of their creators. As notions about the nature and function of music become embedded into the structure of software-based musical systems and compositions, interactions with these systems tend to reveal characteristics of the community of thought and culture that produced them (p. 33).

Davis and Interface utilise technology to create a link between performance practice and their particular notion of live performance. For Davis, recording non-stop in the studio mirrored his live performance practice at the time of continuous sets (i.e., not breaking between tunes). Producer Teo Macero then edited the lengthy recordings into finished albums. For Interface, the focus on gesture for sound generation and their use of spherical speaker arrays (i.e., creating an 'inside-out' sound diffusion) constitutes "a new approach to electronic chamber music" (Bahn, Cook & Trueman, 2000, p. 1) that resonates with their own early experiences with acoustic instruments.

Contrary to most of the artists in the improvising genre, and connecting perhaps more strongly with rock and popular music practices, Douglas considers the potential for studio production to be one where a recording offers more than just a document of live performance: "In my records, I'm trying to make something special that can be enjoyed

and listened to in many different situations" (Douglas cited in Gitler, 2002, p. 12). Whilst not made explicit in the literature, this sentiment is also apparent in Hancock's "Chameleon" where numerous synthesiser and keyboard overdubs move the work away from merely a live performance document.

A link with popular music is also apparent in Pine's use of the turntable; an instrument linked with electronic dance music forms, particularly hip-hop. However the intervention of emerging 'copyright technology' (Théberge, 1997) led Pine to record his own samples, based on recorded excerpts that he was unable to secure permission to utilise. In this way, Pine's track complicates the notion of live performance/studio creation by creating a double layer of live performance that requires the studio for realisation whilst also being able to be performed live at a later date (after the initial samples have been made).

In terms of *inputs*, the works analysed here offer a wide range of variables within each parameter. While it is difficult to make generalisations as to particular inputs determining genre terrain, some patterns emerge vis-à-vis combinations of inputs. Other similarities emerge when considering the two sub-groups ('jazz' or 'art music' traditions – as discussed in 5.2.2) as separate entities. For example, in terms of *sound sources*, the works from a jazz tradition all feature drumkit, bass, piano (or keyboard) and/or guitar, trumpet and/or saxophone. A range of traditional and/or non-traditional instruments is used to augment this texture including: bass clarinet, electric and double basses and two drumkits ("Bitches Brew"); synthesisers ("Chameleon"); and, turntable and samples ("Oneness of Mind" and "November"). However, for the 'art music' works, the only generalisation that is applicable for *sound sources* is that western

orchestral instruments are used in combination with electronic/sampled/synthesised sounds, or in the case of "Bye Bye Butterfly", only synthesisers and samples.

In terms of *sound objects*, the improvised works contain the full spectrum from pitched instrument sounds to white noise. Some works contain a range of fairly homogenous sound objects (e.g., "On the Other Ocean" or "Valentine") whereas others present a veritable smorgasbord of timbres (e.g., "Scrb" and "Voyager"). In many of the works the individual *timbres,* once established, remain mostly static, although there are notable exceptions. These include the lead synthesiser solo in "Chameleon", the constant timbral shifts in the sound objects in "Scrb", and the frequent use of extended instrument techniques for trombone in "Voyager". In some cases effects are used to transform individual instrument sounds, for example via the use of delay on the trumpet in "Bitches Brew", 'wah wah' on keyboard parts in "Chameleon" or filtered drumkits on "Oneness of Mind" and "November". Oliveros was particularly interested in the timbral transformations present when multiple occurrences of the same sound were heard simultaneously via tape delay, an effect heard in "Bye Bye Butterfly".

Considering the parameters grouped under *rhythm* in the analysis template it is possible to make some connections between the individual works. Works with a regular pulse (i.e., "Bitches Brew", "Chameleon", "Oneness of Mind", "Valentine" and "November") are in 4/4 metre (with the exception of "Valentine" and sections of "Bitches Brew" and "Chameleon") and feature some degree of repetition and syncopation with riff-like parts for at least some of the instruments. These works also generally feature solos with some constant 1/8th or 1/16th note phrases and larger groupings in multiples of four bars. In terms of *structure*, these works also feature sectional forms over a harmonic progression

(i.e., *pitch – vertical patterning*) of fixed or open lengths. On the other hand, the works without a regular pulse or metre (i.e., "Bye Bye Butterfly", "On the Other Ocean", "Scrb" and "Voyager") contain irregular sound object durations, phrase lengths and, in terms of *structure,* are free.

Regarding pitch selection, a wide spectrum of choices is presented in the improvised works. This ranges from a limit of six pitches ("On the Other Ocean") through diatonic tonalities with some chromaticism ("Chameleon", "Oneness of Mind", "November" and "Valentine") to containing polytonal ("Bitches Brew") and microtonal ("Voyager") elements to works based on largely non-pitched elements ("Bye Bye Butterfly" and "Scrb"). There is a correlation between pitch selection and the attendant vertical structures whereby the tonal works feature more traditional chord structures and voicings (i.e., seventh chords featuring extensions and alterations common to jazz with bass playing root notes) and the works at the microtonal or non-pitched end of the spectrum that exhibit more random vertical structures. A similar correlation occurs in terms of the horizontal structures whereby motive development and the use of sequences can be more readily identified in the tonal works whereas the phrasing (or horizontal structures) in the non-tonal works such as "Voyager" and "Scrb" appears somewhat random. However, this correlation is inconsistent due to the random phrasing apparent at times in the two tonal computer interactive works ("On the Other Ocean" and "Valentine").

Interaction between sound sources and/or performers occurs on a range of levels and via a range of parameters. A solo and accompaniment model is common to the jazz tradition works ("Bitches Brew", "Chameleon", "Oneness of Mind" and "November"). However the degree to which the accompaniment instruments are 'locked' to particular

parts varies. For example, during the various instrument solos in “Bitches Brew” the electric pianos are very active and feature much variation, alternating between chords and single note lines throughout whilst the electric bass repeats a two bar figure with little variation. In “Oneness of Mind” and “November” the drumkit parts provide a fairly static bed on which the soloists improvise. In contrast to the solo/accompaniment model, collective improvisation involving all or some of the sound sources/performers is an aspect of most of the works and features most prominently in “Voyager” and “Scrb”.

Spatial elements contribute to the presence or absence of foreground/background relationships. In the solo/accompaniment model, the soloist is generally foregrounded via higher volume, whereas in the more collective, non-heirarchical models (e.g., “On the Other Ocean”, “Scrb”, “Valentine” and “Voyager”), most sounds are perceived to be a similar distance from the listener. The placement of sounds within the stereo field is crucial for isolating sound sources and hence an opportunity for the aural analysis of interaction. The blurring of sound origin, alongside timbral matching, is utilised deliberately by Chadabe to achieve the compositional aim of creating a “larger than life instrument” (Chadabe, 1997, p. 318) where the listener is made unsure as to the human and computer output.

The use of tension and release is common to most of the works and achieved collectively via joint shifts in *dynamics*, *texture* and rhythmic interplay. The B section of “Chameleon” provides an example where tension is built by all instruments avoiding a strong backbeat and increasing activity and dynamic before returning to a strong backbeat groove. In “Voyager”, low volume levels and thin textures often follow dynamic and textural peaks. Similar synchronisation of dynamic and textural peaks and

troughs occurs in “Scrb”. The principle of tension and release is utilised in a broader structural manner in “Bitches Brew” via the alternation between a somewhat rhythmically free section (i.e., introduction, bridge and coda) and regular pulse of the other section.

Rules for interaction are established in the interactive computer works and embed varying degrees of human control. Chadabe uses the software application M (which he developed), where basic MIDI information is recorded and then pitch, rhythm and timbre are manipulated by collections of algorithms accessed via graphic display by the user (Chadabe, 1997). The applications utilised by Behrman and Lewis operate in real-time without direct human control and are based on the computer ‘listening’ to the human performance and responding in certain ways. For example, the “Voyager” system, when multiple performers are present, decides which performer to listen to and whether to match, oppose or ignore various parameters (Lewis, 2000b). The development of such rules in some way represents a ‘top down’ process of creation. However, the sonic outcomes of such systems are determined by the performers and hence represent, simultaneously, a ‘bottom up’ approach. The traditional model of playing jazz standards, (i.e., the model used for many of the works considered here) where a soloist improvises over a set form, represents a similar merging of ‘top down’ and ‘bottom up’ processes.

A summary of the predominant shaping factors, inputs and processes for the improvised genre is given in Figure 5.4 with predominant elements highlighted.

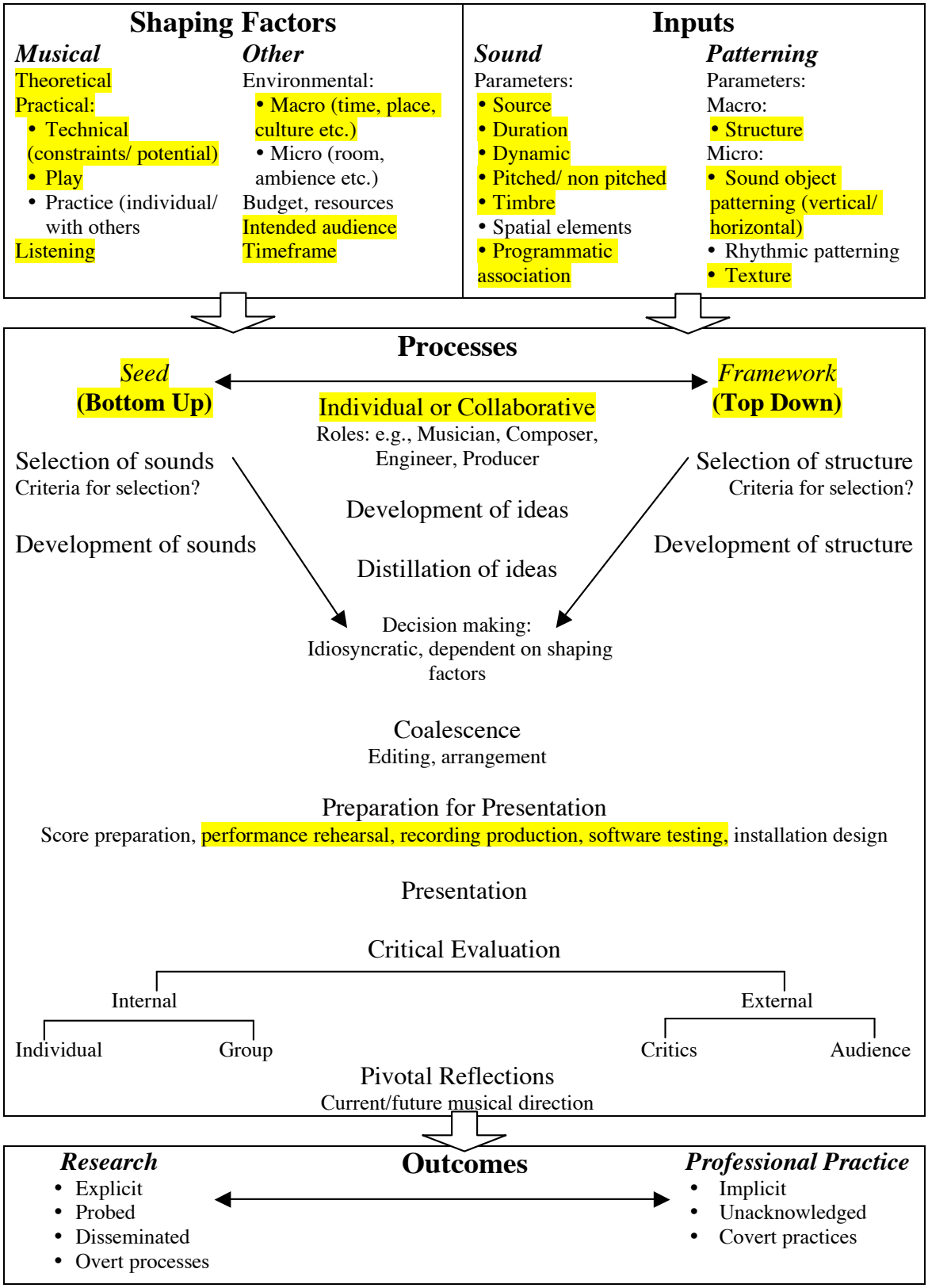


Figure 5.4. The creation of a musical work: Features of improvised works highlighted.

5.2.4 Applying Compositional Methods / Development of Improvised Study

Particular *resonances* observed in shaping the creation of the Improvised Study are listed in Table 5.5. The aspects of compositional methods, *elements of personal interest*, are identified in the second column of Table 5.6 below. The third column in Table 5.6 provides the detail of the study developed.

Table 5.5. *Resonances Observed Between Factors Shaping Selected Key Works and Factors Shaping the Creation of the Improvised Study*

Parameter			Resonances
Musical	**Theoretical**		• University music study (all).
	Practical	**Technical**	• Computer interactivity (Behrman, Chadabe, Lewis). • Use of computer as tool which effects creation process (Chadabe). • Belief in 'amorality' of technology (Behrman).
		Play	• Long history of live performance (all). • Interest in performer autonomy, i.e., breakdown of traditional composer/performer split (all).
		Practice	
	Listening		• Acknowledged range of influential music styles (Davis, Douglas, Hancock, Oliveros, Pine). • Interest in environmental sounds (Oliveros).
Other	**Environmental**	**Macro**	• Acknowledged desire to reflect current social/culture climate, particularly popular aspects (Davis, Hancock, Pine, Oliveros). • Interest in exploring experimental means (Lewis – AACM).
		Micro	• Live performance in studio setting (all except Lewis and Interface).
	Budget/ Resources		
	Intended Audience		
	Timeframe		• Initial recording of live performance in matter of day/s (all).

Table 5.6. *Elements of Personal Interest and Elements of Improvised Study*

Parameter		Elements of Interest	Elements of Study
Sound	**Sources**	• Traditional instruments (all). • Combination of acoustic instruments and electric/sampled sound sources (all). • Electric pianos (Davis, Hancock, Pine). • Computer generated samples/synthesis (Behrman, Chadabe, Interface and Lewis). • Turntable/vinyl sounds/samples (Douglas, Oliveros, Pine).	• Computer generated samples/synthesis, constructed in Reason and 'remixed' in Max/MSP. • Between one and three loops of original track heard.
	Objects	• Live instrument sounds (all). • Synthesised/sampled instrument sounds (Chadabe, Douglas, Hancock, Lewis, Pine). • Range of homogenous objects (Behrman, Chadabe). • Range of heterogeneous objects (Interface, Lewis). • Sustained wide bandwidth tone throughout (Oliveros). • Noise elements, including vinyl 'hiss' (Douglas, Oliveros, Pine).	• Synthesised/sampled instrument sounds including drumkit, acoustic bass, electric piano (Rhodes), acoustic guitar played at various speeds. • Range of homogenous 'meta-objects' created by use of up to three layers of same source.
	Object processing	• Delay (Davis, Oliveros). • Filtering (Douglas, Pine).	• Variable speed playback. • Delay.
Rhythm	**Pulse**	• Constant (Davis - mostly, Chadabe, Douglas, Hancock, Pine). • No pulse (or multiple, unmetrically related) (Behrman, Interface, Lewis, Oliveros).	• Mostly constant throughout with multiple pulse often. • Main loop 173 bpm (heard at 0'1'37" and 2'43 – 3'50"). • Middle loop 133 bpm (at 1'15 – 2'08")
	Metre	• 4/4 (Davis & Hancock – mostly, Pine, Douglas). • 5/8 (Chadabe). • Variations (Davis, Hancock). • Ametric (Berhman, Interface, Lewis, Oliveros).	• Main and middle loops 2/4.
	Patterning	• Repetitive, syncopated elements (Chadabe, Davis, Douglas, Hancock, Pine). • Constant 1/8th or 1/16th note phrases in solos (Chadabe, Davis, Douglas, Hancock, Pine). • Free (Behrman, Interface, Lewis, Oliveros).	• Repetition and syncopation in main groove. • Repetition of rhythms throughout, with variable speed creating isometric effect.
Pitch	**Selection**	• Limited pitch set (Behrman). • Tonal with some chromatic elements (Chadabe, Douglas, Hancock, Pine). • Polytonal elements (Davis). • Microtonal elements (Lewis). • Mostly non-pitched or indeterminate pitch (Interface, Oliveros).	• Tonal, polytonal and microtonal elements.
	Vertical structures	• Chord structures and voicings based on extensions and alterations of diatonic harmony as per jazz style (Davis, Douglas, Hancock, Pine). • Somewhat random vertical alignment of pitch elements (Interface, Lewis, Oliveros). • Range of intervals from semitone to octave utilised (all).	• Chord structures and voicings based on extensions of diatonic harmony as per jazz style. However multiple loops heard simultaneously and therefore actual vertical alignment of pitched events somewhat random. • Three modes of vertical alignment heard in study and result from various playback speed formula: '(a) matching' - where computer generated playback speed (*cps*) is a factor or multiple of player playback speed (*pps*)(i.e., 0.25, 0.34, 0.5, 0.67, 0.75, 1, 1.5, 2, 3 or 4 times player speed); (b) 'opposing' – where *cps* is determined by following (if *pps* < 2, *pps* + *cps* = 2, or if *pps* >2, *pps* + *cps* = 500); or (c) 'ignoring' – where

			cps changes at regular intervals by semi-random amount (using Max drunk object). • Intervals vary according to playback speed. At normal speed (i.e., speed of main loop) mostly stepwise or third intervals with some larger intervals up to and including a perfect fifth.
	Vertical patterning	• Static harmony or pedal point (Behrman, Davis). • Repeating chord progression (Chadabe, Douglas, Hancock, Pine). • Random (Lewis). • Nil (Interface, Oliveros).	• One layer provides static harmony for most of work. Main riff - contrapuntal elements outline Eb Minor 7 (dorian) tonality. Middle riff (at 1'15" – 2'08") – pitches include C – Eb – G (electric piano) and Gb – Db (guitar). • Somewhat random patterning from other layers and presents polytonal/microtonal elements at times. (Three playback speed modes – see above - determine actual combinations).
	Horizontal structures and patterning	• Motive development, use of sequences, diminution, augmentation etc., (Behrman, Chadabe, Davis, Douglas, Hancock, Lewis, Pine). • Apparent random elements (Behrman, Chadabe, Interface, Lewis).	• Repetition of elements throughout with isorhythmic shifts due to changes in playback speed. • Main 'loop feature repeating Ab – Gb - Eb descending figure. • Middle riff features repeats Eb – C (descending) – G (ascending).
	Dynamics	• Shifts due to texture (all). • Fairly constant throughout (Behrman, Chadabe). • Peaks and troughs creating tension and release (Davis, Hancock, Interface, Lewis, Pine).	• Shifts due to texture and performance. • Decrescendo on main loop from 1'20" – 1'37", fade to silence. • Some fades on other layers.
	Texture	• Instrumentation includes: drumkit, bass, guitar/keyboard, sax/trumpet (Davis, Douglas, Hancock, Pine). • Homogenous (Behrman, Chadabe) • Thick diverse, heterogenous (Davis, Interface, Lewis). • Major shifts marking sections or start/end of solos (Davis, Douglas, Hancock, Pine).	• Varies between 1 – 3 homogenous 'meta-layers'. Each meta-layer includes drumkit, bass, electric piano and acoustic guitar samples. (See form diagram below, Fig. 5.5).
	Timbre	• Mostly static timbres throughout (Behrman, Chadabe, Davis). • Foregrounding of timbral transformation (Hancock, Interface, Lewis, Oliveros). • Use of extended instrument techniques (Interface, Lewis).	• Mostly static timbres throughout with changes due to variations in playback speed.
	Spatial elements	• Placement of sounds in stereo field (all). • Blurring of source of multiple timbrally similar sounds (Chadabe). • Lack of foreground/background relationships (Behrman, Interface, Lewis, Oliveros). • Foregrounding soloists in solo/accompaniment texture (Davis, Douglas, Hancock, Pine).	• Sounds mostly centred with some spread (via reverb) across stereo field. • Delayed sound heard at far left and right. • Lack of clear foreground/background relationships with consistent elements (i.e., main and middle loops) mostly at same volume as other elements. Exception to this at beginning (0 – 40") where main loop is perceived as foreground.
	Programmatic Association	• Movement from centered to dispersed achieved by range of parameters including spatialisation, instrument roles, melodic/harmonic aspects, structure and effects (Davis). • Use of vinyl hiss adding 'warmth' to track (Douglas, Oliveros, Pine). • Random, 'non-human' feel at times (Behrman, Chadabe, Interface Lewis).	• Juxtaposition of constant and varying elements (echoing centred/dispersed movement of Davis) created by maintaining one layer (main loop or middle loop) for most of work. • Random nature of changes in playback speed combined with 'skipping' feel of loops create non-human feel. • Repetitive and syncopated aspects

		• Repetitive, syncopated rhythmic aspects providing somatic/dance aspect (Davis, Douglas, Hancock, Pine).	provide somatic/dance aspect albeit at very fast tempo and with somewhat 'unhuman' feel.
	Structure	• Sectional with solo/accompaniment sections (Chadabe, Davis, Douglas, Hancock, Pine). • Free (Behrman, Interface, Lewis, Oliveros).	• Sectional: ABA Coda, with sections determined by presence of main (A) or middle (B) loops. Coda without main/middle loop. See form diagram below. • Length of sections freely determined during performance. • Main and middle loops not precomposed or predetermined, resulting instead from chance placement of start and end points on sample.
	Interaction	• Solo/accompaniment sections with some accompaniment parts 'locked' (Davis, Hancock, Pine, Douglas). • Collective improvisation sections between two or more sources (all). • Blurring of role between soloist/accompanist (Behrman, Chadabe, Davis, Lewis, Oliveros). • Non-hierarchical environment (Behrman, Lewis). • On timbral and textural levels (Interface, Lewis). • Computer interaction (Behrman, Chadabe, Lewis). • Computer interaction based on rules – match, oppose or ignore (Lewis). • Importance of gestural component (Interface). • Tension and release principle achieved via variety of parameters, e.g. pitch, dynamics, rhythm, texture, and/or structure (all).	• Computer interaction system developed in Max/MSP. Multiple sample (one to four) playback with computer controlling playback speed of two samples. Rules based on 'match', 'oppose' or ''ignore' principles (Lewis). However player controls other parameters of computer playback (e.g., interaction mode, sample selection, volume and loop start and end point selection). • Level and nature of interaction varies between sections. See form diagram (Fig. 5.5) for graphic representation. • 'Matching' and 'ignoring' modes of interactive system utilised. • 'Locking' of some parts (e.g., main and middle loops). • Tension and release achieved by: removal and return of main loop; alternating between 'matching' and 'ignoring' modes of computer (e.g., 2'58" – 4'22").
	Score	• Nil.	
	Presentational Format	• Compact disc.	

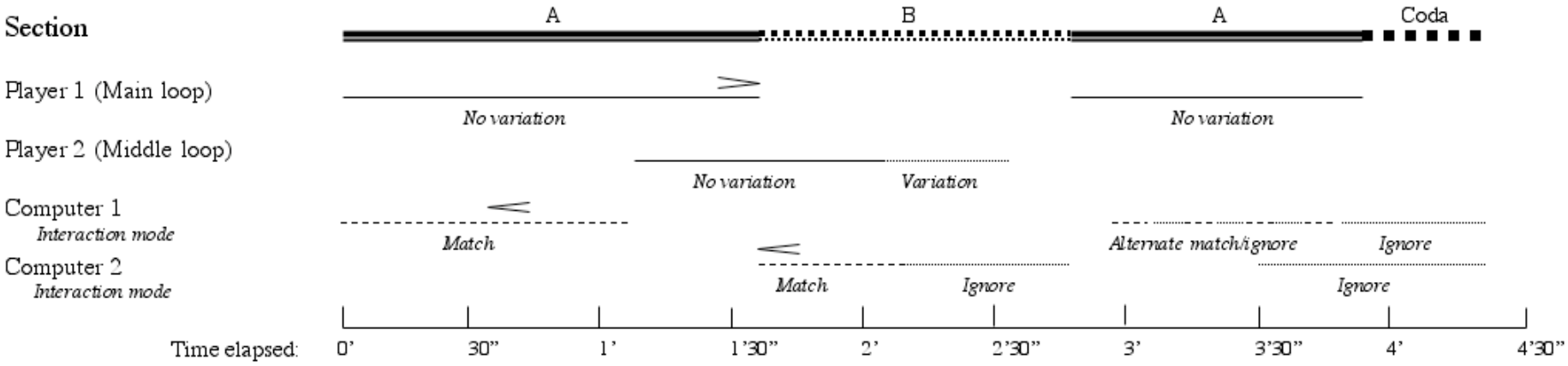


Figure 5.5. Improvised Study: form diagram.

In terms of *shaping factors*, particular resonances observed in the creation of the study include *theoretical, technical, practical, environmental* and *listening* elements, these listed in Table 5.5 above. Of the elements listed, the most pertinent are *technical* aspects, particularly an interest in computer interactivity, and *listening* and *environmental* aspects, including an interest in a range of musical styles and live performance. On a *micro environmental* level, the Improvised Study was realised as a live performance in a studio setting, a process common to most of the improvised works discussed herein. In terms of the practical element, *play*, my interest in creating works that involve some degree of performer autonomy reflects the concerns elaborated by Behrman and Chadabe in section 5.2.3 above.

In terms of *inputs* for the study, many of the *elements of interest* (listed in the second column of Table 5.6) were incorporated into the study (listed in the third column of Table 5.6). This extends to the incorporation of somewhat disparate elements of interest within individual parameters. For example, the *sound source* utilised for the study is a draft of an instrumental work for drumkit, electric piano, double bass and guitar that was realised using samples within the Reason software application. For the study, multiple short sections of this work are sampled and played at various speeds. Thus, in some way, all of the sound sources listed as elements of interest in Table 5.6 are incorporated into the study. Samples of traditional instruments, including electric piano, are replayed in the study in a manner echoing the use of a turntable as source in both Oliveros' "Bye Bye Butterfly" and Pine's "Oneness of Mind". Furthermore, as in the Pine example, samples of my own performance are used as a sound source.

Other examples of the incorporation of disparate elements of interest into the study include elements of *rhythm* and *pitch*. In terms of rhythm, for the works analysed, two categories can be established; (a) works with a constant pulse and (b) works without or with multiple or unmetrically related pulse. For the study both categories are explored by foregrounding a constant pulse in some sections and overlaying irregular/unmetrically related fragments at other times. In terms of pitch, tonal, polytonal and microtonal elements are apparent due to the variable speed playback of a tonal work. However, the focus of the study is the development of the interactive system in Max/MSP and therefore the rhythmic and pitch elements apparent in the study represent a secondary outcome, not the primary compositional endeavour. This reflects the focus of Chadabe (n.d.) towards composition as the development of *activities* as opposed to *pieces* discussed in 5.2.3.

In terms of *interaction*, I was particularly interested in the interactive computer systems developed by Behrman, Chadabe and Lewis. An integral component of all of these systems is analysis and computer performance on a note-to-note level, and the incorporation of some traditional pitch elements. However, given my ongoing interest in utilising field recordings and sound fragments above and/or below note level in terms of timescale (see section 2.4), the study incorporates computer interactivity at a conceptual level, not a note-to-note level. Instead, the study is an attempt to incorporate computer interaction within a system of multiple sample playback modules in an improvised performance context.

5.2.5 Realisation of Improvised Study

The performance system developed in Max/MSP for the Improvised Study extends from my previous work with field recordings (Hill, 2003) where various parameters such as start and end points of loop, playback speed and spatialisation of various sound fragments, between approximately three and thirty seconds in length, were manipulated in real time. The Max/MSP abstractions utilised in Hill (2003) were further developed for performances throughout 2004 and 2005 with the interactive aspects constituting the new component developed for the Improvised Study. For the study I sought to explore the computer automation of playback speed in terms of the rules of interaction utilised by Lewis in "Voyager", i.e., the three modes, matching, opposing or ignoring. However, whilst the system developed for the Improvised Study could be utilised in a 'non-hierarchical' (Lewis, 2000a) manner, my own exploration of the system involved some degree of control of the computer's output. This included at a basic level, sound source selection and volume control. Figures 5.6 and 5.7 present the basic audio and interactive control flow charts for the abstractions developed in Max/MSP, with key objects indicated where appropriate (see Appendix C for the complete Max/MSP patches).

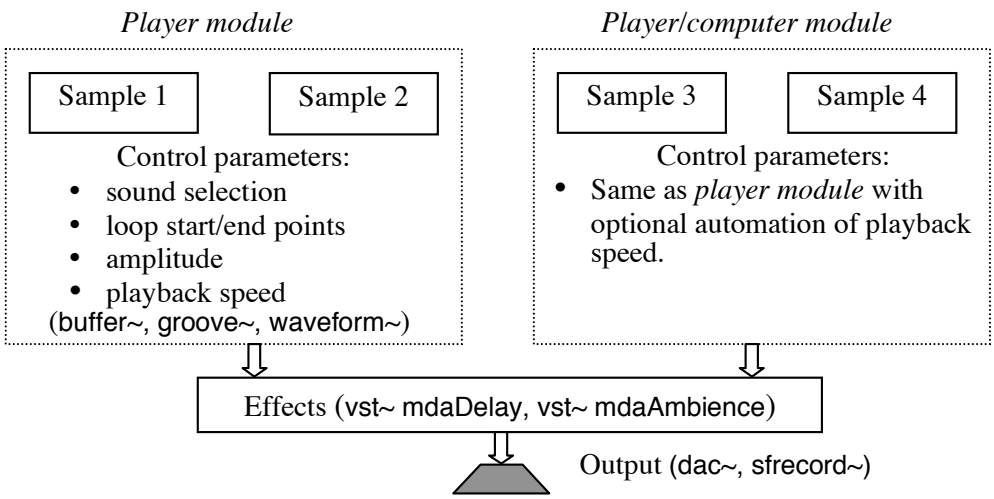


Figure 5.6. Improvised Study: Basic audio and control flow chart.

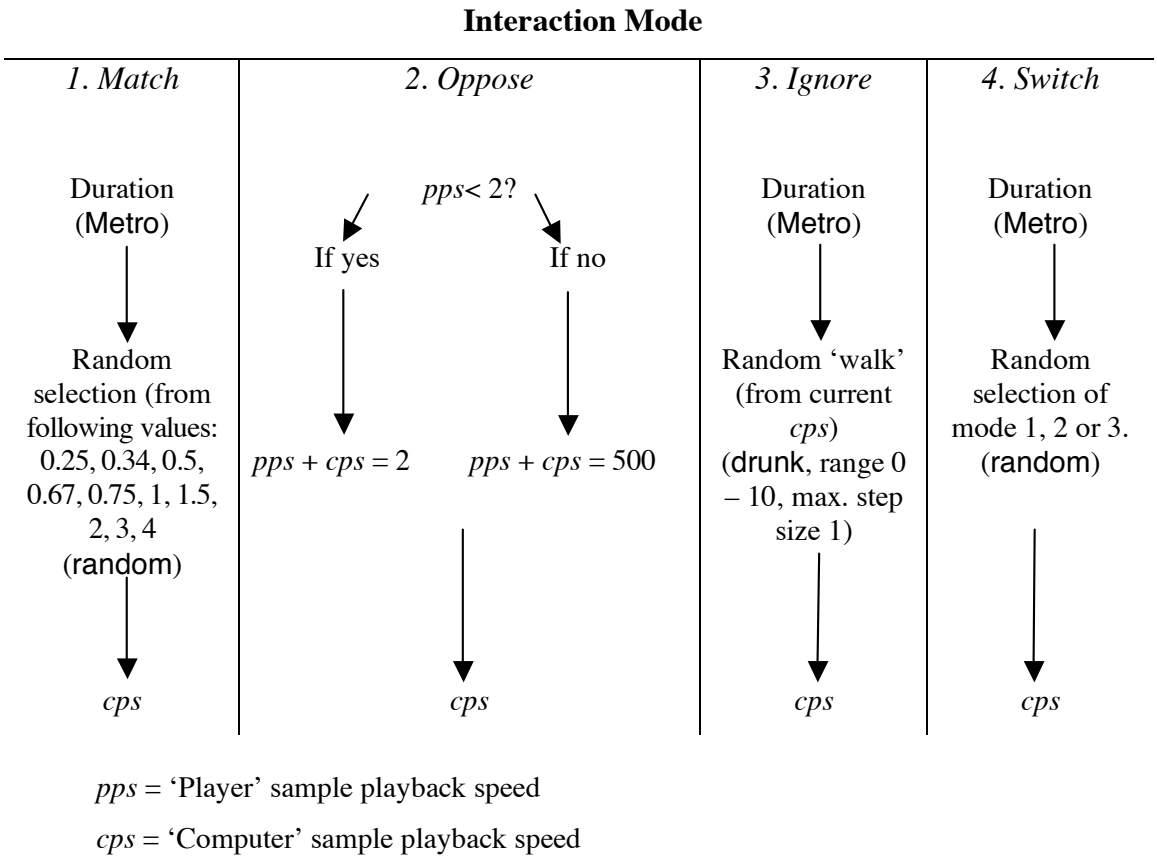


Figure 5.7. Improvised Study: Interaction mode flow chart.

Given that the system developed was an extension of my earlier work, minimal system testing was required. However, once operational, a lengthy play process was undertaken where a range of sound sources, interaction modes and performance techniques were explored. Numerous performances were recorded and reviewed, most featuring the utilisation of only one interaction mode. Through this initial process of minimisation where, for example, only the matching or opposing modes of interaction were utilised, a more thorough exploration of the various modes and potential sonic outcomes was possible. Having established some fruitful performance avenues, further reflection on the various compositional methods identified through the analysis of the selected key

works was conducted before completing the study. The Improvised Study was selected from numerous performances conducted in a home studio environment, monitoring with headphones and utilising the computer mouse, trackpad and computer keyboard for control. The study was recorded directly within Max/MSP and transferred to Pro Tools for normalisation with no further editing or effects added.

CHAPTER SIX

ANALYSIS OF COMPOSITIONAL METHODS IN SELECTED POPULAR MUSIC GENRES

6.1 Rock Works

6.1.1 Identifying Key Works

The selected key works analysed in the rock genre are listed in Table 6.1.

Table 6.1. *Selected Key Works in Rock Genre*

	Artist	**Work**	**Year**	**Key Aspect(s)**
1.	Beatles	"Tomorrow Never Knows"	1966	Production techniques, use of multitracking and *musique concrète*.
2.	Jimi Hendrix	"All Along the Watchtower"	1968	Use of guitar effects, studio multitracking.
3.	Stevie Wonder	"Isn't She Lovely"	1976	Key figure in use of commercial synthesisers.
4.	David Bowie	"Heroes"	1977	Eno involvement, key figure in rock production.
5.	New Order	"Blue Monday"	1983	Use of drum machines/synthesisers, EDM crossover.
6.	Prince	"Sign 'o the Times"	1987	Key figure in solo production, use of commercial drum machines and synthesisers.
7.	U2	"Zoo Station"	1991	Use of new technologies but reaction against pristine production.
8.	Radiohead	"Everything in its Right Place"	2000	Vocal manipulation, use of Max/MSP.
9.	Björk	"Desired Constellation"	2004	Incorporation of 'glitch' style in pop/rock, all source vocal origin.

6.1.2 Applying Analytical Methodology

The analyses of the rock works are presented in Appendix B. In many of the analyses alternative forms of presentation are used to supplement the text-based descriptions of the various parameters. Given the relative abundance of standard pitch and rhythmic elements, traditional notation is utilised where appropriate, for example in the *pitch* and

rhythm parameters. Texture and form can be succinctly presented in graphic form diagrams and these have been included in two of the works, "Tomorrow Never Knows" and "Blue Monday".

Whilst the field of 'popular music musicology' has grown substantially over the last two decades, only two of the works listed here have been the subject of academic research ("Tomorrow Never Knows" as part of the Beatles' *Revolver* – see Reising, 2002, and "Zoo Station", Fast, 2000). Other works of some of the artists listed here have been examined including Prince (e.g., Danielsen, 1997; Hawkins, 2000, 2002) Björk (e.g., Dibben, in press), Radiohead (Hubbs, 2000) and Hendrix (Brown, 1997). Such research offers contextual and comparative opportunity and where appropriate these have been included in the *shaping factors* section of the analyses. The bulk of the extant literature related to the selected key works is aimed at the general public and/or fans of the artist and includes a large amount of biographical, interview or review material. The combination of these factors (i.e., lack of specific academic research and predominance of popular journalistic material) is reflected in an abundance of information in the *shaping factors* section and little in the *literature* column of the *inputs* section of the analyses.

The collaborative processes involved in the creation of many of the rock works highlight a particular shortcoming of a desk-based analytical methodology: the reliance on documentation of studio processes by those involved in order to fully examine such processes. Such documentation is rare and, where existing, usually offers only one participant's perspective. In order to counter this deficiency, the majority of the works

selected were the subject of at least some literature dealing with studio processes and/or the nature of collaboration.

6.1.3 Ascertaining Compositional Methods / Mapping Genre Terrain

In terms of shaping factors, a key similarity amongst all of the rock works is extensive utilisation of major studios for production. This is evident in the *technical* and *timeframe* parameters and requisite of substantial *budget/resources*. The Beatles' "Tomorrow Never Knows" was recorded at EMI Studios in London on a four-track recorder (Lewisohn, 2002). 12-track recording was at the time only available in the USA and Hendrix's *Electric Ladyland* (1967) represents one of the first recordings made at the (then) state of the art Record Plant Studios (New York) (Hendrix, 1997b). In contrast to the one or two studio production, Björk's *Medúlla* (2004) was recorded at eighteen different studios around the world, reflecting not only her interest in international travel and collaboration, but also a contemporary portability and compatibility of recording equipment. The correlation between *timeframe* and *resources* is perhaps most apparent in Wonder's *Songs in the Key of Life* (1976), the album on which "Isn't She Lovely" appears. Wonder negotiated a $13 million dollar deal with Motown Records prior to spending two and a half years producing the album at studios in Los Angeles and New York (Wonder, 1997).

In all of the works analysed, the factor of *play* is prominent on two levels. Firstly, each of the artists was an established and active performer, either solo or as a band. Whilst difficult to measure the impact of live performance experience on the creation of new works, it is nonetheless a common factor. Secondly, having the resources to afford

lengthy studio sessions enabled bottom up processes to be explored, enabling the studio to become the site of creativity, in addition to a site for capturing sounds. For example this is evident in the *musique concrète* techniques used by the Beatles in "Tomorrow Never Knows" (McDonald & Kaufman 2002) and in the rhythm section 'jamming' that provided the bed for many of the tracks on David Bowie's *Heroes* album (Buskin, 2004).

With the possible exception of Prince, all of the works analysed were the result of collaboration between at least two people. However, as mentioned above, the documentation of collaborative processes involved in the creation of these works is far from comprehensive and thus difficult to assess. Suffice to say, the recordings are the product of the work of many, in a *micro-environment*, that included band members, session musicians, engineers, producers and, in some cases, additional 'hangers-on'. From the available literature a range of processes emerge; from the more 'dictatorial' (e.g., Prince) to the 'committee' (e.g., Bowie). As producer/engineer Tony Visconti recalls from the recording of "Heroes": "Between Bowie, Visconti, Eno and [guitarist] Fripp, everything was done by committee, with each person throwing in suggestions that might contribute to the final product" (Visconti cited in Buskin, 2004, p. 139).

At the inputs level, a core set of *sound sources* is common to all of the works with the exception of Björk's vocal only "Desired Constellation". A common *texture* is vocals, drumkit (acoustic and/or electronic), guitar and/or keyboards. Bass guitar or bass keyboard is utilised on all works except Radiohead's "Everything in its Right Place" and "Desired Constellation". Synthesisers are utilised on most of the works except "Tomorrow Never Knows" and "All Along the Watchtower". A range of additional

sources is utilised including tamboura and tape loops ("Tomorrow Never Knows"), harmonica ("Isn't She Lovely") and percussion (most).

Elements of *pitch* and *rhythm*, whilst prominent for all works, do not adhere to 'lattice'-based constructions (Wishart, 1996) due to a combination of expressive vocal and instrumental performance, unique timbres, distortion, and particular rhythmic 'feel' (i.e., varied placement of note in front of or behind the beat in performance). As such, the use of traditional notation for transcription or presentation can only act as a guide for listening or analysis, not a score for performance, reflecting the predominantly aural tradition of the rock genre. However the analysis of pitch elements does afford points of comparison both within the genre and in a wider context. All the works feature *pitch selection* derived largely from the major scale: Ionian ("Isn't She Lovely"), Aeolian ("All Along the Watchtower", "Desired Constellation"), Dorian ("Blue Monday", "Sign 'o the Times"), Mixolydian ("Tomorrow Never Knows", "Heroes", "Zoo Station") and Phrygian ("Everything in its Right Place") modes. The use of pentatonic or blues scales is common for melodic and fill elements. The bass usually plays the root of the chord and vocal melodies are mostly stepwise or third interval movement. Whilst some of the works feature triads in closed voicings (e.g., "Tomorrow Never Knows", "All Along the Watchtower"), extensions (e.g. 9th, 11th, 13th), wider voicings and secondary dominant chords do appear (e.g., "Isn't She Lovely", "Everything in its Right Place", "Desired Constellation").

Repetitive *rhythmic patterning* is common to all the works with one and two bar patterns predominant. Most works feature generally constant tempos ranging between 99 ("Sign 'o the Times") and 165 bpm ("Desired Constellation" first section), with the majority of works ranging between 110 – 125 bpm. Most works are in 4/4 metre with

the exception of “Isn’t She Lovely” (12/8), “Everything in its Right Place” (10/4), and “Desired Constellation” (3/4 and 4/4). Strong, regular backbeat accents are featured on all works with the exception of “Everything in its Right Place” and “Desired Constellation” and syncopation between all parts is common.

In terms of *structure*, a sectional (i.e., verse/chorus/bridge etc.) or strophic form is common. Most of the works feature sections of eight or sixteen bars in length with some variations to this formula. For example, the ‘bridge’ of “Tomorrow Never Knows” (i.e., B section in analysis in Appendix B) is sixteen bars in length with tape elements prominent for six bars and guitar solo for ten. New Order’s “Blue Monday”, whilst mostly structured in multiples of eight-bar units, features occasional two or four-bar breaks. A more notable exception is Björk’s “Desired Constellation”, which has sections of 18, 25, 24, 18, 10, 24 and 30 bars in length. This track contains the least explicit rhythmic elements with the somewhat free vocal phrases determining the length of sections.

Recording and mixing processes create a range of *timbral* and *spatial* elements that form an integral part of the genre terrain. The use of effects (i.e., *object processing*) such as reverb, delay, compression, equalization and distortion are commonplace with highly processed sounds often foregrounded in the mix. Examples include the vocal treatments in “Tomorrow Never Knows”, “Blue Monday”, “Zoo Station”, “Everything in its Right Place” and “Desired Constellation”, the sustaining distorted guitar in “Heroes” and the filtered keyboard at the end of “Everything in its Right Place”. Synthesised drum, bass, electric piano/keyboard and string timbres are predominant in many of the works, most notably in “Isn’t She Lovely”, “Blue Monday”, “Sign ‘o the Times” and “Everything in its Right Place”.

Multitrack recording enables the creation of 'unreal' acoustic spaces in relation to the relative volume and placement of sounds in a stereo field or 'sound box' (Moore, 1993). Such *spatial elements* provide an important creative dimension for all of the rock works. A subtle example is the relatively high volume level of percussion in "Tomorrow Never Knows", "Isn't She Lovely" and "Sign 'o the Times" (tambourine) and "All Along the Watchtower" (vibra slap). More obvious is the dynamic panning utilised on many of the works including "Tomorrow Never Knows", "All Along the Watchtower" and "Blue Monday". A common placement for kick and snare drums in most tracks is the centre. An exception is Hendrix's "All Along the Watchtower" where the placement of drums and percussion is at the far left and right of the stereo field, creating an immersive effect for the listener.

Spatial elements contribute to the construction of meaning or *programmatic association*. The perceived closeness of Björk's voice in "Desired Constellation" or Thom Yorke in "Everything in its Right Place" creates an intimacy that is reinforced by the minimal texture in both these works.[10] In "Heroes" David Bowie's voice moves from close to distant throughout the track. Producer and engineer Tony Visconti recalls how this was the result of a deliberate placement of three microphones at increasing distances from Bowie with gates used to open and close the microphones depending on the volume of the voice (Visconti cited in Buskin, 2006). The movement from intimate to distant provides another dimension to the expressive delivery and content of the lyric that moves from a mellow confidence to an anguished cry.

[10] For detailed discussion of intimacy and self-expression in Björk's earlier work see Dibben, in press.

Lyric content and delivery style are important contributors to the perception of *programmatic association* in rock works. With the possible exception of "Isn't She Lovely", the lyrics for each of the works analysed here are complex and open to a range of subjective interpretations. Reviewers, fans and researchers link possible lyric meanings to other musical and extramusical attributes creating various levels of response.

Reviews in the popular press and historical overviews generally offer a cursory assessment of meaning whereas academic research focusing on one or two tracks has the scope to provide a detailed response. In order to compare and contrast a range of literature the analyses included herein include material from both sources. However a thorough analysis of the lyrics is beyond the scope of this research and the focus of the comments included in the *programmatic association* parameter is largely on the relationships between lyric and technology. For example, the following cursory assessment of Hendrix's *Electric Ladyland* album is offered by Prendergast (2000) in his historical overview of ambient music: "Each side of the album summoned up a different mood – its first the blues, its last [including "All Along the Watchtower"] incendiary protest" (Prendergast, 2000, p. 203). This contrasts Fast's (2000) detailed analysis of U2's "Zoo Station" including the lyric which "explores the possibility of personal transformation through decadent means … willingness to take risks, to gamble … throw caution to the wind" (p. 46).

A summary of the predominant *shaping factors, inputs* and *processes* (as highlighted) for the rock genre is given in Figure 6.1.

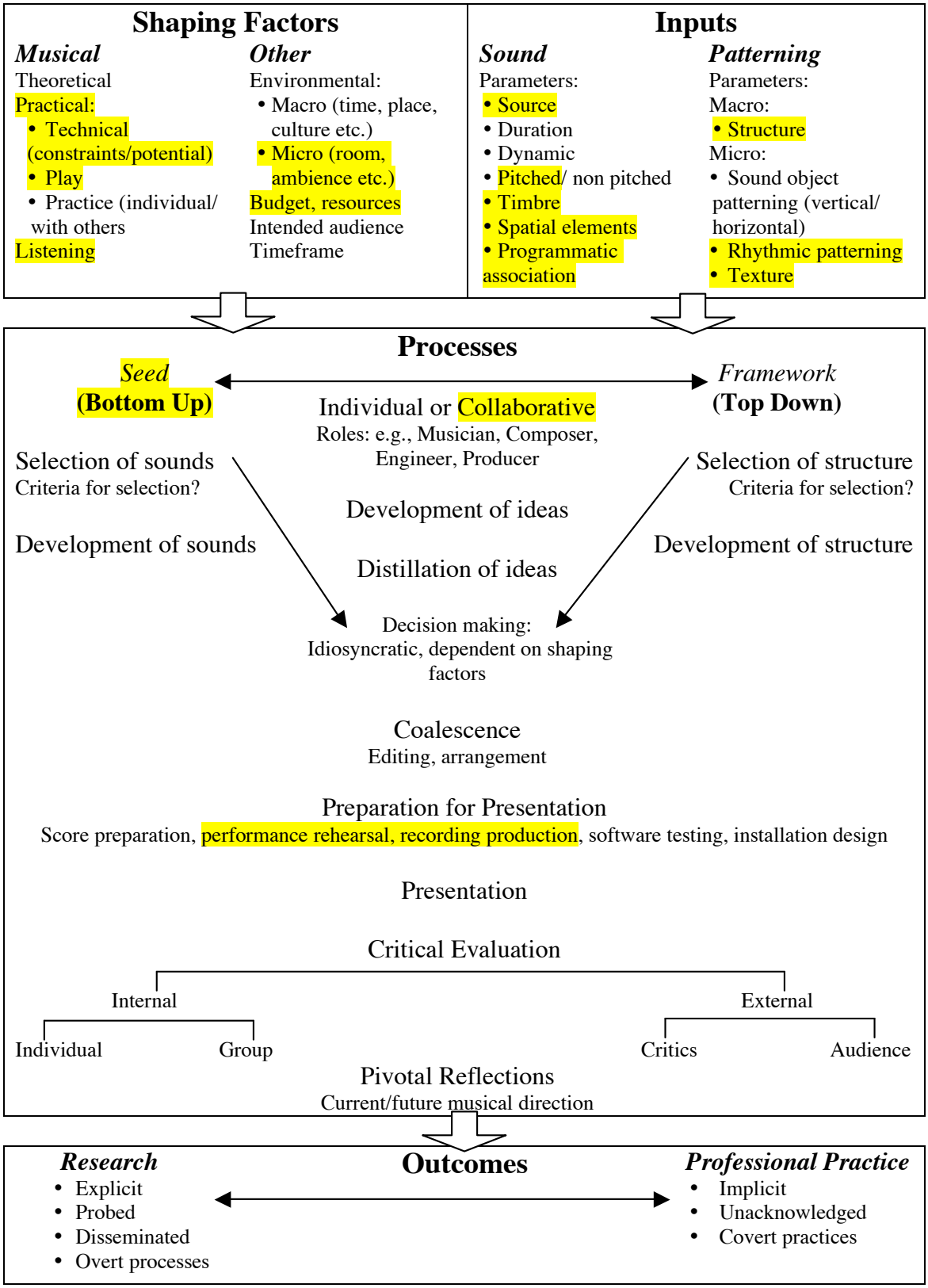


Figure 6.1. The creation of a musical work: Features of rock works highlighted.

6.1.4 Applying Compositional Methods / Development of Rock Study

Particular *resonances* observed in shaping the creation of the Rock Study are listed in Table 6.2. The aspects of compositional methods, *elements of personal interest*, are identified in the second column of Table 6.2 below. The third column in Table 6.2 provides the detail of the study developed.

Table 6.2. *Resonances Observed Between Factors Shaping Selected Key Works and Factors Shaping the Creation of the Rock Study*

Parameter			Resonances
Musical	**Theoretical**		• No explicit music theory driving compositional process (all).
	Practical	**Technical**	• Studio used as creative site, i.e., song not completely written/prepared prior to recording (all). • Majority of production work involved editing of performances (Björk).
		Play	• Experimentation with sample loops (Beatles). • History of performance and recording (all). • Jamming to specified chord changes to build bed track (Bowie).
		Practice	• History of performance and recording prior to making track (all).
	Listening		• Initially learnt guitar via aural means (Hendrix).
Other	**Environmental**	**Macro**	
		Micro	• Recording in part on portable computer in variety of settings (Björk).
	Budget/ Resources		• Extensive access to studio and recording facilities (all).
	Intended Audience		
	Timeframe		• Lengthy process from creation of original bed track to completion of overdubs and mixing (Beatles, Björk, Bowie, Radiohead).

Table 6.3. *Elements of Personal Interest and Elements of Rock Study*

Parameter		Elements of Interest	Elements of Study
Sound	**Sources**	• 'Standard' instrumentation, i.e., vocals, drumkit, guitar/keyboard, bass/keyboard (all except Björk, Radiohead). • Synthesisers (Bowie, New Order, Prince, Radiohead, U2, Wonder). • Electronic drums (New Order, Prince, Radiohead). • Manipulated samples (Beatles, Björk Radiohead). • Acoustic percussion, standard (Beatles, Hendrix, Prince, Wonder) and found objects (Bowie, U2).	• Instrument: Drumkit, bass guitar, guitar, synthesised electric piano (Wurlitzer and Rhodes), alto saxophone, glockenspiel. • Software instruments: Sampled hi hat, synth pads. • Live and sampled vocals.
	Objects	• Processed and unprocessed acoustic/electric instrument and vocal sounds (all). • Synthesised drum and percussion sounds (New Order, Prince, Radiohead). • Synthesised keyboard sounds (New Order, Prince, Radiohead, U2, Wonder).	• Processed and unprocessed acoustic/electric instrument sounds. • Sampled spoken word fragments, male and female voices. • Processed female vocal. • Sampled hi-hat sounds • Synthesised electric piano sounds. • Synth pads include: at 3" - layered noise, bell and slightly detuned resonance moving through different pitch centres; at 36", 1'00" etc., 10 second duration, slow attack, resonant harmonic pad with some noise elements; at 1'29" resonant harmonic pad with slow attack and high pitched, fast attack 'chiming' elements.
	Object processing	• Reverb (including minimal use e.g. Radiohead, and varied e.g. Bowie vocals). • Filtering (e.g. Beatles, Björk, U2, vocals). • Range of guitar effects including distortion, wah wah, chorus etc. (Bowie, Hendrix, U2). • FM/granular synthesis (?) used to produce bed of "Desired Constellation" (Björk).	• Reverb on all instruments (D-verb 'medium room 2' preset). • Compression on all parts. Heavily present on drumkit and vocal; moderately on saxophone and bass parts. • Range of effects used on vocal: e.g., filtering in verse (12dB cut below 440Hz, 12dB cut above 10.5KHz, 12dB boost at 1KHz); 337ms delay on chorus and outro. Simulation of ADT (automatic double tracking) achieved by duplicating vocal track and shifting 20 – 40ms. • Low and high cut filter on sampled (spoken) vocals (12db below 80Hz and 12dB above 12KHz) with 3.5 dB boost at 280Hz. • 486ms delay on Wurlitzer in chorus.
Rhythm	**Pulse**	• Mostly constant tempo (all except Björk).	• Constant, 80bpm.
	Metre	• 4/4 (all except Björk, Radiohead and Wonder) • 12/8 (Wonder) • 10/4 (Radiohead) • 3/4 and 4/4 (Björk)	• 4/4.
	Patterning	• Repeating one, two or four-bar patterns (all). • Syncopation between all parts (all). • Mostly 8 or 16-bar sections (all except Björk). • Reinforced back beat, e.g. snare and handclap (Wonder).	• Repeating one, four and eight-bar patterns (see Figure 6.2 for transcription). • 5 x 16-bar sections followed by 36-bar coda. • Backbeat snare accent throughout. • Syncopated elements including: Electric piano (Rhodes) accents 1/8th note anticipation of beat one each bar; glockenspiel playing mostly upbeats; guitar 1/16th note.

Pitch	**Selection**	• Tonal, Mostly major scale harmony (all). • Use of Phrygian mode (Radiohead). • Pentatonic scale predominant for vocal melodies (Wonder). • Blues scale predominant for guitar parts (Beatles, Hendrix, Prince).	• Mostly tonal, with polytonal and microtonal elements. E.g., introductory synth pad contains microtonal elements, saxophone parts outline G minor against G mixolydian mode on first chord of progression. Chord progression lacks tonal centre – a succession of dominant chords moving in parallel.
	Vertical structures	• Bass plays 1 and/or – 5 –8 patterns (all except Björk). • Vocal stepwise or small intervals (all). • Guitar diads, fourth intervals. • Wider voicings (than close voice triads) for keyboard parts (Wonder, Bowie, Prince, Radiohead). • Use of extended chords and/or secondary dominants (Björk, Prince, Radiohead, Wonder).	• Bass plays root of chord throughout with occasional approach note either a perfect fourth, minor third or semitone below. • Vocal and saxophone melodies mostly stepwise or thirds intervals. Mostly narrow tessitura with final phrase widening to minor 7th interval (see Figures 6.3 and 6.4). • Saxophone choir features closed voiced triads outlining upper extensions of chord (e.g., 7, 9 and 11) (see Fig. 6.3). • Open voicings for keyboard and guitar parts (see Fig. 6.2). • Use of extended chords, e.g., 11 and sus11 chords.
	Vertical patterning	• Mostly static harmony (Beatles, New Order, Prince). • Diatonic chord progressions based on mode of major scale (All except above). • Repeating patterns in multiple of four bars (all except Björk).	• Repeating four-bar pattern throughout: Asus7 - Gsus7 - Bbsus7.
	Horizontal structures and patterning	• Repeating 2/4 bar patterns for instruments and vocals (all). • One-bar guitar fills (Beatles, Bowie, Hendrix, Prince).	• Repeating one or four-bar patterns for all rhythm section instruments (see Fig. 6.2). • Vocal features series of four-bar phrases (see Figure 6.4). • Saxophone solo features similar patterning to vocal, i.e., four-bar phrases (see Fig. 6.3).
	Dynamics	• Variations due to texture with peak in later part of track (all).	• Variations due to texture with peak in coda.
	Texture	• Drumkit, bass/keyboard, guitar/keyboards, vocal as basic texture (Beatles, Bowie, Hendrix, U2, Wonder). • Minimal texture for prolonged sections (Björk, Prince, Radiohead). • Staggered layering of various elements (Beatles, Bowie, New Order, Prince). • Alternation between thin and thick textures, e.g., verse/chorus or verse/solo (Hendrix, Prince, U2).	• Drumkit, bass, keyboards provide basic texture throughout. • Staggered layering of elements after introduction and for coda (i.e., after introduction: electric piano, drumkit, synth pad, bass, vocal). • Major textural shifts at 8 or 16 bar intervals. • Chorus texture thicker, adding glockenspiel, synth pad, electric piano with delay. • Saxophone sections feature 1/16th note hi-hat and guitar.
	Timbre	• For particular fixed timbres see 'sound objects' above. • Shift from 'full' vocal to filtered vocal (Beatles). • Variety of guitar sounds (Bowie, Hendrix, U2). • Variety of keyboard/synthesiser sounds (New Order, Wonder).	• Variety of fixed timbres described in 'sound objects' above. • Shift from filtered (verse) to 'full' (chorus) vocal sound at 1'36". • Variety of keyboard/synthesiser sounds utilised.
	Spatial elements	• Creation of 'unreal' acoustic space (all). • Foregrounding vocal (all). • Drums/percussion not centred, panned left and right (Hendrix). • Movement from proximate to distant of vocal (Bowie).	• Unreal acoustic space created via shift in vocal reverb level from verse to chorus. • Sounds placed in stereo field – vocal, sax, kick, snare, hi-hats, bass, electric piano centred; guitar at right; 1/16th note hi-hat at left; synth pads, chorus electric

		• Changes in nature of perceived acoustic space throughout track (U2).	piano and sax choir spread across stereo field. • Vocal or saxophone foregrounded. • Movement from proximate (verse) to distant (vocal) in vocal.
	Programmatic Association	• Complex and multiple meanings possible (all). • Use of production (e.g. effects, spatialisation) to reinforce possible meanings (All). • Repetitive and syncopated aspects invite movement and/or dance from listener (all).	• Repetitive and syncopated elements emphasise somatic aspect. • Lyric reinforces repetitive elements (e.g., chord progression, rhythmic patterning) whilst relatively straightforward meaning in lyric slightly complicated by sampled elements presenting voice of main protagonists. • Initial sampled fragment alludes to compositional process undertaken, mirrors process of many of the rock works analysed.
	Structure	• Sectional with regular (i.e., multiples of four) bar lengths (All except Björk). • Strophic or Verse/Chorus/Bridge (all).	• Sectional: Introduction (12 + 4 bars) | Verse (16) | Chorus (16) | Sax solo (16) | Chorus (16) | Coda (8 + 24 + 4).
	Interaction	• Call and response between parts, instrumental and vocal (Hendrix, Prince, Wonder). • Building intensity at end of sections (all).	• Some call and response between parts, e.g., sampled vocal fragment at start of chorus answered by main vocal; electric piano (with delay) fills in chorus; vocal fragments in sax solo.
	Score		
	Presentational Format		

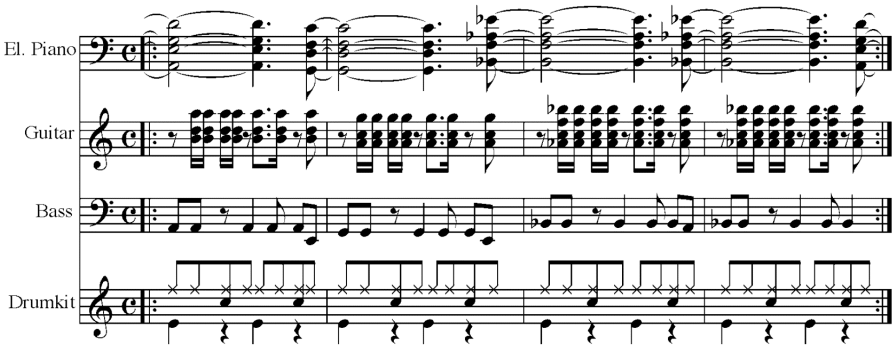


Figure 6.2. Rock Study: Rhythm section excerpt (for sax solo and coda).

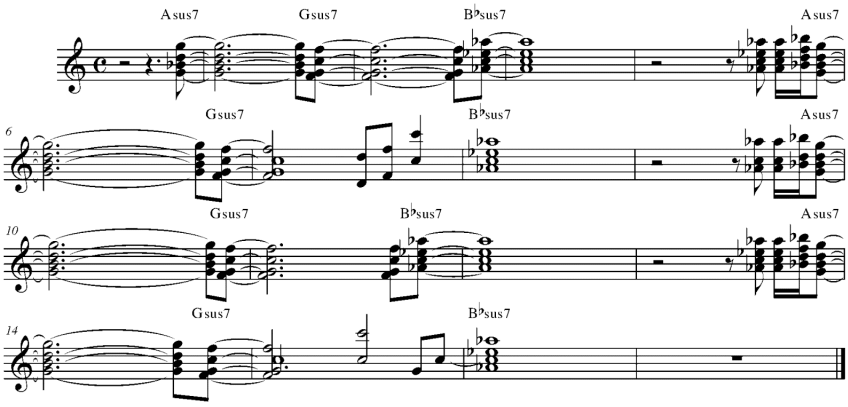


Figure 6.3. Rock Study: Saxophone choir at 4’00”.

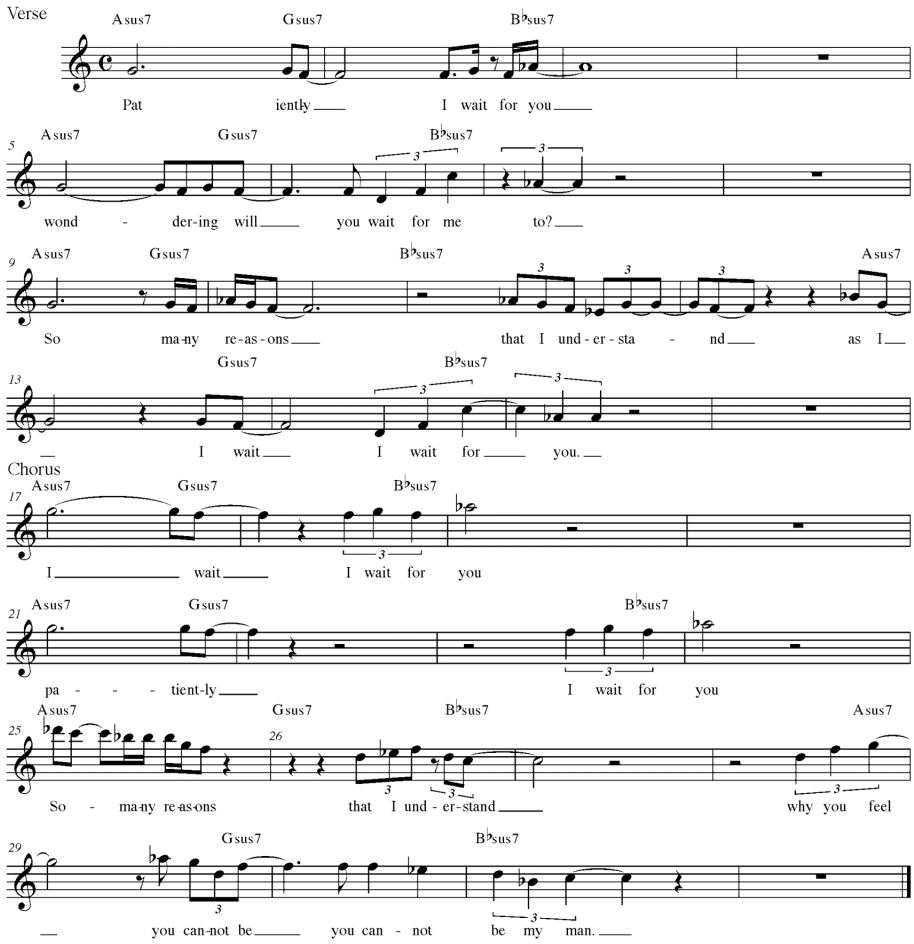


Figure 6.4. Rock Study: Vocal lead sheet.

In terms of *shaping factors*, particular resonances observed in the creation of the study include *theoretical*, *practical*, *resources* and *timeframe* and these are listed in Table 6.2 above. At the *theoretical* level the compositional process was not driven by any particular musical theoretical consideration. Instead, in keeping with the predominant methodology of the rock works analysed, the study was the result of a lengthy exploratory process in a studio involving much experimentation and editing. Such a process reflects the various *practical* elements listed as shaping factors in Table 6.2 above. The capacity for digital home-studios to recreate much of the hardware of older

analogue studios enabled the study to be produced with a similar amount of studio time (*timeframe*), but with a fraction of the *budget* of the works analysed and this constitutes the incorporation of new technologies in the study. However, my own lack of professional studio expertise (i.e., as a recording, mixing and mastering engineer) remains an important difference between the production of the study and the production of the works analysed.

In terms of *inputs* for the study, many of the elements of interest (listed in the second column of Table 6.3) were incorporated (listed in the third column of Table 6.3). The *sound sources* chosen for the study include the 'standard' instrumentation of many of the rock works (i.e., drumkit, bass, guitar, keyboard and vocal), supplemented by glockenspiel, software synthesisers, and vocal samples. The *processing* of sounds is an integral part of the works analysed in the rock genre with reverb, compression and filtering most prominent in the study. Three of the works analysed (viz. The Beatles' "Tomorrow Never Knows", U2's "Zoo Station" and Björk's "Desired Constellation") feature a heavily filtered vocal in at least part of the track and this technique was explored in the verse of the study. A recreation of automatic double tracking (ADT), Ken Townshend's innovation used on "Tomorrow Never Knows" (Everett, 1999), was also employed.

Rhythm and *pitch* elements utilised in the study exhibit some similarities with the rock works analysed whilst displaying some important differences. Rhythmic elements such as repeating one, four and eight-bar syncopated patterns and a strong backbeat are common to both whereas the tempo of the study (80bpm) is significantly slower than any of the works analysed. Pitch elements such as the bass playing root notes, the use of the Mixolydian mode and the use of open voicings in keyboard and guitar parts are

common in the rock works analysed. On the other hand the non-diatonic chord progression, and the dissonance created by the saxophone choir's Bb note against the Asus11 chord in the electric piano (at 4'00", 4'12" etc., see Figures 6.2 and 6.3) utilised in the study is unlike the pitch materials presented in any of works analysed. The rationale for such discrepancies lies in the priority given to the exploratory processes emphasising an aural approach to composition, the process favoured in the development of both the study and the rock works analysed. In this way the uncommon pitch materials utilised in the study emerge from my own and the other musicians' personal stylistic preferences.

At a general level, the basic *texture, timbre, spatial elements* and *structure*, are drawn from the genre terrain mapped via the analysis of the nine selected key works. For example, the study is structured in mostly sixteen-bar sections with major textural shifts occurring at regular eight or sixteen-bar intervals with some staggered layering of parts. Some specific methodologies identified from the selected key works are utilised in the study. For example, the perceived movement from proximate to distant heard in the vocal of Bowie's "Heroes" as the song progresses provided the impetus to vary the reverb amount on the vocal from verse to chorus in the study.

6.1.5 Realisation of Rock Study

The Rock Study was created over a twelve-month period and is the result of collaboration between myself and other members of the band Torakina (Ian Brunskill, Rebecca McHutchison and Matthew Curnock). This section outlines the processes undertaken and presents my own view of the nature and extent of the others'

contribution to the study. The collaborative band model was chosen as it reflects the processes involved in many of the rock works analysed.

Prior to the creation of the study, Torakina had been rehearsing and performing together for approximately six months. The band's repertoire was the result of freely improvised 'jams' and prior to the study little concern was given to developing and/or arranging material beyond what was initially played. All the rehearsals were recorded and thus a subsequent review of material was possible. The basic chord progression, rhythmic feel, and main melody of the study were established in one of these jams. I played the electric piano and wrote the chord progression, Matthew followed on bass playing root notes, Ian played a fairly standard rock pattern and Rebecca wrote the melody, performed initially on saxophone.

Months after the original jam, the drumkit, bass and keyboard parts were rerecorded at Old Pucker Studios (a semi-professional studio owned by the Torakina member Matthew Curnock) to a click without any particular arrangement in mind. At a later date I edited and arranged these parts into a basic structure and added the synthesiser pads (from the software synthesiser, Atmosphere), sampled glockenspiel, guitar and additional electric piano parts in my home studio. I then presented this as a bed track to the rest of the band for review before saxophone and vocals were added. Furthermore, the band was performing the song regularly at local gigs where I was adding the synthesiser parts and other drum loops using a laptop running Ableton Live software. Thus the structure of the study was allowed to emerge in a somewhat organic fashion.

The final overdubs (saxophone, vocals, real glockenspiel) were recorded at Old Pucker Studios before further editing and mixing at my home studio. Rebecca wrote the lyric and also arranged the saxophone choir, featured in the coda of the study. The saxophone and vocal parts heard in the study were pieced together from numerous takes after I undertook an extensive auditioning and selecting process (without consulting the band members until the final version was in place). I rhythmically displaced part of the chorus vocal (the fourth phrase "I wait for you") but otherwise the phrasing is as performed by Rebecca. Matthew recorded Ian's performance of the glockenspiel part I had written.

The mixing process for the study involved initially negotiating a high track count (over 32, beyond the capabilities of the Pro Tools system and computer I was utilising) due to the multiple saxophone parts, doubling of vocal parts and numerous overdubs. The edit window of the Pro Tools session for the study (Figure 6.5) shows the final rationalisation achieved after bouncing the saxophone parts onto one track. Additional auxiliary tracks, used for effects sends (e.g., reverb, compression and delay) are hidden in Figure 6.5. Figure 6.5 also provides an overview of the structure of the study with the vertical lines indicating sixteen bar sections. A vertical line within each of the audio 'regions' indicates an edit point.

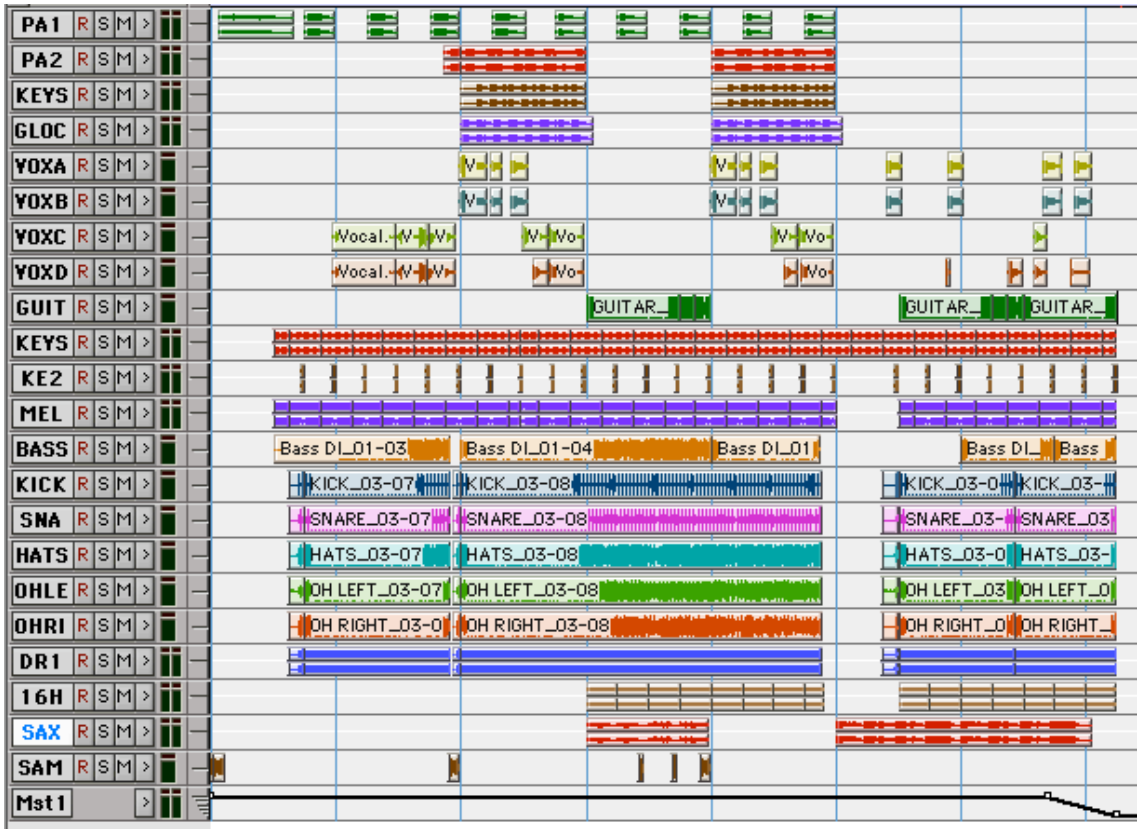


Figure 6.5. Edit window of Pro Tools session for Rock Study.

The first mixes were completed at my home studio, monitoring with headphones with further refinements made at the studio at James Cook University, monitoring through Mackie HR624 speakers. Numerous mixes of the study were completed and auditioned on various playback systems. Whilst members of Torakina were involved in this process the final decisions for both arrangement and mix of the Rock Study were my own.

6.2 Electronic Dance Music Works

6.2.1 Identifying Key Works

The selected key works analysed in the electronic dance music genre are listed in Table 6.4. Whilst not providing an exhaustive list of the multitude of sub-genres within the electronic dance music (EDM) genre, the works selected meet the selection criteria outlined in 4.2.1.

Table 6.4. *Key Works Selected in Electronic Dance Music Genre*

	Artist	**Work**	**Year**	**Key Aspect(s)**
1	Kraftwerk	"Autobahn"	1974	Cited by many EDM artists and researchers as key forerunners.
2	Donna Summer/Giorgio Moroder/Pete Bellotte	"I Feel Love"	1977	Disco and Moog synthesiser exemplar.
3	Afrika Bambaataa	"Planet Rock"	1982	Early hip-hop exemplar.
4	Larry Heard (Mr Fingers)	"Can You Feel It"	1987	Key figure and track in development of Chicago House.
5	Derrick May (Rythim is Rythim)	"Strings of Life"	1987	Key figure and track in development of Detroit Techno.
6	Public Enemy	"Fight the Power"	1990	Use of multiple samples and hip-hop exemplar.
7	Autechre	"Montreal"	1994	Intelligent dance music (IDM) exemplar.
8	Chemical Brothers	"Dig Your Own Hole"	1997	Big Beat exemplar.
9	Roni Size and Reprazent	"Brown Paper Bag"	1997	Drum 'n' Bass exemplar.

6.2.2 Applying Analytical Methodology

The analyses of the electronic works are presented in Appendix B. The limitations of a desk-based analytical methodology, in terms of *musical* and *spatial frames* (see 3.2 and 3.3), are most keenly felt in the EDM genre. Many of the selected key works are

explicitly intended for club audiences, not for private listening with headphones, and hence different musical and extramusical aspects are foregrounded. In particular, the somatic and functional aspects of the music are highlighted in a club setting. For example, in the following, Reynolds (1999) notes the impact of volume on the perception of low frequencies in a club setting:

> At massive volume, knowledge is visceral, something your body understands as it's seduced and ensnared by the paradoxes of the music: the way the breaks combine rollin' flow and disruptive instability, thereby instilling a contradictory mix of nonchalance and vigilance; the way the bass is at once wombing and menacing…. Inside the bass, you feel safe, and you feel *dangerous*. Like cruising in a car with a booming system, you're sealed by surround sound while marauding through urban space (p. 349).

This description of the club experience by Reynolds is indicative of the often intimate and personal perspective presented in discourse surrounding EDM. Such descriptions, in addition to the comments by the creators themselves regarding the context of presentation, enable some recompense for the desk-bound researcher.

Whilst acknowledged as a genre where the role of the producer is critical (Reynolds, 1999) the extant literature contains few detailed accounts of the producer's work. There are two main factors contributing to this, firstly, the popular/cultural/sociological orientation of much of the literature where such detail is secondary and secondly, the trade/commercial orientation of the genre, where explicit and probed accounts of individual process are

beyond the needs of the participants. In place of specific accounts are numerous 'how to' books covering all aspects of dance music production (e.g. Snoman, 2004).

A similar issue is presented with the lack of detail regarding descriptions of timbre evident in the literature. An example of such is the following by Prendergast (2000) describing Summer's "I Feel Love": "Much tonal change was applied to the bass synthesiser… dry drum-machine resonations abounded" (p. 375). The nature of the "tonal change" and the specific "drum-machine resonations" are not indicated, making such descriptions somewhat meaningless for the analyst. This contrasts the importance placed on 'sound' by the creators of the works themselves (e.g., see comments by Rowlands in Berman, 1999, and Booth in O'Leary, 2005, noted in the analyses) and also the attention given to achieving appropriate timbres in both trade magazines and 'how to' books (e.g. Snoman, 2004).

In addition to text-based descriptions, alternative presentation modes were utilised in the analyses. Conventional notation for the parameters of *pitch* and *rhythm* offered a concise means to convey such elements. The form diagram included with the analysis of Roni Size's "Brown Paper Bag" (see Appendix B) provides a succinct overview of the structure of the work. The similarity between this form diagram and the arrangement window in much sequencing software (e.g., Ableton Live, Cubase, Pro Tools, Reason, etc.), also reinforces the link between analysis and creation, particularly in the selected key works where such software has been utilised.

6.2.3 Ascertaining Compositional Methods / Mapping Genre Terrain

The examination of selected key works in the EDM genre revealed numerous compositional methods. These are presented in elemental form in Appendix B however the following summary comments can be made. In terms of *shaping factors*, *practical* and *environmental* factors are well documented. The importance of *play,* or a bottom up process, in the creation of works is recognised by many of the artists themselves. For example, Berman (1999) cites Tom Rowlands (from the Chemical Brothers) account of their process: "We kind of play with sounds until tunes arrive" (Berman, 1999). In the case of Derrick May's "Strings of Life" (1987), a piano part retrieved whilst searching for something else became the seed for the track. Sean Booth (from Autechre) emphasises 'messing about' with equipment for an extended time before getting desirable sounds (O'Leary, 2005).

The equipment utilised for realisation of EDM works are mostly commercially available synthesisers, drum machines and computer software. The 'misuse' of such equipment is an established part of the genre. Specific examples of such include the polyphonic orchestral 'hit' in "Planet Rock", (a 'mistake' on a Fairlight which became an integral part of the track), and the piano riff in "Strings of Life" (as noted above). At a more general level examples include the misuse of samplers by Public Enemy's producers, whereby 'gritty' sounds were achieved by resampling with lower sample rates (Walser, 1995), and the use of the Roland 303 bass sequencer, originally intended as a practice aid for guitarists, as a key component of the sub-genre Acid House. Turntable techniques, utilised in many EDM genres, originally constituted a similar misuse of

equipment. However, now such practices are an established part of the genre, with purpose built hardware and software.

Macro environmental factors are well documented in many of the works. Whether this is merely a result of the biographical emphases of artist interviews, or if such factors do impact greatly on the creation of works, is unclear. In the literature, links are made between cultural context and particular aspects of the music. For example, Afrika Bambaataa discusses growing up in New York amidst gang violence and how this impacted on the incorporation of messages of resistance to oppression in his music (Fricke & Ahearn, 2002, p. 49). Derrick May describes Detroit's cultural and economic desolation as an important factor in stimulating creativity where "people tend to use their imaginations to compensate" (May cited in Reynolds, 1999, p. 15).

With some exceptions (e.g., Kraftwerk, Donna Summer, and Larry Heard) *theoretical* factors are not derived from traditional music theory. Hank Shocklee of Public Enemy is strident in his belief that the musicianship involved in rap is different from, for example, than that involved with classical or jazz, "with its virtuosity dependent on different tools, exercised on a different field, and motivated by different musical and cultural priorities" (Walser, 1995, p. 198). Sean Booth from Autechre acknowledges the influence of hip-hop and rap and suggests, in regards to classical music theory that "either you know everything, or you know nothing. There is no in-between. It's in the in-between that people fall over" (cited in Reighley, 2000, p. 183).

Rejection of other aspects of classical, or more generally Western art music, is also evident in the importance placed on positive feedback from audiences. In many cases, EDM artists

explicitly acknowledge the *intended audience* as club attendees, and furthermore, reactions from this audience are an integral part of the creation process. For example, Ed Simons (from Chemical Brothers) gives the following account of track creation:

> We get something down. Then we go record it somewhere else. Then we edit somewhat and we play it live. Look at the reactions we get on the dance floors. That gives us an idea of how the sounds are working together and how the arrangements are. Then we go in there again and again (Simons cited in Miller, 1997).

However, the proliferation of various sub-genres and sub-sub genres in EDM suggests that in tandem with audience approval, the need to present a certain degree of originality is another important driver for EDM producers.

In terms of inputs, *rhythm* and *timbre* are most significant in the EDM genre. The metre for all works analysed is 4/4. With the exception of "Autobahn", tempo is constant and ranges between 105bpm ("Fight the Power") and 160bpm ("Brown Paper Bag") with most tracks between 120 and 130 bpm. "Autobahn" features a number of sections with different, yet constant tempos. All works feature repeating one, two or four bar rhythmic patterns incorporating polyrhythm and syncopation. High frequency percussion elements (e.g., hi-hats) are the most active and generally feature constant quaver and semi-quaver patterns. Strong low frequency (e.g., bass or bass drum) accents are featured on beat one in most sub-genres with hip-hop and drum 'n' bass featuring more syncopation than house and techno within kick and snare drum parts.

A range of synthesised, sampled, vocal and instrumental sounds are utilised as *sound sources*. Hip-hop and drum 'n' bass are generally more sample oriented, although live performances of the drum 'n' bass exemplar discussed herein ("Brown Paper Bag"), feature live vocals and instruments. The synthesisers and drum machines utilised in the selected key works are typical of those used in the genre. These include analogue synthesisers such as the Moog (heard in "Autobahn" and "I Feel Love"), Roland Juno (used by Larry Heard and Autechre) and Roland SH 101 (Chemical Brothers). Important drum machines include the Roland TR 707 (heard in "Can You Feel It") and Roland TR 808 ("Planet Rock"). The timbres generated by such equipment are a key aspect of the overall sound of particular sub-genres and have been recreated in many digital synthesisers since the early 1990s.

The *structure* of most EDM works is sectional with major textural changes occurring in multiples of four-bar units. One or two 'breakdowns', where most of the instrumentation is tacit, are common and are of similar duration. A notable exception to this rule is "Strings of Life", which features a twenty-six bar introduction and a thirty-one bar breakdown section. The duration of tracks ranges from four and half minutes ("Fight the Power") to twenty-two minutes ("Autobahn"), however most are six to eight minutes in length.

In terms of *spatial elements*, the placement of similar timbres on different sides of the stereo field (i.e., panning) is common. Drum parts featuring multiple versions of the same instrument are a typical example. This is most evident in "Fight the Power" where three separate snare drums are heard left, centre and right. The main synthesiser riff in "I Feel Love" is divided as downbeats, left and upbeats, right. A possible effect of such panning is to give the listener a sense of immersion and thus enhance the somatic qualities of the track.

A summary of the predominant *shaping factors, inputs* and *processes* (highlighted) for the EDM genre is given in Figure 6.6.

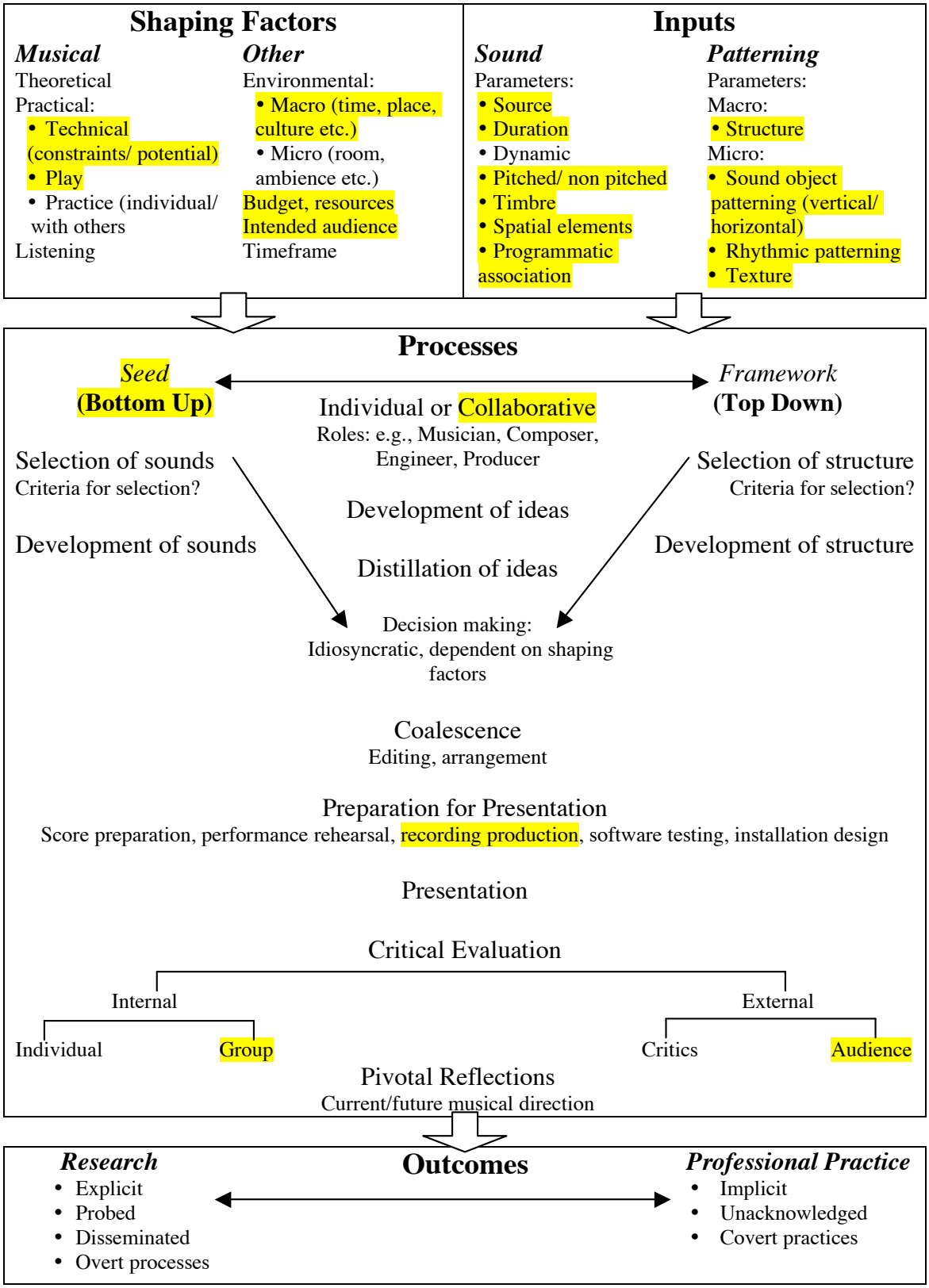


Figure 6.6. The creation of a musical work: Features of EDM works highlighted.

6.2.4 Applying Compositional Methods / Development of EDM Study

Particular *resonances* observed in shaping the creation of the EDM Study are listed in Table 6.5. The aspects of compositional methods, *elements of personal interest*, are identified in the second column of Table 6.6 below. The third column in Table 6.6 provides the detail of the study developed.

Table 6.5. *Resonances Observed Between Factors Shaping Selected Key Works and Factors Shaping the Creation of the EDM Study*

Parameter			Resonances
Musical	**Theoretical**		•
	Practical	**Technical**	• Software version of Minimoog synthesiser (Kraftwerk, Summer).
		Play	• Previous experience playing in rock, jazz and fusion bands on acoustic instruments (Heard). • Emphasis on 'playing' with equipment/technology to find desirable sounds and building tracks from those sounds (Autechre, Chemical Brothers). • Seed of study a part intended for another track (May).
		Practice	•
	Listening		•
Other	**Environmental**	**Macro**	• Living outside major cities/cultural centres, cultural isolation of Detroit encourages imagination (May).
		Micro	•
	Budget/ Resources		•
	Intended Audience		•
	Timeframe		•

Table 6.6. *Elements of Personal Interest and Elements of EDM Study*

Parameter		Elements of Interest	Elements of Study
Sound	**Sources**	• Combination of electronic, instrumental, vocal and *concrète* sounds (Chemical Brothers, Kraftwerk, May, Public Enemy, Size, Summer). • All electronic sounds, no vocal (Autechre).	• All electronic sounds, no vocal. • All software origin: Minimoog, Stylus, Atmosphere, Trilogy.
	Objects	• Mid to low frequency synth pads with slow attack and decay amplitude envelope (Autechre). • Short duration, noise based percussive sounds (Autechre, Size). • Sampled and synthesised drumkit sounds (all). • Short duration, rounded envelope, synthesised bass clicks (Summer). • Short vocal phrases sung and semi-spoken (Heard). • Fragments sampled from recordings – vocal and instrumental. Varying in duration – range from percussive effect to length of short vocal phrases. (Public Enemy).	• Sampled drumkit, bass and guitar sounds • Short to mid duration, noise based percussive sounds. • Synthesised bass and low – mid frequency pad sounds. • Synthesised mid frequency melodic sounds.
	Object processing	• Reverberation (all), filtering (all), delay (all except May).	• Reverb on all parts. • Equalization on drums and bass. • Delay on some moog and drum parts. • Filter sweeps on melodic and pad moog sounds. • Limiter applied to master fader.
Rhythm	**Pulse**	• Constant tempo throughout (all).	• Constant tempo throughout.
	Metre	• 4/4 (all).	• 4/4
	Patterning	• Repeating 1, 2 and 4-bar phrases (all). • 16 bar sections feature prominently – occasional interruptions to this pattern • Syncopated kick and snare patterns (Autechre, Bambaataa, Chemical Brothers, Public Enemy, Size). • Non-syncopated kick and snare patterns (Heard, Kraftwerk, May, Summer).	• Repeating 1, 2 and 4-bar phrases. • Syncopated kick and snare/rimshot patterns. • Multiple high hat parts including constant 1/16th notes and constant 1/8th notes with accent on beats 1 and 3. • Backbeat snare accent. • Major textural changes at 16-bar intervals.
Pitch	**Selection**	• Tonal (all). • Mostly tonal but sampled fragments producing polytonality (May, Public Enemy).	• Mostly tonal, Bb minor, with some pitch elements outside this scale. • Guitar sample (heard at 1'29") suggests A and C# notes. • Synth pad at 1'42" outlines D minor. • Slowing 'vinyl' sample at 3'00" fragment creates pitched glissandi. • Low frequency synth pad at 3'18" Bb with numerous resonant overtones, F, C and D notes prominent.
	Vertical structures	• Major 9 and Minor 7 chords (May).	• Melody at 1'18" features diads, parallel fourths. • Low frequency synth pad at 3'18" with vertical structure as above. • Synth pad at 1'42" features two layers, a static D minor chord with ascending and descending glissandi. • Synth pad at 4'30" features F, Ab, C, Db notes sustained with Gb added to arpeggiated notes.
	Vertical patterning	• Repeating 8-bar chord progression played by piano (May). • Static harmony throughout (Autechre, Bambaataa, Chemical Brothers, Size).	• Static harmony throughout. • Bb minor tonality with exception of 1'42"-2'06", D minor.

	Horizontal structures and patterning	• Vocals - phrase length varies between 1 beat and 2 bars. Phrases begin and end on various parts of bar. Combination of shorter and longer phrases to cover 8-bar sections. Some repeated rhythmic patterns and imitation of phrases (Bambaataa, Public Enemy). • Repeating bass, guitar and/or keyboard riffs (all). • Piano main riff features repeating 2-bar rhythmic figure, alternating bass note and chord. Right hand accents grouped 2 3 3 3 3 2 (counting 1/16th notes) (May).	• Bass riff repeating 2-bar phrase, range - fifth. • Synth at 1'00", 2-bar phrase, range - octave. • Synth melody at 1'18", repeating 4-bar phrase with repeat shortened, i.e., without last bar, range - eleventh. • Synth at 2'30", repeating 2-bar phrase, range - octave.
	Dynamics	• Generally constant with variations due to texture (all).	• Generally constant with variations due to texture.
	Texture	• Variations in texture achieved by layering parts/sounds (Autechre, Chemical Brothers, Heard, May, Size).	• Variations in texture achieved by layering parts/sounds. • Major changes in texture at 16-bar intervals. • Bassline heard throughout with exception of sixteen bar D minor section.
	Timbre	• Multiple drum sounds augmented by rhythmic noise elements (Autechre, Bambaataa, Public Enemy, Size). • Range of snare drum sounds heard (Public Enemy). • Predominance of noise based sounds in mid to high frequencies (particularly hi-hats) (Autechre). • Filtering of drumkit features high resonance on kick and snare with gradual rising cutoff of highpass filter (Chemical Brothers).	• Multiple drum sounds, up to three drumkit layers, augmented by rhythmic noise elements. • Range of snare/rimshot sounds including initial light rimshot, dry snare at 0'30", thicker snare at 1'42", slightly filtered and resonant rimshot at 2'30" and 3'42". • Range of hi-hats, including filtered sounds at 2'30" and 3'42". • Resonant filter sweep on synth melody sound at 1'18" and on low synth riff at 2'30". • Second bass sound (highly resonant, filtered) added at 3'19". • Resonant filter sweep on low frequency pad at 3'43" and 4'06".
	Spatial elements	• 1/16th note bass pattern, alternate left and right panning of notes (Summer). • Bass and kick drum centred (all).	• Bass riff, kick drum, synth melody (at 1'18") and riff (at 2'30") centred. • Percussive noise elements, filtered bass and filtered low pad move across stereo field. • Semiquaver hi hats panned left and right. Quaver hi hats centred. • Panned delay of some drumkit and percussion sounds. • Synth pads spread across stereo field.
	Programmatic Association	• Syncopation, repetition and textural focus on drums and bass emphasise somatic aspect of music (all). • Industrial quality, pace, and density of percussive sounds contrasted by ambient quality of synth pads (Autechre).	• Syncopation, repetition and textural focus on drums and bass emphasis somatic aspect of music. • Relatively fast tempo and somewhat ambient quality of synth pads places track in IDM (Intelligent dance music)-type genre, where functional (dance) aspects are secondary.
	Structure	• Sectional form (all).	• Sectional form. • Bassline from another song ("Warm Keep Warm", Hill, 2005) formed seed of track.
	Interaction		• Some call and response-type figures between melodies and percussion/noises.
	Score		
	Presentational Format		• Compact disc

In terms of *shaping factors*, particular resonances observed in the creation of the study include *practical* and *technical* elements via an emphasis on *play*. An exploration of various software instruments, including Atmosphere, Arturia Minimoog V (software version of analogue synthesiser), Stylus (drum, percussion and effects sample player), and Trilogy (bass sample player, synthesiser) was undertaken with emphasis placed on listening to, and selecting, desirable sounds from the range of preset sounds available on each instrument. This exploration represents the incorporation of new technologies and the process replicates the bottom up method discussed by members of Chemical Brothers and Autechre above. (Details of the process are discussed in 6.2.5 below). The use of the software Minimoog synthesiser also provides a link with the early works by *Kraftwerk* and Summer. To a lesser extent, resonances can be observed at a practical level in terms of Heard's background in playing acoustic instruments in rock, jazz and fusion bands, a situation similar to my own (as outlined in 2.4).

In terms of the *inputs* for the study, many of the elements which form part of the genre terrain align with the elements of interest identified in Table 6.6. As mentioned above (6.2.3) *rhythm* and *timbre* are key aspects defining genre terrain. In the case of EDM, important elements of *rhythm* include a constant pulse, 4/4 metre and one and two bar repetitive patterns and these are all incorporated into the study. Two broad categories of kick and snare drum patterns emerge from the selected key works and are of interest; firstly, a constant quarter note kick drum with backbeat (e.g., May, Heard and Summer), and secondly, more active and syncopated kick and snare patterns (e.g., Autechre, Bambaataa, Chemical Brothers, Public Enemy and Size). The latter category was utilised in the study, and more specifically, the drum 'n' bass style rhythms and faster tempo (160bpm) of Size providing the nearest reference point.

The use of multiple drum sounds (e.g., two or more snare drum sounds) is a *timbral* characteristic of the genre and this, in combination with the use of noise-based percussive sounds (e.g., Autechre, Bambaataa, Public Enemy and Size) provides a key element of interest. In the study, two or more sampled drum loops, incorporating kick, snare and hi-hat patterns, are layered together and additional noise-based percussive effects added (e.g., at 1'03" and 1'14"). Further timbral variety within the drum part is achieved by adding a filtered drum loop to the texture (e.g., at 2'30"), a technique inspired by the gradual filtering of the drum part in "Dig Your Own Hole".

In terms of *pitch*, elements of interest include a static tonal harmony (e.g., Autechre, Bambaataa, Chemical Brothers and Size) and polytonality resulting from the use of pitched samples in different tonalities (e.g., Public Enemy). Most of the pitched elements in the study derive from a Bb minor tonality with the exception of the first breakdown (1'42" – 2'06"), where the pad outlines D minor. The incorporation of various short, pitched fragments (e.g., at 1'29 and 3'00") and the low frequency pad (at 3'18") provide an element of polytonality. Further elements of interest (and genre characteristics) in terms of *pitch* include the repetition of one, two and four-bar phrases. In most of the works analysed, such bass, guitar or keyboard riffs are a constant part of the *texture* and the study incorporates this principle via the use of the bass riff heard throughout most of the track.

6.2.5 Realisation of EDM Study

This section outlines the bottom up process undertaken in the development of the EDM Study. The combination of EDM genre terrain, new technologies (software instruments)

and the filter of personal practice (see section 2.4) provided the initial framework for the track. An overview of the process is as follows:

1. Establish tempo and sub-genre (160 bpm, drum 'n' bass)
2. Create/select seed (bass riff)
3. Audition and select drum loops
4. Augment loops with percussive and noise based elements
5. Audition and select timbres for melodic and harmonic elements
6. Improvise/play with selected timbres against drum and bass loops
7. Refine melodic and harmonic elements
8. Arrange
9. Mix
10. Reflect (feedback from self and others), remix (repeat as necessary)

The seed of the track, the bass riff, was taken from another of my own works, "Warm Keep Warm", (Hill, 2005), a work influenced, in terms of tempo and rhythmic feel, by drum 'n' bass. Bass sounds from the software sample player Trilogy were auditioned, with two complementary sounds selected; a sub bass and resonant Roland 303-type sound. This riff was performed and recorded as a MIDI track in Pro Tools before being quantized and bounced to two separate audio tracks, one for each sound.

Drum and percussion loops from the software sample player Stylus were then auditioned against the bass riff and a short list of ten possible loops were selected from the two hundred and forty presets available in the 160bpm 'groove menu'. In Stylus, the 'groove menus' map all available loops at the same tempo across a MIDI keyboard thus presenting a relatively quick means to audition loops. Loops from the 80bpm 'groove

menu' were also auditioned for possible 'half-time' application. The criterion for selection to the shortlist was simply an immediate positive subjective response to both the loop itself and the loop in context with the bass riff. The selection of loops from the short list involved a lengthier comparative process, including exploration of possible combinations, with five loops, offering textural variety, finally selected. Additional noise based percussion elements, selected from the 'Fx' menu in Stylus were then added.

An interim arrangement of the selected drum and percussion parts into four or eight-bar loops was then made. Against these loops, auditioning of preset sounds in the Minimoog and Atmosphere software instruments was undertaken. The selection of particular sounds was again the result of positive subjective response to the sound, with some sounds selected after minor changes to available parameters. Emphasis was made in selecting varied timbres with melodic and 'pad' applications intended. The pitch and rhythmic content emerged from a process of live improvisation with the selected sounds against the backing of the drum and bass loops. In keeping with the genre, composition of two and four-bar melodic phrases and sustained pads was the goal of the improvisation/refinement process.

Having created the various melodic and harmonic elements, an arrangement of the various parts was made. The layering of parts and 'breakdown' sections follows the structure of many EDM works. Similarly, major textural shifts occurred at sixteen bar intervals. Figure 6.7 presents the edit window of the Pro Tools session for the EDM Study and provides an overview of the structure of the study. The horizontal rows represent the various parts of the texture, with bass and drum parts in the lower half. The vertical lines represent sixteen bar sections and enable the regular textural shifts to be observed.

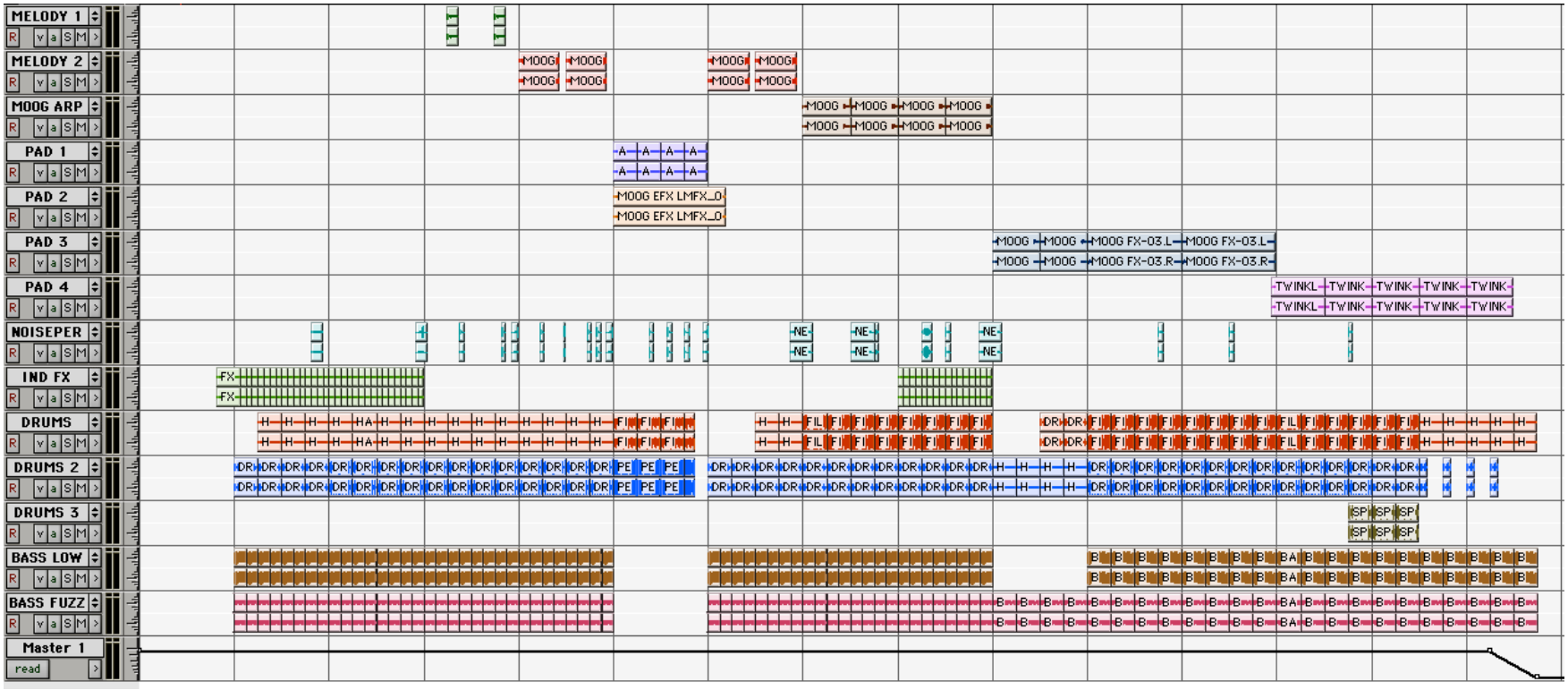


Figure 6.7. Edit window of Pro Tools session for EDM Study.

Mixing the study involved balancing levels and placing sounds within the stereo field. Minimal effects were utilised as the various parts were selected primarily on the basis of existing timbres. Some equalization and compression was applied to the bass sounds and a limiter was placed on the master channel to avoid audio clipping. The final mix was bounced to a stereo audio file, burnt to audio CD and auditioned on various sound systems. Further remixes were completed in order to correct various perceived problems, specifically surrounding a lack of clarity in the bass and low volume levels on some melodic elements.

CHAPTER SEVEN

DEVELOPMENT OF A COMPUTER BASED PERFORMANCE INSTRUMENT

7.1 Introduction

In Chapters Five and Six the identification and analysis of various technological compositional methods is presented in a genre-specific context, with the four practical studies incorporating style elements specific to each genre. The following two chapters present the development of a computer based performance instrument (CBPI) and a series of musical works that seek to encompass a range of conserved and emergent technological compositional methods and improvisation practices across all genres studied and within the context of my own personal practice. Figure 7.1 presents an overview of the development of the CBPI.

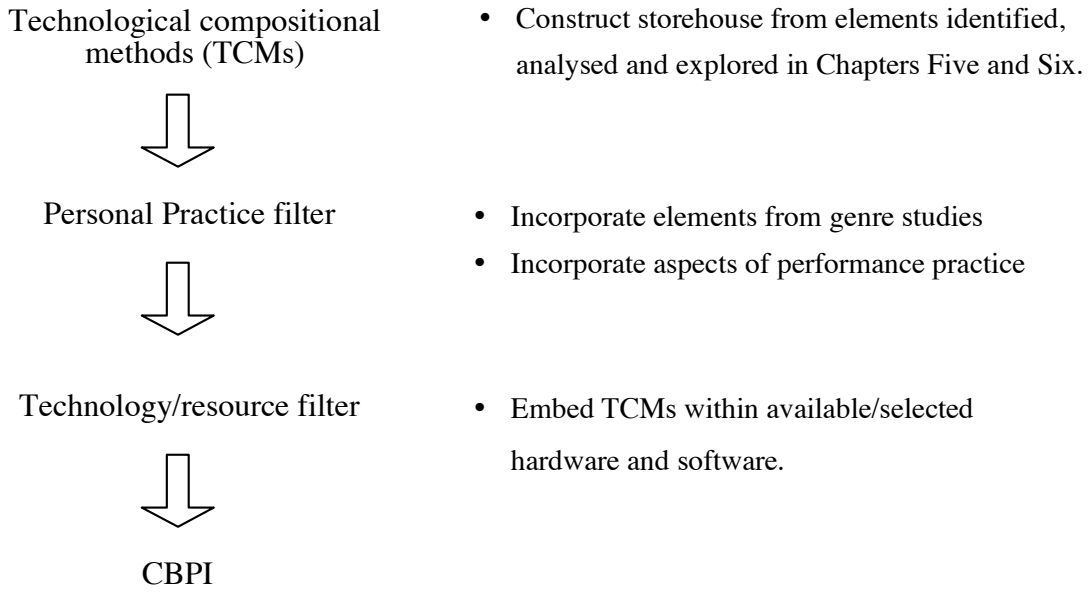


Figure 7.1. Overview of CBPI development process.

The *shaping factors* and *inputs* tables used for the analysis of selected key works and development of genre studies in Chapters Five and Six (first presented in section 4.3.2) provide a useful framework for the development of a storehouse of technological compositional methods. Combining the summary tables from each genre study (i.e., Tables 5.2, 5.3, 5.5, 5.6, 6.2, 6.3, 6.5 and 6.6), a complete overview of the resonances at the *shaping factors* level and the elements of interest at the *inputs* level could be given. However, not all of the elements identified in these tables are applicable to the development of the CBPI. For example, some *inputs*, such as traditional instrumentation (a *sound source* utilised in many of the works analysed in Chapters Five and Six) or aspects of pitch and rhythm, can be incorporated as compositional elements and defined for individual works. *Programmatic association* elements also may be incorporated in works via various means and not necessarily built into the CBPI. Similarly few of the various *shaping factors* identified can be incorporated into the CBPI. Instead the *shaping factors* constitute the reference point from which the CBPI is developed, forming crucial aspects of the personal practice and technology and resource filters via my preferred/given theoretical, practical, environmental and economic context.[11]

The personal practice filter (discussed in 2.4) provides both general and specific criteria for the development of the CBPI. At a general level the CBPI is intended, due to my own interests, to be used in live performance and improvisational contexts in mostly small ensemble settings. Stylistically, the CBPI is intended to incorporate a range of elements from the genres of personal interest, including the four genres studied herein. At a more specific level, my own experience as a keyboard player, in addition to my

[11] The resonances at the shaping factors level for the major works are given in 8.1, Table 8.1, providing a summary of the shaping factors from the key selected key works as a whole.

familiarity with performing on both keyboard and mixing desk (i.e., with amphibian as discussed in 2.4), determines my initial selection of a control interface, i.e., commercial MIDI controller keyboard with numerous knobs and sliders.

The selected hardware and software, in conjunction with available time and my own familiarity/expertise, sets the limits and potential for the incorporation of the selected compositional methods into the CBPI (i.e., the technology/resource filter). Of the applications with which I have expertise, Max/MSP was selected firstly for its flexibility in building the CBPI and its components from the ground up and thus allowing the design of software tools applicable to a wide range of compositional methods. Secondly, the Max/MSP environment allows, through its incorporation of the Rewire protocol and inclusion of VST instruments, access to a range of commercial software (e.g., Halion, Reaktor and Live) – commercial software not utilised within the works developed but remaining an option for future application of the CBPI.

Table 7.1 provides a summary of the elements of interest identified from the analysis of works in four genres, the elements (in general terms) to be incorporated in the CBPI, and finally the specific functions to be realised in the Max/MSP environment. The genre/s in parentheses for each item in the first column indicates that the element is applicable to more than two works from that genre otherwise individual works are listed. Specific Max/MSP objects utilised are indicated in the third column where appropriate.

Table 7.1. *Relationship Between Storehouse of Elements of Interest from Analyses and Development of CBPI*

Parameter		Elements of Interest	Elements of CBPI	Function required
Sound	**Sources**	• Traditional instruments (EDM, Impro, Rock). • Vocal (all genres). • All electronic/computer source (EDM, Electronic, Impro). • Combination of acoustic instruments and electric/sampled sound sources (all) • Keyboard instruments (all). • Computer generated samples/synthesis (all). • FM synthesis (Electronic). • Granular synthesis (Electronic, Rock) • Turntable/vinyl sounds/samples (EDM, Electronic, Impro).	• Combination live and prerecorded sampled sound sources including traditional instruments, vocals, recorded music (e.g., vinyl) and environmental sources.	• Play audio files existing on hard drive (assigned to keys of MIDI controller). • Receive and record live audio (push button/key record start/stop). • Keep playing something while recording something else.
	Objects	• Live instrument sounds (all). • Short vocal phrases/spoken word fragments (EDM, Electronic). • Synthesised/sampled instrument sounds (all). • Range of homogenous objects (all). • Range of heterogenous objects (all). • Sustained wide bandwidth tone throughout (Oliveros). • Noise elements - including vinyl 'hiss', percussive noise and part of synth pads (all). • Application of serial procedures (Stockhausen, "*Studie I"*). • Timbrally evolving pitched sounds (all). • Amplitude envelopes of individual partials of one sound applied to another (Harvey).	• Wide range of sound objects possible and inclusive of all elements of interest, including live instrument sounds/samples.	• Playback with variable speed (keys of MIDI controller), reverse play, loop (on or off), selectable loop points, scrubbing, view waveform. (groove~ , waveform~ and wave~ objects). • Individual voice amplitude envelopes (function) • Timbral transformation of sound objects (via envelopes or MIDI controller applied to processing).
	Object processing	• Delay (all). • Filtering (all). • Compression (EDM, Impro, Rock). • Reverb (EDM, Impro, Rock). • Variable speed playback (EDM, Electronic, Rock). • Distortion (Rock, EDM). • Wah Wah (Rock). • Chorus (Rock).	• Delay, filtering, compression, reverb, variable speed playback, chorus.	• Send individual voices to processing possibilities. • LFOs (various waveforms, speed, depth parameters) assignable to various parameters (including amplitude modulation parameters, spatialisation, filters) and ability to sync to tempo (cycle~, phasor~). • Read amplitude of selected audio files and use information as control signal for spatialisation and other parameters) (e.g., Electronic Study).

Rhythm	**Pulse**	• Constant (EDM, Impro, Rock). • No pulse (Electronic, Impro). • Multiple tempos/pulse (Electronic, Impro).	• Possible to configure as constant, none or multiple. • Ability to sync (via MIDI clock) to external source.	• Sync tempo to outside source (e.g., *Abelton Live*) (tempo, midiout, ctlin objects).
	Metre	• 4/4 (EDM, Impro, Rock). • Other metres, including 12/8, 5/8, 3/4 (Impro, Rock). • Variations (Impro, Rock). • Ametric (Electronic, Impro).	• Range of metres possible.	• Relate looped elements to given metre if necessary.
	Patterning	• Repetitive, syncopated elements (EDM, Impro, Rock). • Repetitive, non-syncopated elements (EDM, Rock). • Repeating 1, 2 and 4-bar phrases (EDM, Impro, Rock). • Mostly 8 or 16-bar sections (EDM, Impro, Rock). • Strong backbeat (EDM, Impro, Rock). • Constant 1/8th or 1/16th note phrases in solos (Chadabe, Davis, Douglas, Hancock, Pine). • Short repeated sections of *concrète* materials create rhythmic patterns (Electronic). • Application of serial procedures (Stockhausen "*Studie I"*). • Free (Behrman, Interface, Lewis, Oliveros).	• Repetitive, syncopated and/or non-syncopated elements. • Repeating 1, 2 and 4-bar phrases (EDM, Impro, Rock). • Possible to define sections (e.g., 8 or 16-bar length). • Short repeated sections of *concrète* materials create rhythmic patterns. • Free.	• Playback with variable speed (keys of MIDI controller), reverse play, loop (on or off), selectable loop points, scrubbing, view waveform (groove~, waveform~, and wave~ objects). • Relate loop lengths, playback speed, accents etc. to global tempo.
Pitch	**Selection**	• Limited pitch set (Electronic, Impro). • Tonal – diatonic/major scale harmony, including modes (EDM, Rock). • Tonal with some chromatic elements (EDM, Impro, Rock). • Polytonal elements (EDM, Electronic, Impro). • Microtonal elements (Electronic, Impro). • Mostly non-pitched or indeterminate pitch (Electronic, Impro). • Pentatonic or blues scale for melodies (Impro, Rock).	• Combination of non-pitched or indeterminate pitch elements with tonal elements.	• Relate and map playback speed of samples to 12- note octave, assign to keys of MIDI controller. • Create various 'pitch' sets related to tonal framework. (Actual pitch perceived unpredictable and varies according to sample however relative frequencies the same).
	Vertical structures	• Chord structures and voicings based on extensions and alterations of diatonic harmony as per jazz style (EDM, Impro, Rock). • Somewhat random vertical alignment of pitch elements (Electronic, Impro). • Combination of discrete frequencies to form larger 'note groups' (Stockhausen, "*Studie I"*). • Range of intervals from semitone to octave utilised for melodies (all). • Mostly small intervals used in melodic phrases (EDM, Rock). • Bass plays root notes or notes of basic 7th chord (EDM, Impro, Rock).	• Ability to layer multiple voices/samples	• Ability to create up to four voice layers.

	Vertical patterning	• Static harmony or pedal point (EDM, Impro, Rock). • Repeating diatonic or non-diatonic chord progression (EDM, Impro, Rock). • Random (Electronic, Impro). • Nil (Electronic, Impro).		
	Horizontal structures and patterning	• Repeating 1, 2 or 4-bar patterns for some instruments – particularly rhythm section (EDM, Impro, Rock). • Motive development, use of sequences, diminution, augmentation etc., (EDM, Impro, Rock). • Short (1beat to 2-bar) phrase lengths combined to form 8-bar sections (EDM, Impro, Rock). • Perceived random elements (Electronic, Impro).	• Random horizontal structures.	• Automation of horizontal structures/patterning within context of interaction 'rules' (see *interaction* below).
	Dynamics	• Shifts due to texture (all). • Fairly constant throughout (all). • Peaks and troughs creating tension and release (EDM, Impro, Rock). • Application of serial procedures (Stockausen).	• Ability to adjust volume.	• Individual voice volume control (assigned to sliders on MIDI controller). • Amplitude modulation. • Master gain.
	Texture	• Basic texture includes: drumkit, bass, guitar/keyboard, (Impro, Rock). • Homogenous (all). • Thick diverse, heterogenous (all). • Major shifts marking sections or start/end of solos (all). • Staggered layering of elements (EDM, Impro, Rock).	• Range of textures possible. • Automated textural shifts possible.	• Polyphonic (4 voices). • Apply subroutine to texture changes - defined or automated.
	Timbre	• Mostly static timbres throughout (EDM, Impro, Rock). • Foregrounding of timbral transformation (EDM, Electronic, Impro). • Use of extended instrument techniques (Impro). • Multiple drum/percussion sounds, including percussive noise elements (EDM). • Timbre continuum – sine waves to white noise, inclusive of boy's voice (Stockhausen, "*Gesang der Jünglinge*"). • Exploration of minimal sound sources (Electronic, Impro, Rock). • Transformation and blending between electronic and *concrète* sources (Harvey).	• Use of static and evolving timbres.	• Timbral transformation of sound objects (via envelopes or MIDI controller mapped to processing parameters).
	Spatial elements	• Creation of 'unreal' acoustic space (all). • Placement of sounds within spatial field (all). • Multiple speakers (i.e., > 2) (Electronic). • Sound trajectories in multi speaker system (Electronic). • Evolving timbres suggesting evolving spatial movement. E.g., local to diffuse (Chowning). • Same or similar sounds placed in different parts of spatial field (EDM, Harvey).	• Multiple speaker configuration (stereo or quad). • Placement, diffusion and trajectories of individual voices definable. • Rapid panning (including at audio rate) possible.	• Send individual voices to spatialisation control where placement, diffusion and trajectories can be defined. • Audio rate panning. • Sync dynamic panning to tempo. • Map panning controls to MIDI keyboard.

		• Blurring of source of multiple timbrally similar sounds (Chadabe). • Lack of foreground/background relationships (Electronic, Impro). • Foregrounding soloists in solo/accompaniment texture (Impro, Rock). • Kick and snare drums centred (EDM, Impro, Rock). • Foregrounding vocal (EDM, Rock). • 1/16th note bass pattern, alternate left and right panning of notes (Summer). • Drums/percussion not centred, panned left and right (Davis, Hendrix). • Movement from proximate to distant of vocal (Bowie). • Changes in nature of perceived acoustic space throughout track (U2).		
	Programmatic Association	• Random, 'non-human' feel at times (Electronic, Improvised). • Repetitive, syncopated rhythmic aspects providing somatic/dance aspect (EDM, Impro, Rock). • Complex and multiple meanings possible (all). • Use of production (e.g. effects, spatialisation) to reinforce possible meanings (all). • Absence of gestural connotation due to perceived randomness of sounds (Electronic, Improvised). • Vocal fragmentation disrupts meaning (EDM, Electronic). • Speech continuum – varying degrees of comprehensibility (Stockhausen, "*Gesang der Jünglinge*"). • Use of vinyl hiss adding 'warmth' to track (EDM, Impro). • Lack of perceived formal development reinforces textural/ambient aspects of work (Chowning). • Movement from centered to dispersed achieved by range of parameters including spatialisation, instrument roles, melodic/harmonic aspects, structure and effects (Davis). • Industrial quality, pace, and density of percussive sounds contrasted by ambient nature of synth pads (Autechre).	• Random elements possible (including randomisation of sample playback and processing).	
	Structure	• Sectional with regular (i.e., multiples of four) bar lengths (EDM, Impro, Rock). • Sectional with irregular divisions (Electronic, Impro). • Strophic or Verse/Chorus/Bridge (EDM, Impro, Rock). • Free (Impro). • Rhythmic patterning forms basis of structure (Cage). • Serial procedures applied to pitch, duration and dynamics	• Possible to utilise as generator of section breaks.	• Interactive subroutines controlling changes to (e.g.,) homogenous/heterogenous texture, layering of elements, etc. (e.g., changes every 16 bars as per EDM or Rock).

		(Stockhausen, "*Studie I*"). • Structure of work in place prior to recording of *concrète* elements – electronic model used for vocalist (Stockhausen, "*Gesang der Jünglinge*"). • One constant texture with development occurring through layering and spatial aspects (Xenakis). • Overall structure of piece evolved from notion of microstructure (Chowning).		
	Interaction	• Solo/accompaniment sections with some accompaniment parts 'locked' (Impro, Rock). • Tension and release principle achieved via variety of parameters, e.g. pitch, dynamics, rhythm, texture, and/or structure (EDM, Impro, Rock). • Call and response between parts, instrumental and vocal (EDM, Impro, Rock). • Building intensity at end of sections (EDM, Impro, Rock). • Collective improvisation sections between two or more sources (Impro). • Blurring of role between soloist/accompanist (Impro). • Computer interaction (Impro). • Non-hierarchical environment (Behrman, Lewis). • On timbral and textural levels (Interface, Lewis). • Computer interaction based on rules – match, oppose or ignore (Lewis). • Importance of gestural component (Interface).	• Computer interaction on timbral (sound object), textural and structural levels. • Computer interaction based on rules – match, oppose or ignore.	• Employ computer interaction (i.e., independent computer control of some voices) with match, oppose, ignore rules (e.g., Improvised Study patch). • Interactive subroutines controlling changes to rule application, sample playback, effects, homogenous/heterogenous texture, layering of elements, etc. (e.g., changes every 16 bars as per EDM or Rock).
	Score	• Graphic score (Stockhausen "*Studie I*").		
	Presentational Format	• CD (all). • DVD (Electronic). • Radio broadcast (Cage). • Purpose built hall (Varèse, Xenakis).	• Live performance application.	

7.2 CBPI Overview

The CBPI consists of a computer running Max/MSP linked to an external keyboard MIDI controller and an external sound card. The current hardware consists of a PowerBook G4 (667 Mhz processor, 1024 MB RAM, OS 10.2.8, Max/MSP 4.5), M Box (for stereo output) or MOTU 828 (for quad output) and an Evolution MK461C MIDI controller keyboard. A series of modules developed in Max/MSP were designed to meet one or more of the functional requirements listed in the right hand column of Table 7.1. The benefits of modular design in Max/MSP are outlined in the Max software documentation (Puckette & Zicarelli, 1990 – 2005, p.279, Max 4.3 *Tutorials & Topics*) and include ease of troubleshooting, transferability of modules to other patches, and ease of use for others. A modular approach is similar to commercially available hardware and software synthesisers and samplers, where particular functions are grouped in categories such as source, modulators, effects processing, and gain controls. The ability to 'nest' patches within other patches and hide objects in Max/MSP enables the creation of a user interface where only the desired performance parameters are visible. This function is built into applications such as Pro Tools and Live however in Max/MSP the interface is completely customised.

Figure 7.2 is a screen shot of the performance interface of the CBPI. Each colour block in Figure 7.2 represents a discreet module with further sub-modules contained within some modules. The four modules on the left side of the figure (two above and two below, labeled 'One', 'Two', 'Three' and 'Four') are the sound source options, with up to four simultaneous 'voices' possible. The six modules in the top right of the figure offer various automation and modulation functions. The six modules in the lower right of the figure include external control options, tempo, external audio input, master gain, presets and an additional sound source playback module.

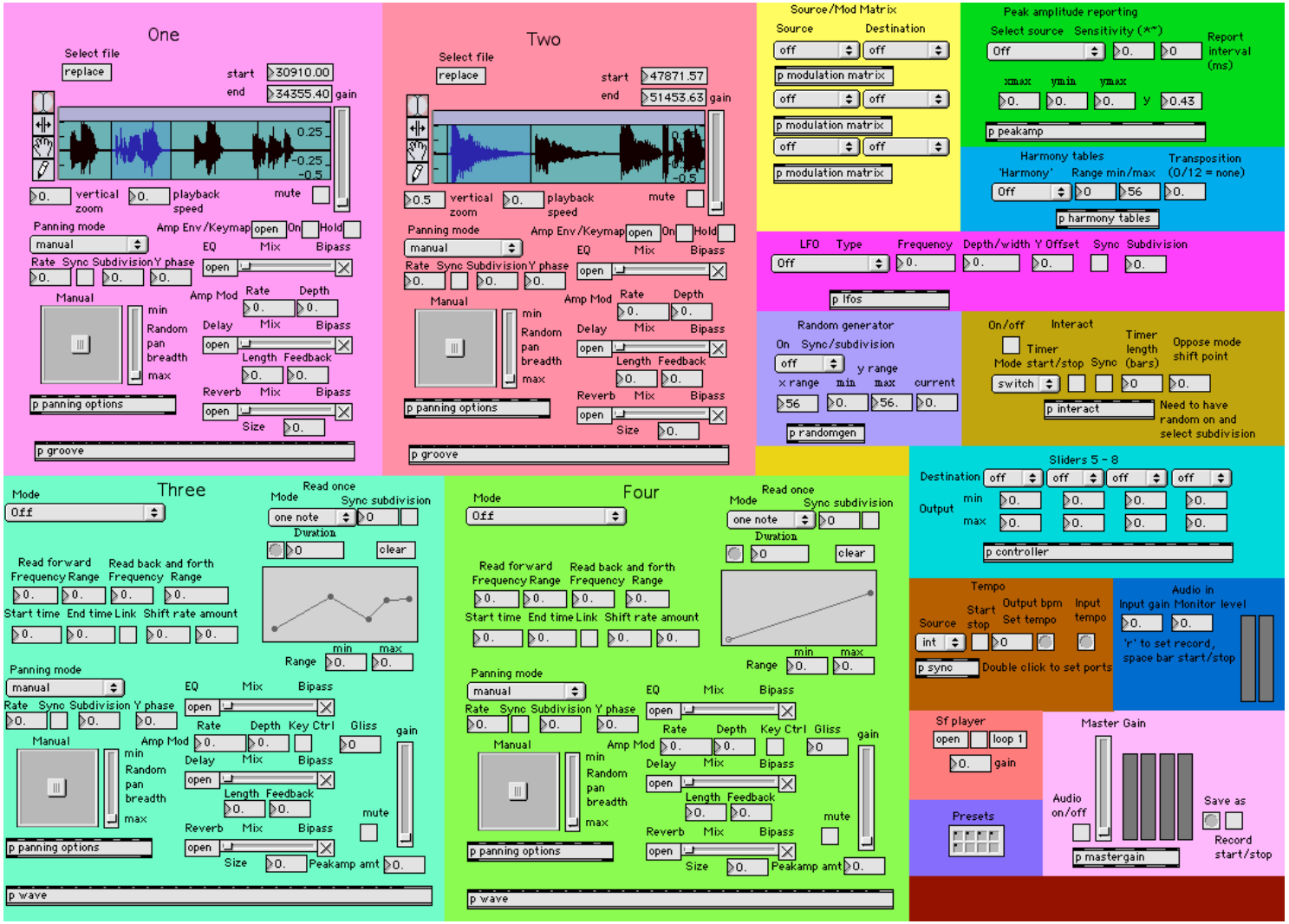


Figure 7.2. CBPI performance interface.

Table 7.2 lists each module and submodule, the function(s) and compositional method(ies) incorporated.

Table 7.2. *CBPI Modules and Sub-modules, Function(s) and Incorporated Compositional Method(s)*

Module/Sub-module (Patcher name)	**Function(s)**	**Compositional Method(s) incorporated**
Groove	Plays audio files, variable speed playback and looping.	Sound source, sound objects, pulse, rhythmic patterning, pitch selection, programmatic association.
/EQ	Filtering/Equalization	Sound object processing.
/Ampmod	Amplitude modulation	Dynamics, timbre.
/Panning options	Panning control, mode selection.	Spatial elements.
/Delay	Delay	Sound object processing, pulse, rhythmic patterning.
/Reverb	Reverb	Sound object processing, spatial elements.
/Gain	Volume control	Dynamics, spatial elements.
/Notein control	Variable speed playback of audio file via external MIDI controller, set amplitude envelope.	Sound objects, pitch selection, dynamics.
Wave	Plays audio files, variable speed playback, looping and wavetable synthesis.	Sound source, sound objects, pulse, rhythmic patterning, pitch selection, programmatic association.
/EQ, amplitude modulation, panning, delay, reverb, gain	All same as *groove* sub-modules.	
Source/modulation matrix	Enables routing of modulators/control signals.	
Peakamp	Reports amplitude peaks from selected source.	Sound object processing.

Harmony Tables	Restricts playback speed of samples to sets corresponding to various 'harmonic' constructions.	Sound objects, pitch selection.
LFO	Generates range of waveforms with type, depth and frequency parameters.	Sound objects, sound object processing, rhythmic patterning, spatial elements.
Randomgen	Generates random numbers with range, rate (related to global tempo and note subdivision) definable.	Sound objects, sound object processing, pulse, rhythmic patterning, pitch selection, horizontal pitch structures, dynamics, spatial elements.
Interact	Generates playback speed for second *groove* module based on selected relationship to first *groove* module. Four modes: match, oppose, ignore and switch. Timing parameter available for switch mode, related to bar numbers at global tempo.	Sound objects, pulse, rhythmic patterning, pitch selection, horizontal pitch structures, dynamics, structure, interaction
Controller	Enables four sliders on MIDI controller to be mapped to amplitude modulation rate on *groove* and *wave* modules or read range on *wave* modules.	
Tempo, sync	Sets internal tempo or sync to external MIDI clock source.	Pulse.
Audio in	Enables input, recording and output of external audio source.	Sound source, sound objects.
Sound file player	Plays audio files, looping.	Sound source, sound objects, pulse, rhythmic patterning.
Master gain	Audio out volume control.	Dynamics.

In the following section selected modules are discussed in detail with reference to the Max/MSP abstractions developed. The actual Max/MSP abstractions, are included in Appendix C.

7.3 Development of Sound Source Modules

7.3.1 'Groove' Module

Figure 7.3 shows the front panel of one of the two almost identical sound source 'groove' modules.

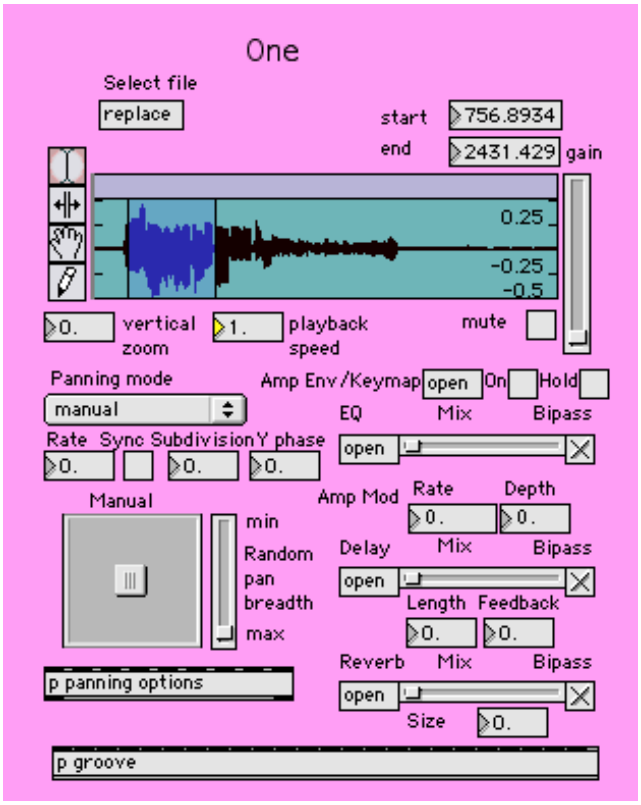


Figure 7.3. Front panel of 'groove' module.

Clicking on 'replace' and choosing the file from the hard drive selects a mono audio file (or one channel of a multi-channel file). A graphic depiction of the waveform is given in the top window and the four icons to the left represent selection, magnification and drawing tools that can be utilised in this window. The vertical slider in the top right controls volume and is mapped to a slider on the external MIDI keyboard controller.

The panning controls in the lower left are active or inactive depending on the particular panning mode selected. For example when the 'manual' mode is selected, the sound output from the module corresponds to the placement of the movable icon in the square (pictslider) below (i.e., in a four speaker, quad setup), however when another panning mode is selected the square becomes inactive. Clicking on the various 'open' boxes reveals more detailed controls for mapping playback to the MIDI keyboard controller or further parameters of the EQ, Delay and Reverb effects. Figure 7.4 shows the basic signal flow in the groove module and lists the key Max/MSP objects utilised for realisation and available control parameters. Figure 7.5 shows the hidden detail of the patcher p groove. The comments within the Max/MSP figures throughout this chapter correspond horizontally to the function of the Max/MSP object or group of objects.

Sub-module	Key Max/MSP objects	Control Parameters
Audio file playback ⇩	waveform~, groove~, buffer~	Playback speed*, selection of loop points
Equalization ⇩	filtergraph~, cascade~	Mix, multiple filters, control via graphic display
Amplitude modulation ⇩	cycle~, *~	Rate*, depth
Panning ⇩	quadpan~, cycle~	Placement/trajectories via x, y coordinates* Panning modes: manual*, cycle (cosine or square root curve), random, keyboard control*
Delay ⇩	vst~ (mda Delay)	Length, feedback, Fb tone, mix, output
Reverb ⇩	vst~ (mda Ambience)	Room size, mix, high frequency damp, output
Gain ⇩	line~, *~	Amplitude*
Keyboard gain control ⇩	notein, mtof, function, line~	MIDI note-on velocity*, amplitude envelope
Output to master gain	send~	

* Denotes control parameter assigned to external MIDI keyboard controller

Figure 7.4. 'Groove module': Sub-module flow chart.

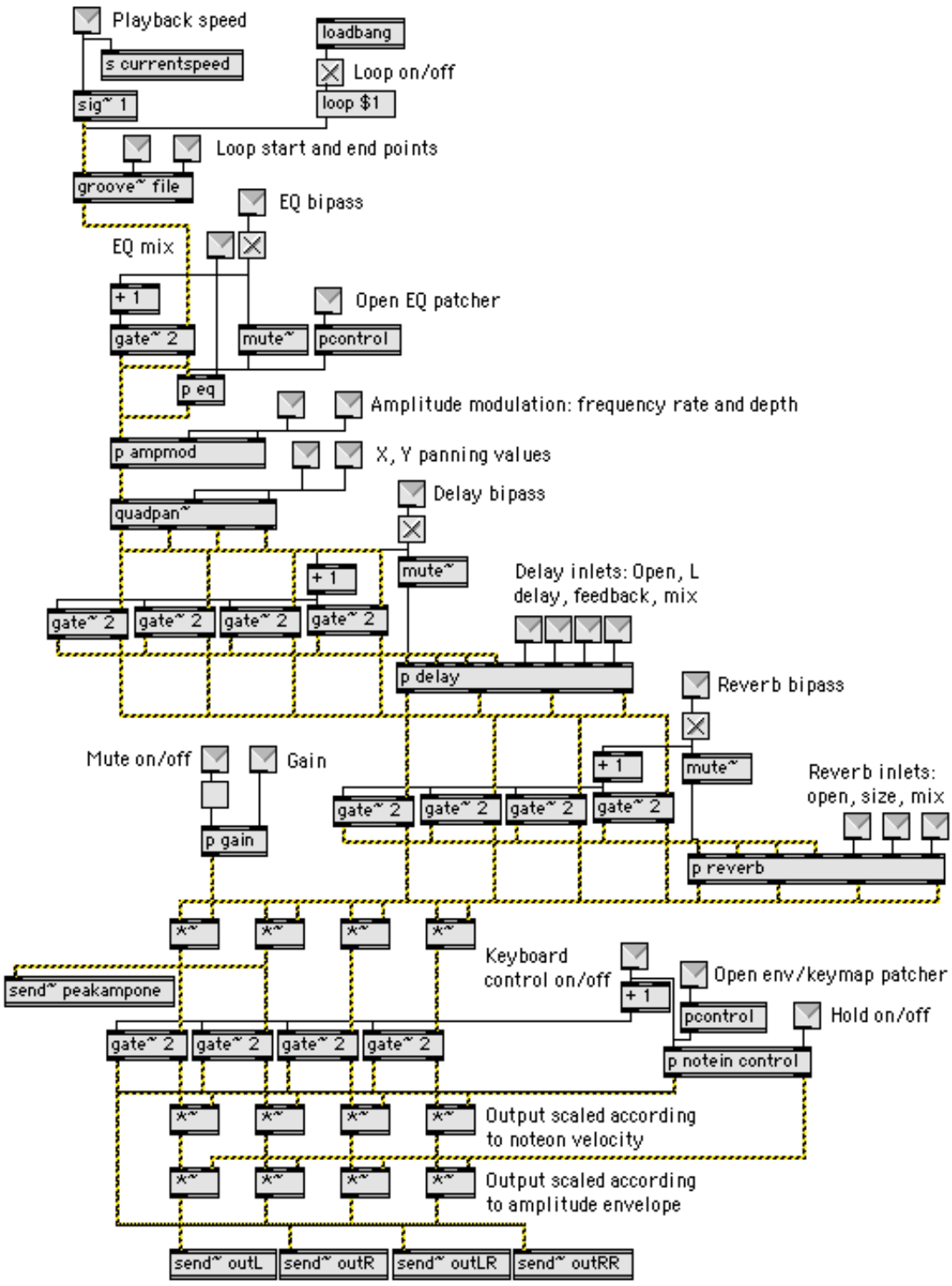
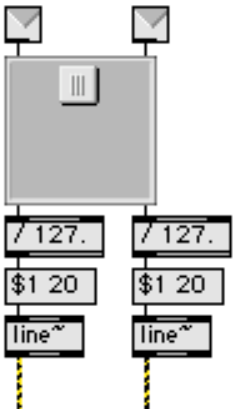


Figure 7.5. Patcher *p groove*: Hidden detail.

A float sent via the s currentspeed object in the top left of Figure 7.5 is received in the patcher p interact and enables automation of playback speed of the other 'groove'

module. The signal value sent via the send~ peakampone object on the lower left of Figure 7.5 is received in the patcher p peakamp where it can be utilised for modulation purposes (discussed in Section 7.4.2 below).

Panning of sound is realised via the quadpan~ object which takes values between 0 and 1 for both x and y panning axes. A sound perceived in the centre of a quad configuration requires x and y values of 0.5 to be input to quadpan~. One of five panning modes can be selected via the 'panning mode' menu (umenu object) on the front panel of the 'groove' module. The programming detail of each mode is contained within the patcher p panning options and Figures 7.6 to 7.10 show the detail of each mode.



Inlets from front panel

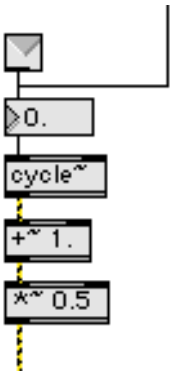
x = 0 to 127
y = 0 to 127

Scale values to 0 to 1

Target value and duration (20ms)

x and y values output to *quadpan~* via *selector~*

Figure 7.6. Patcher *p panning options*: Manual mode.



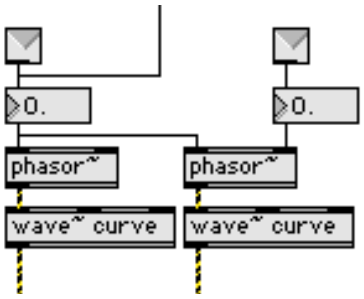
Rate: received from front panel or via sync if selected

Cosine wave, output range -1 to 1

Scale output to 0 to 1

x and y values output to *quadpan~* via *selector~*

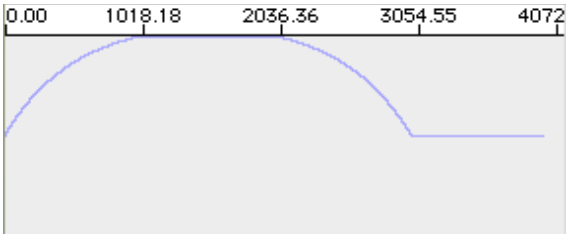
Figure 7.7. Patcher *p panning options*: Cycle mode.



Rate: received from front panel or via sync if selected, y offset received from front panel

phasor~ (0. to 1. signal) driving oscillator (*wave~*) with *buffer~* contents as shown

x and y values output to *quadpan~* via *selector~*



buffer~ contents used by *wave~* object. x axis = duration (4000ms), y axis = signal value, scale -1 to 1 (i.e., displayed curve between 0 and 1)

Figure 7.8. Patcher *p panning options*: Curve mode.

Cycle and curve panning modes are intended for rapid regular panning at speeds up to and including audio rates (i.e. greater than 20Hz). Cycle mode is most suitable to a stereo application with the x value oscillating between 0 and 1 and the y value constant. If the cycle mode is used in a quad configuration (i.e., with y oscillating at identical rate and phase) the perceived movement would be diagonally between rear left to front right speakers. The curve panning mode utilises the customised waveform shown in Figure 7.8 to generate circular movement in a quad configuration. The waveform is divided into four equal lengths with the following signal values: 0 to 1; 1 to 1; 1 to 0; and, 0 to 0. By setting the phase of the second phasor~ object (driving the wave~ curve for the y panning value) to 0.25, the following four stage x and y movement is achieved, producing an anticlockwise cycle: x = 0, y = 0; x = 1, y = 0; x = 1, y = 1; x = 0, y = 1. Various curve shapes were trialed, including trapezoidal and square root curves, with the above waveform offering the most desirable sonic results.

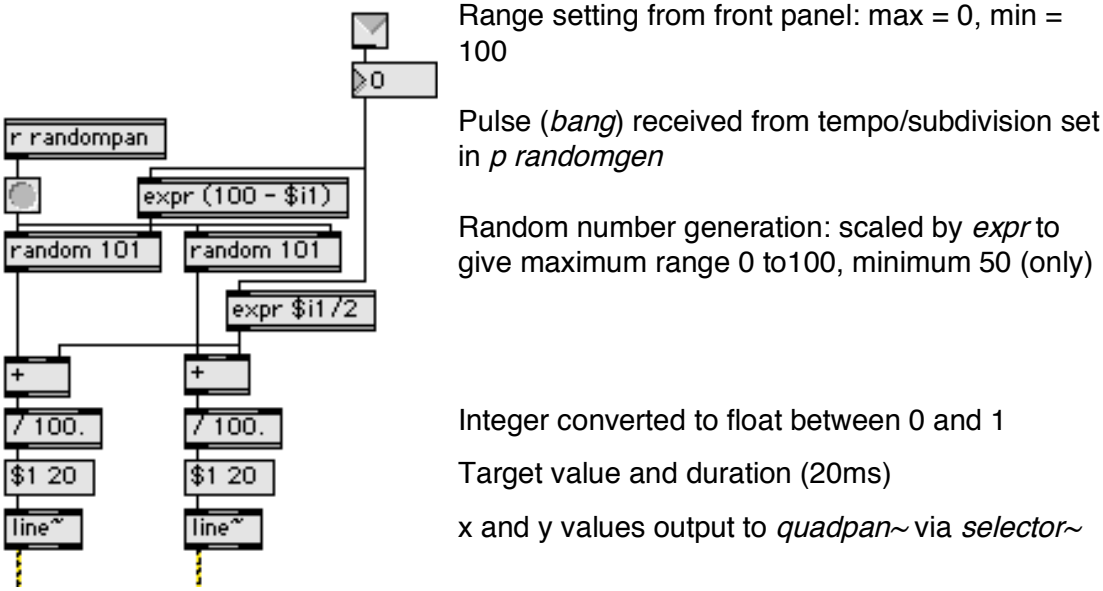
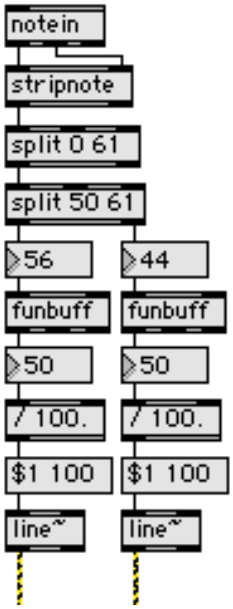


Figure 7.9. Patcher *p panning options*: Random mode.

In random panning mode, x and y values are randomly generated within a set range (slider on front panel of groove module). When the maximum range is chosen the output sound is placed at any point within the quad configuration (i.e., x and y values = 0 – 1), changing at a constant rate according to the global tempo and note subdivision selected in the patcher p randomgen. When the minimum range is chosen sound is output only to the centre (i.e., x and y value = 0.5).



Receives MIDI note information

Filters note-off (i.e., velocity = 0) messages

Filters out notes above C3 (MIDI note)

D2 – C3 notes to left, below C#2 to right

Stored set of values in left funbuff: 52 (E2) 0, 54 (F#2) 25, 56 (G#2) 50, 58 (A#2) 75, 60 (C3) 100. In right: 40 (E1) 0, 42 (F#1) 25, 44 (G#1) 50, 46 (A#1) 75, 48 (C2) 100

Integer converted to float between 0 and 1

Target value and duration (20ms)

x and y values output to *quadpan~* via *selector~*

Figure 7.10. Patcher *p panning options*: Notein mode.

Notein panning mode enables panning to be controlled via the keyboard on the MIDI controller with placement of sound along x and y axes at five equidistant points. In this mode the left hand of the performer controls panning on the y-axis by fingering notes E2, F#2, G#2, A#2 and C3, and the right hand controls panning on the x-axis fingering same notes an octave higher. Playing both G#2 and G#3 results in a sound perceived at the centre.

The keyboard of the external MIDI controller can be used for variable speed sample playback, with range, root key selection and amplitude envelope parameters available within the patcher p notein control. Figures 7.11 and 7.12 show the hidden detail from this patcher.

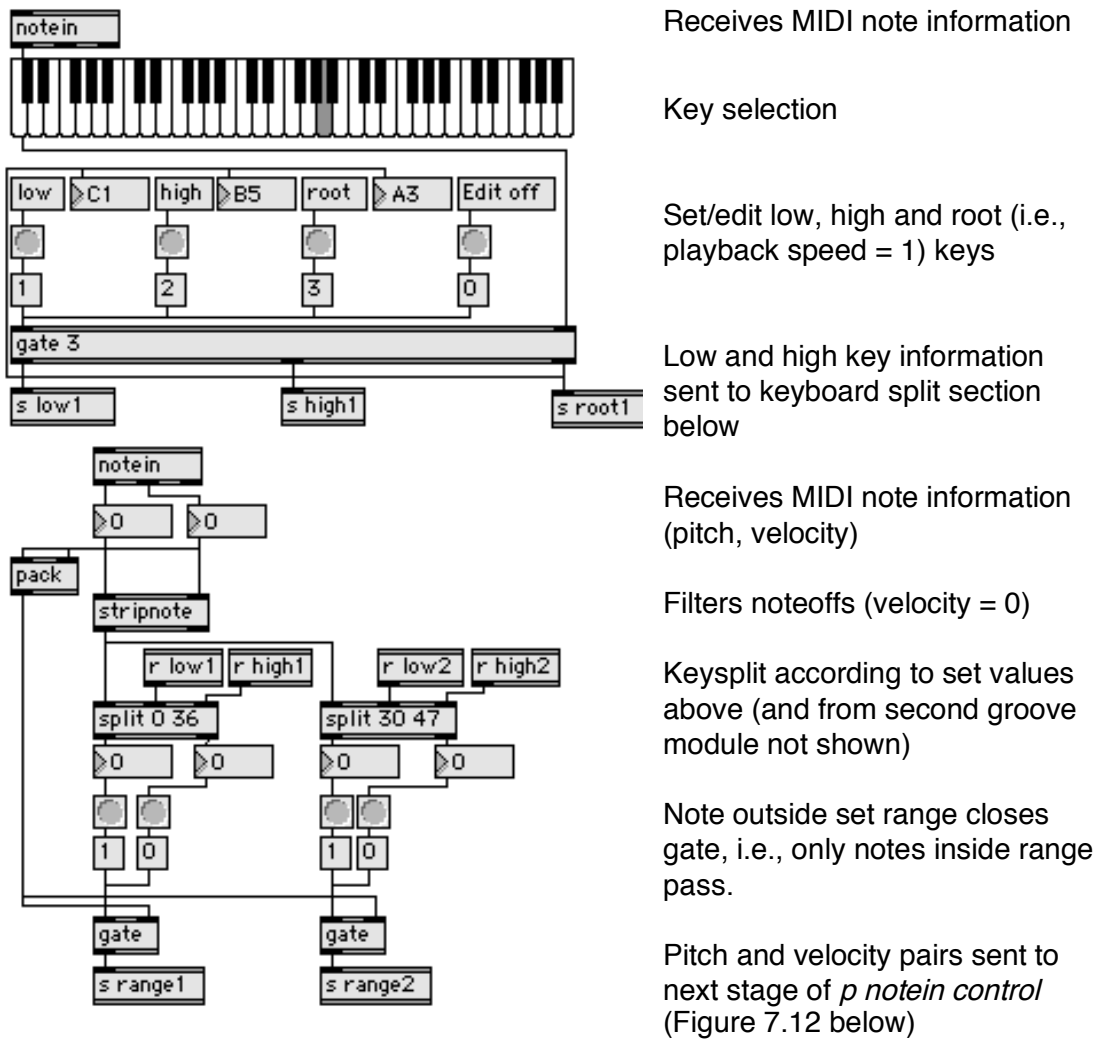


Figure 7.11. Patcher *p notein control*: Range, root key and keyboard split.

The low, high and root keys are set by clicking on the appropriate message ('low', 'high' or 'root') and then selecting the desired key either via the external MIDI controller or via the keyboard graphic (kslider) shown in Figure 7.11. Separate range and root key information can be set for the second groove module and is sent via the s range2 object in the lower right of Figure 7.11.

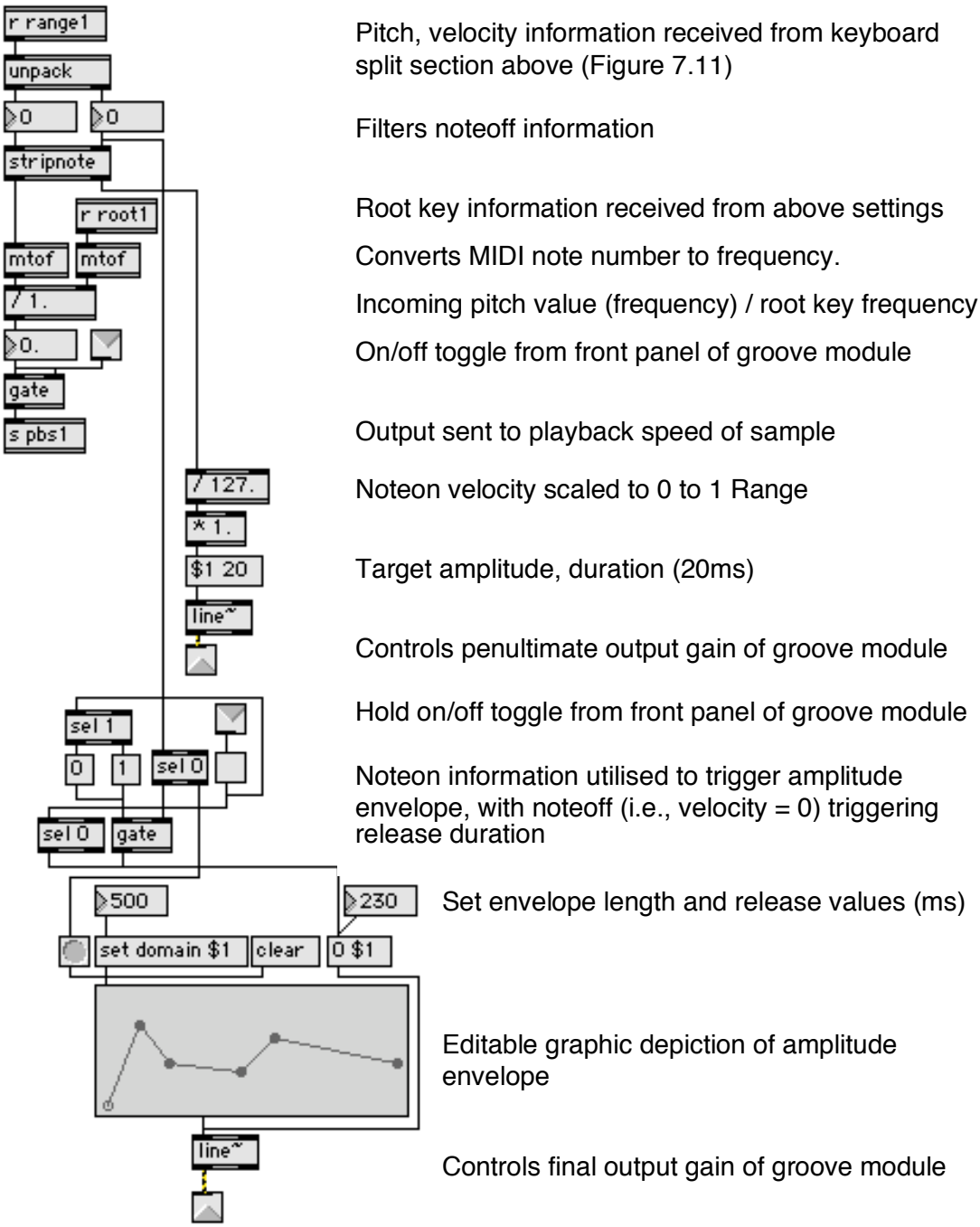


Figure 7.12. Patcher *p notein control*: MIDI to frequency conversion and amplitude outputs.

The MIDI note to frequency conversion shown at the top of Figure 7.12 scales the playback speed relative to an equal tempered scale and is taken from the MSP *Tutorial*

20 (Puckette & Zicarelli, 1990 – 2005, p. 139, MSP 4.3 documentation) Both the MIDI noteon velocity and the amplitude envelope determine the output gain of the module when the 'Amp Env/Keymap' function is on (toggle on the front panel of the 'groove' module). The release stage of the envelope is bypassed when the 'hold on' function is selected (toggle on the front panel of the 'groove' module).

7.3.2 'Wave' Module

Figure 7.13 shows the front panel of one of the two identical 'wave' modules.

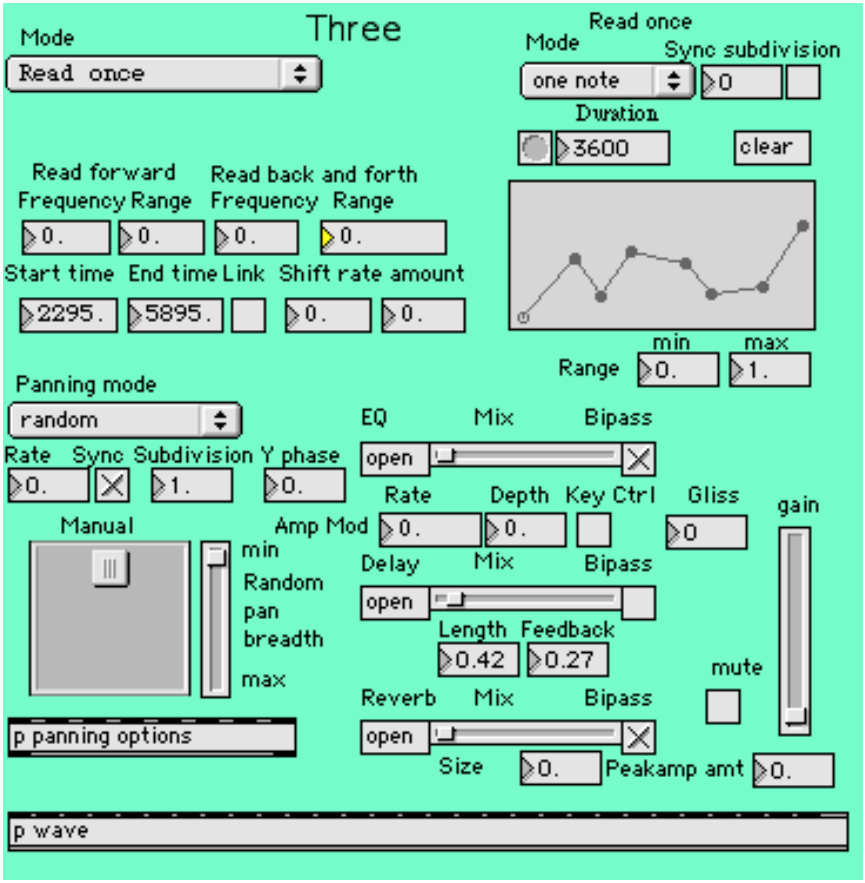
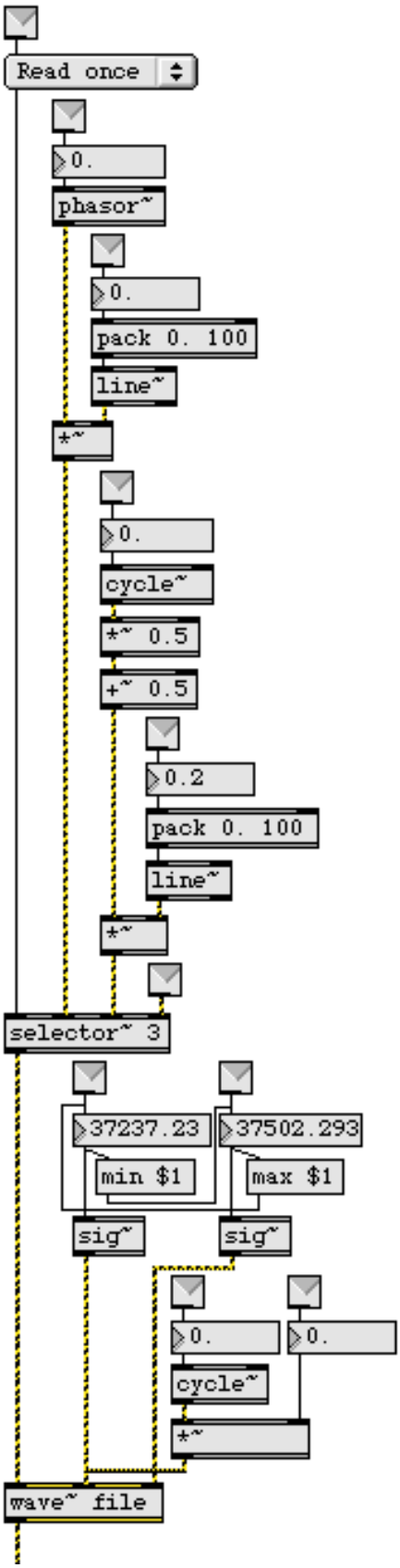


Figure 7.13. Front panel of 'wave' module.

The ‘wave’ module ‘three’ uses the same audio file selected for the groove module ‘one’ as a sound source. (‘Wave’ module ‘four’ shares the same audio file as ‘groove’ module ‘two’). The module uses the MSP wave~ object to playback a selected portion of the audio file in a direction and rate (frequency) determined by the parameters available on the front panel. Three modes of playback are available: ‘read forwards’, ‘read back and forth’, ‘read once’ and much of the programming detail for these modes is given in the MSP *Tutorial 15* (Puckette & Zicarelli, 1990 – 2005, pp. 112 – 116, MSP 4.3 documentation). An additional three modes are available within the ‘read once’ mode: ‘one note’, ‘loop’ and ‘sync loop’. When the ‘read once’ mode is selected the editable graphic display in the top right of the module determines the direction and rate of audio file playback.

The start and end points of the audio file can be selected via the ‘start time’ and ‘end time’ boxes or can be linked to the selection made via the graphic waveform display in the corresponding groove module via the ‘link’ toggle. The ‘shift rate’ and ‘amount’ boxes allow dynamic shifting of the start and end points to occur. The amplitude modulation sub-module contains additional parameters, ‘key control’ and ‘gliss’, to the corresponding groove sub-module. When selected, the ‘key control’ function enables a series of preset values for ‘ampmod rate’ to be input via the external MIDI controller keyboard. The ‘gliss’ value determines the duration (in ms) taken to reach the preset values. The panning, equalization, delay and reverb functions are identical to the ‘groove’ module. The hidden detail of part of the patcher p wave is shown in Figures 7.14 and Figure 7.15 (The remaining detail includes the sub-modules listed above and is identical to the ‘groove’ module).



Selects mode

'Read forward' mode:

Sets frequency/rate

Generates sawtooth wave (0 to 1)

Sets range (i.e., scales *phasor~* output)

Output to *wave~* object via *selector~*

'Read back and forth' mode:

Sets frequency/rate

Generates cosine wave (-1 to 1)

Scale output to 0 to1 range

Sets range (i.e., scales *cycle~* output)

Output to *wave~* object via *selector~*

Input from 'Read once' mode (see Figure 7.15 below)

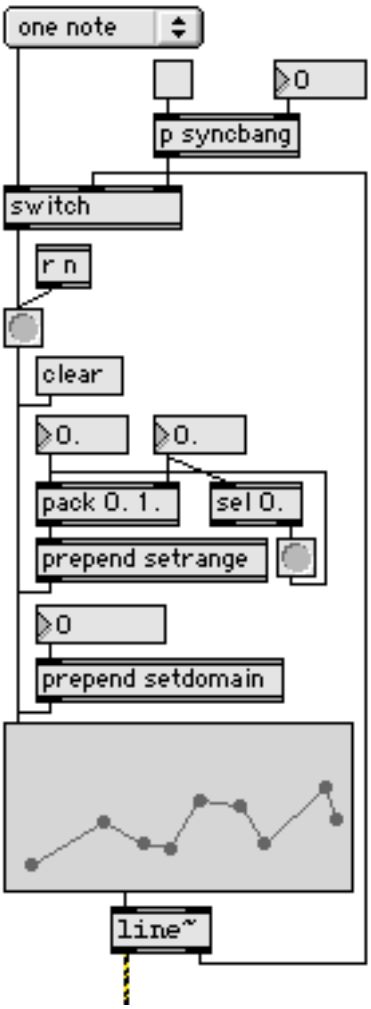
Sets start and end time of sample (ms)

Shift rate and amount

Scaled cosine output used to dynamically vary start and end points

Output sent to eq, amplitude modulation, panning, delay and reverb submodules

Figure 7.14. Patcher *p wave*: Excerpt of hidden detail.



'Read once' mode selection: 'one note', 'loop' or 'sync loop'

Sets sync on/off (to internal tempo) and selects subdivision (i.e., 1 = whole note, 4 = quarter note etc.). Bang output = tempo/subdivision.

Receives *bang* from patcher *p controller* (when 'n' key pressed on computer keyboard)

Clears graphic line setting below (*function*)

Sets range (y axis) of *function* object (min. 0 max. 1)

Bang to trigger *pack* output when either max or min values changed

Sets domain (x axis) of *function* object i.e., duration (ms)

Graphical breakpoint function editor (*function*)

Output to *wave~* object via *selector~. Bang* output of *line~* when completed, used for looping

Figure 7.15. Hidden detail of 'read once' mode in 'wave' module.

7.4 Development of Modulation, Automation and Control Modules

7.4.1 'Source/Mod Matrix' Module

The 'Source/Mod Matrix' enables the routing of source to destination information according to the following table (Table 7.3):

Table 7.3. *Source/Modulation Matrix*

Source	Destination
Random (patcher p randomgen)	Playback speed (groove module 'one')
Peakamp (p peakamp)	Playback speed (groove module 'two')
Harmony tables (p harmony tables)	Mute on/off (groove module 'one')
LFO (p lfos)	Mute on/off (groove module 'two')
	Harmony tables
	Amplitude modulation rate (groove module 'one')
	Amplitude modulation rate (groove module 'two')
	Amplitude modulation rate (wave module 'three')
	Amplitude modulation rate (wave module 'four')

In the current state of the CBPI, up to three source-destination routes can be selected and further routes could be selected by simply copying the source-destination menus (umenu objects) and patcher p modulation matrix.

7.4.2 'Peak Amplitude Reporting' Module

Figure 7.16 shows the front panel of the 'Peak amplitude reporting' module.

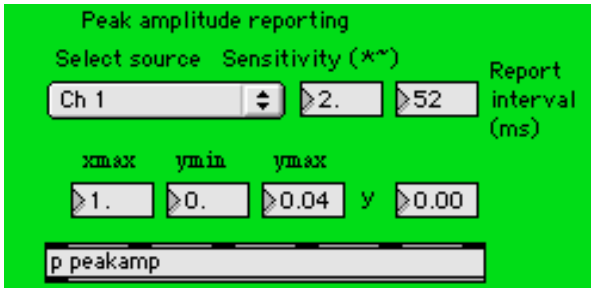


Figure 7.16. Front panel of 'Peak amplitude reporting' module.

Source options include the individual outputs of modules ‘one’ to ‘four’ or the main (master) output. The other parameters are necessary in order to scale the output signal of the module to useful values depending on the selected destination. For example, if amplitude modulation rate is selected as a destination, low (i.e., < 20) ‘ymin’ and ‘ymax’ values result in a tremolo effect and a low ‘report interval’ (e.g. 20ms) results in perceptually continuous change. Figure 7.17 shows the hidden detail of patcher p peakamp.

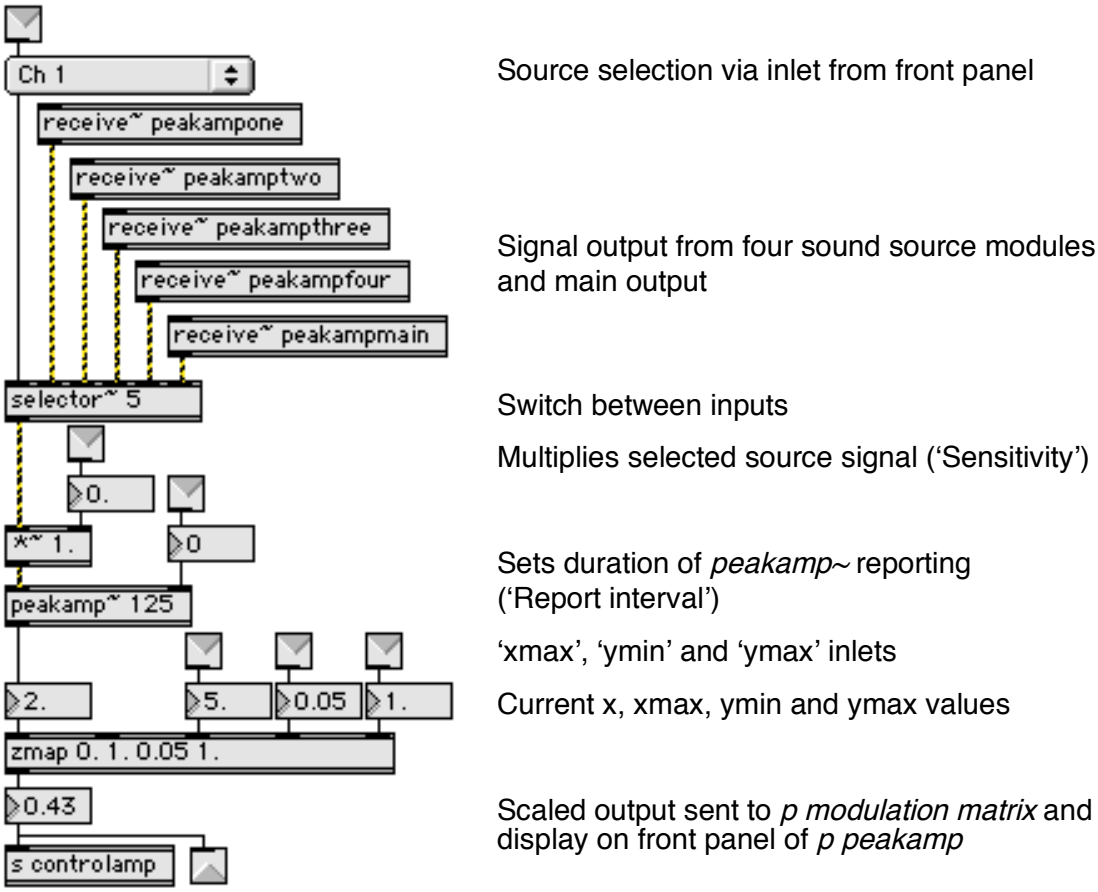


Figure 7.17. Hidden detail of patcher *p peakamp*.

7.4.3 'LFO' Module

The 'LFO' enables the selection of one of five possible wave types to be used as a modulator: sawtooth (via phasor~ object), cosine (cycle~), trapezoid (trapezoid~), pulse (phasor~ and >~) or wavetable (wave~). Whilst deriving the name from standard synthesis term, 'low frequency oscillator', the frequency range is not restricted on the 'LFO' module. The front panel enables the selection of wave type, frequency, depth (or pulse width) and offset controls. Frequency can be synced to the internal tempo at the desired note subdivision rate. Currently only one 'LFO' output is available on the CBPI but additional outputs could be made by copying the patcher p lfos and accompanying controls. Figure 7.18 shows the front panel of the 'LFO' module.

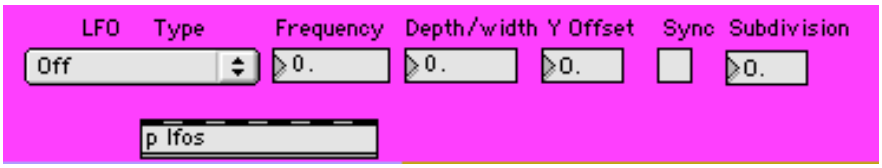


Figure 7.18. Front panel of 'LFO' module.

7.4.4 Playback Speed Automation Modules

The 'harmony tables' and 'interact' modules are used to automate the playback speed of audio files in the groove modules. The patcher p harmony tables contains fifteen stored sets of indexed frequency ratios of the following pitch patterns spread over seven octaves: major scale; melodic minor scale (ascending only); harmonic minor scale; diminished scale; pentatonic scale; chromatic scale; major triad; minor triad; augmented triad; diminished triad; suspended 4th triad; one-five (i.e., C1 – G1 – C2 – G2 etc.); fourths (i.e., C1 – F1 – Bb1 – Eb2 – Ab2 etc); minor thirds (i.e., diminished 7th

arpeggio); octaves (i.e., C1 – C2 – C3 etc.). Figure 7.19 shows the front panel of the 'harmony tables' module.

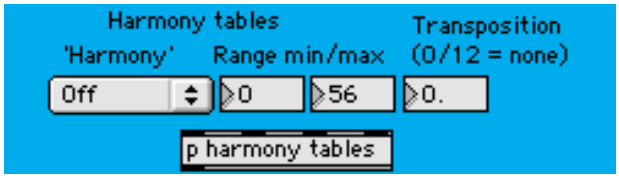
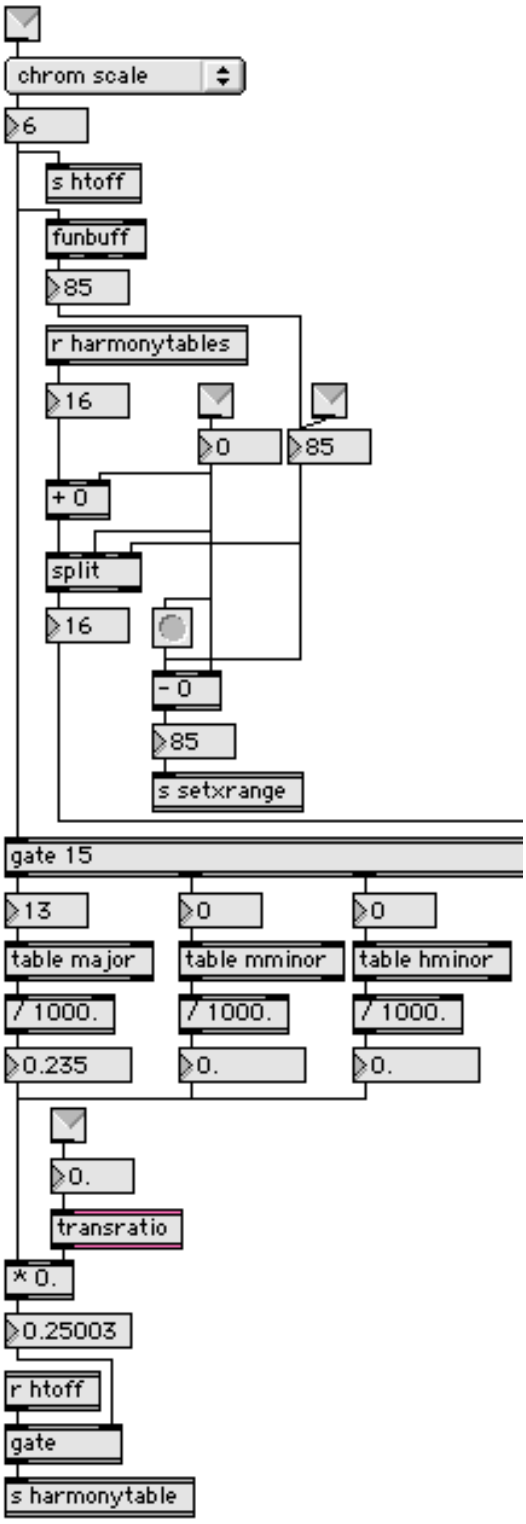


Figure 7.19. Front panel of 'harmony tables' module.

The desired 'harmony' (pitch pattern) is selected via the umenu object on the left of the module. The 'range max' value is reset for each 'harmony' and corresponds to the number of notes in the selected pitch set. For example, the 'chromatic' range is 85 and the 'octaves' range is 9. Adjusting the 'range min/max' values further constricts the output range. The 'transposition' value enables coarse and fine-tuning of the output with an integer corresponding to semitone ratio, i.e., a float enables tuning of less than a semitone.

The output of the random module is used to supply a constant stream of integers to the 'harmony tables' module at a rate determined by the tempo/subdivision settings on the random module. The range of possible numbers is restricted to the corresponding range of each harmony table. With each integer input, an output value from the selected 'harmony' set is sent to the playback speed of the groove modules. Figure 7.20 shows the hidden detail of the patcher p harmony tables.



Selects ‘harmony’

Sent to *r htoff* object below

Outputs stored range value corresponding to ‘harmony’ selected

Integer received from patcher *p modulation matrix*

Range min. and max. values from front panel

Restricts output according to set range

Current range max. sent to patcher *p randomgen* restricting random number generation

Integer into right inlet of *gate* object, output to selected ‘harmony’ above

Stored sets of frequency ratios (other 12 table objects not shown)

Integer output scaled to float

Transposition value received from front panel. (*transratio* object from Puckette & Zicarelli, 1990 – 2005, 4.5 ‘examples’/ ‘pitch-to-freq ratio’ folder)

Ratio scaled according to transposition value

0 turns off output

Output to playback speed of groove module via patcher *p modulation matrix*

Figure 7.20. Hidden detail of patcher *p harmony tables*.

The ‘interact’ module is a modified version of the patcher used for the Improvised Study. Using the current playback speed of the first groove module as a reference, the

‘interact’ module controls the playback speed of the second ‘groove’ module according to a selected rule. In the Improvised Study and in the CBPI, four interactive modes (’rules’) are available: match, oppose, ignore and switch (see Figure 5.7). The ‘interact’ module for the CBPI refines the ‘oppose’ mode and adds a timer function. Figure 7.21 shows the front panel of the ‘interact’ module.

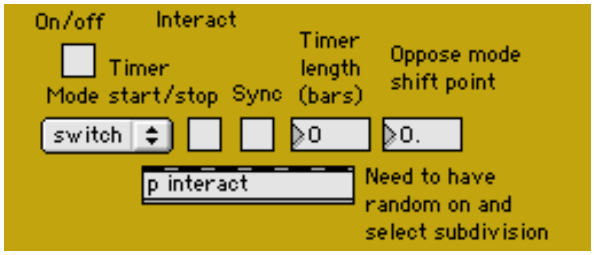


Figure 7.21. Front panel of ‘interact’ module.

When ‘match’ mode is selected the playback speed for the second ‘groove’ module (*2ps*) is a factor or multiple of the playback speed of the first ‘groove’ module (*1ps*) (i.e., 0.25, 0.34, 0.5, 0.67, 0.75, 1, 1.5, 2, 3 or 4 times *1ps*). The ‘Oppose mode shift point’ provides an offset for the calculation of output playback speed when the ‘oppose’ mode is selected. In this mode the playback speed for the second ‘groove’ module is determined by the following calculation: 0 – *1ps* + oppose mode shift point. When the ‘ignore’ mode is selected, *2ps* changes by a semi-random amount (using Max drunk object) at a rate determined by the global tempo and note subdivision selected in the random module. In ‘switch’ mode the interact module switches between ‘match’, ‘oppose’ and ‘ignore’ rules at a regular intervals according to the timer settings. With ‘sync’ on, the ‘timer length’ enables the ‘switch’ mode to be synced to the global tempo with changes occurring after a set number of bars (assuming a 4/4 metre). (i.e., the ‘switch’ mode requires the timer to be on).

7.4.5 'Random' Module

Figure 7.22 shows the front panel of the 'random' module.

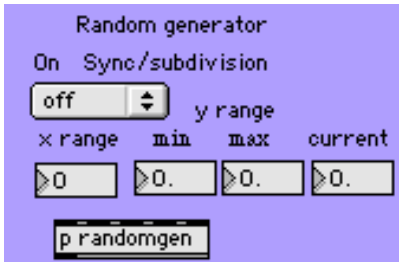
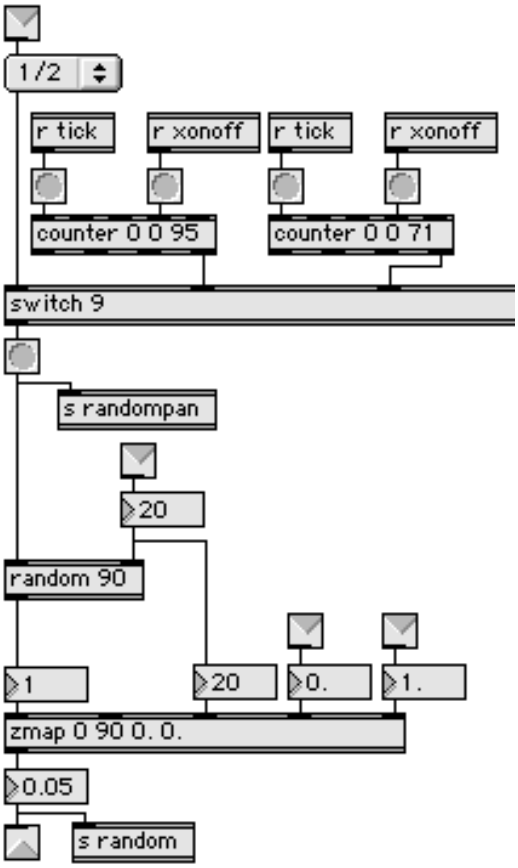


Figure 7.22. Front panel of 'random' module.

The 'random' module outputs random floats at a rate and within a range determined by the parameters on the front panel shown in Figure 7.22. The rate is determined by the current global tempo and selected note subdivision with nine note subdivisions available: whole note, dotted half note, half note, dotted quarter note, quarter note, dotted eighth note, eighth note, sixteenth note and thirty-second note. The 'x range' determines the range input to the Max random object. The 'y range' (min. and max.) scales the output of the random object to within a set range using the zmap object. Figure 7.23 shows the hidden detail of the patcher p randomgen.



Selects note subdivison and turns on 'random' module

Receives MIDI real-time messages: 'tick' (i.e., 24 ticks per beat at set tempo), 'xonoff' (start/stop)

Outputs bang if set number of ticks counted, i.e. 96 ticks = 4 beat note, 72 ticks = 3 beat note etc. (other subdivisions not shown)

Pulse (*bang*) output at rate corresponding to selected note subdivision. (Sent to 'panning' and 'interact' modules)

Sets 'x range', i.e. range of random numbers to be output from *random* object

Input to be scaled according to 'y range' values input on front panel

Scaled output sent to front panel and patcher *p modulation matrix*

Figure 7.23. Hidden detail of 'random' module.

7.4.6 'Tempo' Module

Global tempo is set via the 'tempo' module and can be synced to external MIDI devices. The front panel, shown in Figure 7.24 allows internal/external sync selection, tempo (bpm) and start/stop with a flash indicating current beat (bang object). The hidden detail of the patcher p sync is shown in Figures 7.25 and 7.26.

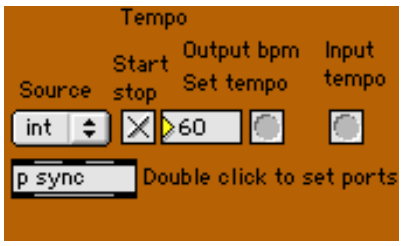
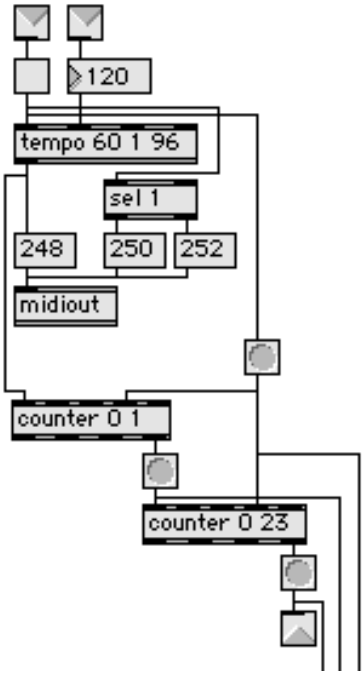


Figure 7.24. Front panel of 'tempo' module.



Inlets from front panel: start/stop, tempo (bpm)

Default tempo settings: bpm = 60, beat multiplier = 1, divisions of whole note = 96 (i.e., = MIDI clock, 24 ticks per beat)

Output MIDI real-time messages (248 = clock, 250 = start, 252 = stop) to external MIDI device

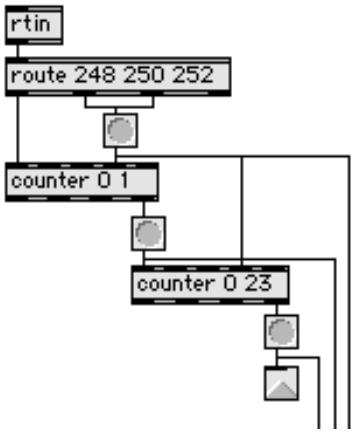
Bang to reset *counter* objects on start/stop (for sync)

Outputs one *bang* per tick

Outputs one *bang* per 24 ticks, i.e., per beat

Tick, beat and on/off *bangs* sent to timed/synced modules via *switch* object

Figure 7.25. Hidden detail of internal sync portion of patcher *p sync*.



Receives MIDI real-time messages from selected external source

Clock, start and stop messages routed to *counters*

Outputs one bang per tick

Outputs one bang per 24 ticks, i.e., per beat

Tick, beat and on/off *bangs* sent to timed/synced modules via *switch* object

Figure 7.26. Hidden detail of external sync portion of patcher *p sync.*

7.4.7 Audio Output and Input Modules

The 'audio in' module uses the MSP adc~ object to receive incoming audio via the selected sound input/device. Input and monitor gain controls are available on the front panel and incoming audio can be recorded via the sfrecord~ object. The 'r' key is used

to set file name and location (i.e., triggers 'open' message to sfrecord~) and the space bar starts and stops recording. The output of the 'master gain' module can also be recorded, with 'save as' and 'record start/stop' controls available on the front panel. Recorded audio can be replayed via the 'groove' or 'wave' modules or via the 'Sf player' module. The 'Sf player' uses the sfplay~ object for audio file playback and audio file selection ('open'), start/stop and loop on/off controls are available on the front panel. The 'Sf player' is intended as a rehearsal/compositional module where pre-prepared loops can be played or recordings of the system output or audio input can quickly be auditioned.

7.4.8 External Control via MIDI Controller

External control of selected parameters is available according to Table 7.4. The mapping of various parameters to knobs, sliders and keys of the MIDI controller is ongoing subject to performance/composition experimentation. The following table represents the current state of the CBPI.

Table 7.4. *External Control Mapping of CBPI*

Module	Parameter	External control source	Status
Groove 'One'	Playback speed	MIDI Controller (MC) keyboard	Optional
		MC slider 5	Optional
	Gain	MC keyboard	Optional
		MC slider 1	Fixed
	Panning	MC keyboard	Optional
		MC knobs 1(x) and 5(y)	Fixed
	Ampmod rate	MC slider 5,7 or 8	Optional
Groove 'Two'	Playback speed	MC keyboard	Optional
		MC slider 6	Optional
	Gain	MC keyboard	Optional
		MC slider 2	Fixed
	Panning	MC keyboard	Optional
		MC knobs 2(x) and 6 (y)	Fixed
	Ampmod rate	MC slider 6,7 or 8	Optional
Wave 'Three'	Gain	MC slider 3	Fixed
	Panning	MC keyboard	Optional
		MC knobs 3(x) and 7 (y)	Fixed
	Read range ('forward' or 'back and forth' modes)	MC sliders 7 or 8	Optional
	Note on ('read once' mode)	Computer keyboard: 'n'	Fixed
	Ampmod rate	MC slider 7 or 8	Optional
		MC keyboard	Optional
	Ampmod rate gliss	MC knob 11	Optional
Wave 'Four'	Gain	MC slider 4	Fixed
	Panning	MC keyboard	Optional
		MC knobs 4(x) and 8(y)	Fixed
	Read range ('forward' or 'back and forth' modes)	MC sliders 7 or 8	Optional
	Note on ('read once' mode)	Computer keyboard: 'm'	Fixed
	Ampmod rate	MC slider 7 or 8	Optional
		MC keyboard	Optional
	Ampmod rate gliss	MC knob 12	Optional
Audio in	Record: set location/file name	Computer keyboard: 'r'	Fixed
	Record: start/stop	Computer keyboard: space bar	Optional
Master gain	Gain	MC slider 9	Fixed

The front panel of the ‘control’ module is shown in Figure 7.27.

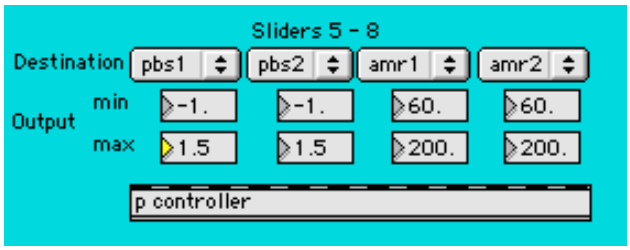


Figure 7.27. Front panel of ‘control’ module.

The patcher p controller contains most of the hidden detail of the control assignments with some control objects hidden on the front panel. Controls with status indicated as ‘optional’ in Table 7.4 are selected either by toggles on the particular module or via the umenu objects (‘Destination’) on the front panel of the control module. The zmap object scales the output of the MIDI controller sliders and knobs (i.e., 0 to 127) linearly according to the requirements of the selected destination. Scaled minimum and maximum values can be set for the sliders 5 to 8 via the front panel of the ‘control’ module.

7.5 System Testing

The system testing of the CBPI can be considered in four stages:

1. Module function
2. Exploration of sonic outcomes of module
3. Exploration of optimum control means
4. Live performance

Whilst the CBPI discussed in this chapter was only completed prior to the development of the major works, prototypes of some of the modules had been developed and trialed

in live performance situations. Thus some of the modules (e.g., the 'groove' and 'interact' modules) have been through the above four stages a number of times whereas other modules (e.g., the 'wave' and 'harmony tables') are 'version 1.0'. The following section will briefly consider each of the above stages and provide relevant examples.

7.5.1 Module Function

The primary concern at this stage is to ensure that the module does what was intended and in the most efficient manner. To this end, the Max/MSP documentation (Puckette & Zicarelli, 1990 – 2005) provides a myriad of tutorials and examples that assist identification of suitable objects/programming. One problem encountered included the need to remove audible clicks when the mute on/off toggle was selected on the sound source modules. This was solved by adding a line~ object with a 20ms duration, i.e., adding a 20ms fade in and out when 'mute' was selected.

Establishing a stable sync via MIDI clock between the CBPI and another computer running Ableton Live proved a particularly lengthy task. When the CBPI was selected as the master, Live ran steadily until I opened or closed windows on the CBPI, at which point the sync was lost. This problem remains and I redesigned elements of the front panel so as to limit the need to open/close windows. When used as a slave, my initial CPBI sync module involved a somewhat complex calculation to derive a number value for bpm from the incoming series of bangs representing ticks (MIDI clock) that was input to the tempo object. However, when trialed with a constant tempo provided by Live, the number value in my sync module constantly fluctuated up to five bpm either side of the source bpm. On revisiting the sync module some days later, a far simpler and

secure solution was arrived at by inputting the incoming bangs directly into various counter objects to give tick and beat values where necessary.

7.5.2 Exploration of Sonic Outcomes of Modules

A bottom up play process was undertaken to explore potential sonic outcomes of both individual modules and various combinations of modules. In addition to the various parameters available in each module, various sound sources (including instrumental, vocal, and environmental sounds) were trialed. This exploration began with a 'one sound – one parameter' limitation, (i.e., I initially attempted to get desirable/interesting results with minimal processing) and I gradually adjusted more parameters to either fine tune a particular sound or to investigate other possibilities. Desirable/interesting sounds were immediately recorded and a screen shot taken to capture the various parameter values. The recorded excerpts were reviewed later and selected excerpts formed the basis for some of the material used in the major works.

7.5.3 Exploration of Optimum Control Means

The mapping of parameters to the external MIDI keyboard controller involved a similar bottom up process to the exploration of sonic outcomes. Having established which parameters produced desirable/interesting results when used dynamically with the computer mouse, keyboard and trackpad, alternative control mappings were trialed. For example the dynamic panning of sounds in various trajectories was attempted first via the computer mouse (within the pictslider object on the front panel of the CBPI), however I was unable to develop a suitable technique to adequately control the

movement. The x and y panning controls were then mapped to two knobs on the MIDI controller and whilst providing more tactile access I quickly developed wrist and arm pain related to an ongoing RSI-type injury. A third and satisfactory solution was found by mapping the x and y panning values to the MIDI controller keyboard (as described in section 7.3.1, and Figure 7.10, above) whereby my existing keyboard technique could be applied to the performance of dynamic panning.

I see the development of control means as an ongoing exploration and the current control mapping does not necessarily represent the most optimum. The current external MIDI controller was selected and purchased relatively early in the development of the CBPI and in hindsight offers a somewhat limited set of options. Having discovered, for example, the ergonomic deficiencies of both the knobs and sliders on the current MIDI controller, future hardware will be examined with a more thorough working knowledge of the performance requirements.

7.5.4 Live Performance

Prototypes of the groove module were utilised in live improvised performance settings in Townsville, QLD (at the *See Hear Now* Festival, October, 2005), Lismore, NSW (with Cyberbass Ensemble at Southern Cross University, April, 2006) and Adelaide, SA (at the *Australasian Computer Music Association Annual Conference,* offsite performances in July, 2006). In the first two performances live audio input was recorded and looped sections were played back. The instrumentation (double bass, saxophone and computer) lack of structure (freely improvised) and length of performance (one hour) at the *See Hear Now* Festival was well suited to the somewhat

hypnotic minimalist looped elements and after some time an alternation between sections of live instruments and loop elements from the groove module produced a satisfying performance.

The need for a more immediate and responsive interface was made apparent with the performance with Cyberbass Ensemble. For this I was effectively 'sitting in' with an established band featuring instrumentation of electronic drumkit, drumkit, bass, violin, and samples, and existing structures for each piece. I used the violin as an input source and prepared loops monitoring with headphones before outputting to the front of house speakers. However, numerous times I prepared loops but when ready to output, the piece had moved to a texturally different section or seemed complete as is, so I remained tacet for much of the performance.

A solo performance at the offsite venue of the ACMA conference highlighted the need for soundchecking through a PA prior to performance and normalising all samples. After a delayed start and minimal setup time, the monitoring levels of my headphones (with which I had prepared initial loops) was significantly louder than and the output of the venue PA. In an effort to increase my volume output to the PA, I mistakenly typed '30' instead of '3' into the master gain value number box causing an immediate sonic eruption. Needless to say the next version of the groove module had a maximum value limit on this parameter.

The development of the CBPI is ongoing and the version discussed here was used in the development of the major works discussed in the following chapter. Further reflections on the CBPI are presented in Section 9.4.

CHAPTER EIGHT

DEVELOPMENT OF MAJOR WORKS

This chapter presents the development and realisation of four major works utilising selected compositional and improvisation strategies identified in the analysis of selected key works in the four genres discussed in Chapters Five and Six. The major works represent some of the potential output of the CBPI and are intended to provide exemplars of a trans-genre approach to music creation containing compositional elements identified in the analysis of the selected key works. In order to further explore the potential and limitations of the analytical methodology developed for this study, the discussion follows the format of the genre analyses and studies, i.e., an exposition of the *shaping factors* and *inputs* involved in the creation of the works. Recordings of the four major works are provided on the accompanying DVD.

8.1 Key Shaping Factors

The four major works, “Hit”, “Scrape”, “Click” and “Drag”, were conceived, developed and realised as a series featuring a fixed set of performers and instrumentation and as such can be considered as one set when considering the *shaping factors*. Particular *resonances* observed in shaping the creation of the major works are listed in Table 8.1. The genre/s in parentheses for each item indicates that the element is applicable to more than two works from that genre. Where whole genres are not applicable individual artists or groups are listed.

Table 8.1. *Resonances Observed Between Factors Shaping Selected Key Works Analysed and Factors Shaping the Creation of the Major Works*

Parameter			Resonances
Musical	**Theoretical**		• University music study (Electronic, Impro). • Need for expanded sound palette (Cage, Schaeffer, Varèse).
	Practical	**Technical**	• Computer interactivity (Behrman, Chadabe, Lewis). • Use of computer as tool which effects creation process (Chadabe). • Belief in 'amorality' of technology (Behrman). • Use of control tape for presentation (Varèse). • Tools for realisation include digital version of early tape studios. E.g., microphone, recorder, mixer, tape editing, etc. (Schaeffer, Stockhausen, Varèse, Xenakis). • Studio used as creative site, i.e., song not completely written/prepared prior to recording (all genres).
		Play	• Long history of live performance (Impro, Rock) • Interest in performer autonomy, i.e., breakdown of traditional composer/performer split (Impro). • Experimentation with sample loops (Beatles). • Jamming to pre-specified chord changes to build bed track (Bowie). • Previous experience playing in rock, jazz and fusion bands on acoustic instruments (EDM, Impro, Rock). • Emphasis on 'playing' with equipment/technology to find desirable sounds and building tracks from those sounds (Autechre, Chemical Brothers).
		Practice	• History of performance and recording prior to making track (Impro, Rock).
	Listening		• Electronic works (Chowning, Stockhausen). • Acknowledged range of influential music styles (Davis, Douglas, Hancock, Oliveros, Pine). • Interest in environmental sounds (Oliveros).
Other	**Environmental**	**Macro**	• Acknowledged desire to reflect current social/culture climate, particularly popular aspects (Davis, Hancock, Pine, Oliveros). • Interest in exploring experimental means (Lewis – AACM). • Institutional support for new technologies (Chowning, Harvey, Schaeffer, Stockhausen, Subotnick, Varèse, Xenakis). • Aesthetic shaped by environmental sounds (Harvey, Xenakis). • Living outside major cities/cultural centres, cultural isolation of Detroit encourages imagination (May).
		Micro	• Live performance in studio setting (Impro, Rock).
	Budget/ Resources		• Use of public institutional studio facilities (Chowning, Harvey, Schaeffer, Stockhausen). • Extensive access to studio and recording facilities (Rock).
	Intended Audience		•
	Timeframe		• Initial recording of live performance in matter of day/s (Impro).

At a *theoretical* level, the major works are informed by my previous university education experiences (see Section 2.4) and are made in the context of a postgraduate research degree. At a *practical* level, particular *technical* factors have been incorporated into the CBPI via the 'interact' and 'peakamp' modules, modules that are utilised in "Scrape". As discussed in Section 5.2.5, the 'interact' module incorporates, at a conceptual level, the 'match', 'oppose' and 'ignore' rules utilised in Lewis' "Voyager".

The development of the 'peakamp' module, firstly for the Electronic Study, and secondly for the CBPI is conceptually related to Varèse's use of a control tape for the presentation of "*Poème Électronique*".

Play constitutes an important *shaping factor* in the development of all the major works and occurred at three stages: firstly, exploring the CBPI; secondly, in developing the major works; and, thirdly, in the selection of, and rehearsal with performers. As discussed in Section 7.5, the system testing of the CBPI was undertaken as a bottom up play process, involving the exploration of sonic outcomes and optimum control means. This follows the processes common to the EDM genre, explicitly outlined by Autechre and Chemical Brothers (see 6.2.3). In developing individual parts for the major works I worked in a largely bottom up manner, building the various instrumental parts in a step-by-step fashion utilising multiple tracks in Pro Tools. This process, similar to that utilised in the development of the EDM Study, involved playing along to short loops of existing parts on keyboard (with synthesised versions of the desired instrumental sound), gradually editing, refining and finally notating each part.

The criteria for the selection of the six performers for the major works include my desire to have performers with improvisation skills and with whom I had extensive experience. These two factors resonate with collaborative creative processes utilised in Rock, EDM and Improvised genres such as those listed in the *play* parameter in Table 8.1. Three of the performers are from Townsville: Ian Brunskill (percussion), Rebecca McHutchison (saxophone, vocals, keyboards) and Simon Self (guitar), with whom I have played in various contexts ranging from experimental improvisation to funk and jazz covers. The other three performers are from the Lismore area: Barry Hill, Cleis

Pearce and David Brammah, with whom I have also worked in a range of contexts (discussed in 2.4). Almost all of the material played for the major works was new to the performers, a situation that reflects the typical context of rock bands and improvised music ensembles developing new works discussed herein.

Important *environmental*, *budget/resource* and *timeframe* factors also resonate with the various *shaping factors* emerging from the analysis of the selected key works. Whilst conceivable outside an institutional context, the development of the major works relied heavily on university resources and facilities, echoing the historical link between public funds and exploration of new technologies apparent in most of the electronic works analysed here. The extent to which living outside major metropolitan centres impacts on the creation of music is somewhat contentious.[12] Nevertheless, living outside of a major metropolitan centre is listed as an *environmental* factor in Table 8.1 as a resonance with May's account of living in Detroit in 1985 and the impact of this on his imagination prior to the development of techno. The rehearsal, performance and recording stages of the production of the major works was completed in five days and intentionally designed to mirror the *timeframe* for many of the improvised works analysed herein. Rehearsals were conducted in a private house on Magnetic Island with the four NSW participants (including engineer, Michael Worthington) staying at the rehearsal venue. Mixing and mastering of the recordings was completed in three days at Michael Worthington's home studio in Lismore, NSW.

[12] For example most of the performers have spent a large amount of time in major cities and many of my own musical influences originate from Europe and USA (discussed in 2.4). Cultural isolation as experienced in 1985 has diminished greatly over 20 years through internet, online music distribution and airfare price reductions. However differences still remain between major metropolitan and many regional areas with regard to the live music scene, particularly for experimental and improvised styles.

8.2 Key Inputs

A summary of the compositional methods identified in the analysis of the selected key works is given in Chapter Seven (the second column of Table 7.1) and constitutes the storehouse from which the major works were developed. A text summary of the key inputs for the major works follows and a detailed table for each major work is included in sections 8.3.1-4.

In terms of *inputs*, the *sound sources* for all the major works involved a combination of acoustic and electronic instruments with sampled and synthesised elements. A conceptual framework for the four works was given by using gestures associated with sound production from both old (e.g., acoustic instrument – hit and scrape) and new (e.g., computer – click and drag) technologies as titles: “Hit”, “Scrape”, “Click”, and “Drag”. The sound sources utilised by the CBPI for each work derived from the title, with three quite literal and one obscure reference. “Hit” features glockenspiel samples, “Scrape” features bowed violin samples and “Click” features saxophone key clicks. “Drag” features guitar samples, a reference to my own interest in, but physical difficulty in playing guitar (due to injury), leading to the phrase, ‘a drag’. The selection of acoustic and electronic instruments (violin, alto saxophone, guitar, bass, electric piano, percussion) was determined by the selection criterion for performers (see above) in conjunction with my stylistic preferences (e.g., the influence of key genres discussed in Chapters Five and Six). The selected performers and instruments provided a balance of soloist and accompaniment possibilities and a range of instrumental, vocal and electronic/sampled timbres.

The range of *sound objects* and *sound object processing* from the CBPI emerged from the bottom up play process described in Chapter Seven. Variable speed and reverse playback of samples combined with delay and amplitude modulation provided the predominant means of *processing* utilised in the CBPI. The drum samples featured a range of processing common to both rock and electronic dance music genres including compression, gating, filtering, bit reduction and delay. Some parameters of these effects were changed in real time performance, most notably filter sweeps. The electric bass and guitar utilised outboard effects including delay, chorus and distortion with guitar use to trigger a Roland guitar synthesiser for a synth string pad on "Hit". Band compression and equalization were applied to most individual recorded tracks during mixing. Noise reduction was applied to the room microphone sounds and to some of the individual tracks.

The four major works feature *rhythmic* elements common to the four genres studied herein. Each work contains sections that are rhythmically free (a feature of some electronic and improvised works) and sections with a constant pulse, repetitive elements and a regular metre (a feature of most improvised, rock and EDM works). With the exception of "Hit", all the works feature repeating one, two or three-bar drum sample patterns. Notated instrument parts for "Hit", "Scrape" and "Drag" feature repeating two, four, six and/or eight-bar patterns. Some parts for "Scrape" and "Click" derived from the CBPI are synced to the tempo of the drum sample patterns. For example, in "Scrape", the violin samples are dynamically panned left and right at a rate of 1/16th note subdivision and in "Click" a constant stream of 'notes' at a 1/16th note subdivision is generated. Other CBPI parts contain an implied pulse or repetition due to the looping

of a sample or the regular oscillation of a modulating waveform. However, these elements are not synced to the tempo of other parts.

The major works contain a combination of pitched and non-pitched elements and utilise a range of tonal, polytonal and microtonal elements. Instrument parts provide the primary means of conveying tonality with pitched elements from the CBPI either reinforcing or blurring instrument pitches. For example, in "Hit", the glockenspiel plays in a random atonal manner and the glockenspiel samples from the CBPI reinforce the randomness whilst blurring the chromatic divisions by adding microtonal elements. In "Click", the initial stream of 1/16th notes is limited to a Bb Dorian minor scale (without the seventh) which provides a harmonic reference for the three instrumental soloists. Later in the same piece, random chromatic and microtonal elements are generated by the 'interact' module of the CBPI and are intended to stimulate the instrumental soloists to play 'outside' the Bb minor tonality. In "Drag", a series of preset values, corresponding to three and a half octaves of a D major pentatonic scale (beginning on F#), provides the amplitude modulation rate (frequency) for the wave module outputs. The tonal output of the wave module is used as a single note accompaniment to the violin solo, reinforcing the E minor tonality of the piece.

The *vertical* and *horizontal pitch structures and patterning* used in the major works reflects personal preference, including those utilised in the four genres examined. Notated melodies, chords and chord voicings for each work draw most heavily on the stylistic features of jazz and improvised genres. For example, the notated melodies feature chromatic elements (e.g., "Hit"), intervallic movement up to and including a diminished fifth ("Scrape"), and melodies derived from non-major pentatonic or major

scale harmonies (“Drag”). “Hit”, “Scrape” and “Drag” contain chords and voicings featuring extensions and alterations above the seventh, including maj7#11 chords (e.g., in “Hit”), 6/9 chords (e.g., “Scrape”) and min7#11 (“Drag”). Such elements are uncommon in the Rock and EDM works analysed in this study. On the contrary, chord progressions (*vertical patterning*) are limited to mostly one to four-chord sequences, reminiscent of many of the EDM and rock works.

For each of the major works *dynamics* are largely a function of *texture*, with peaks occurring towards the end of instrumental solo sections. All the works exhibit a staggered layering of parts with introductions (varying in length between one to three minutes) beginning with one or two instruments and the CBPI followed by main sections containing most players. The endings of “Hit”, “Scrape” and “Drag” return to a similar texture to their introductions whilst “Click” ends with a series of conducted notes from all players. The B section of “Scrape” provides a good example of the staggered layering of parts with sounds entering in the following order (with each part heard for two to four bars before the entrance of the next): violin samples, hi-hats, filtered snare and kick, guitar, bass guitar and rim shot, unfiltered drums, violin, saxophone. The entrance and exit of instruments in performance was mostly on my cue with the exception of individual drum sample parts that were controlled by David Brammah. The form diagrams in section 8.3 below (Figures 8.1, 8.5, 8.11 and 8.16) provide a graphic depiction of the *textural* shifts and *structure* of each work.

A range of individual instrument *timbres* are utilised in the major works with timbres generally fixed within sections of each work. For example, in “Scrape”, three distinct guitar sounds are heard in different sections: a synth lead, an acoustic and a clean

electric sound. In the introduction to “Click” the saxophonist explores extended instrument techniques, including key clicks and breath sounds. At times in all of the works, in particular “Click”, the violin features ambiguity between the sounding of the fundamental of the stopped note and the emphasis on higher frequencies in the harmonic series of the stopped note.

Timbral transformation is evident in the output of the CBPI and in the sample drum parts. The use of sampled instrument sounds for the CBPI enabled a homogenous blend and blurring of instrumental and CBPI timbres. This is most evident in the introductions to “Hit” and “Click” where glockenspiel and saxophone samples are heard alongside the same acoustic instrument. Varying the degree of processing on these samples enabled the timbres to be distinguished whilst obscuring the origin of the sound in a manner similar to Chadabe’s “Valentine” or Harvey’s “*Mortuos Plango, Vivos Voco”*. Timbral transformation of the drum samples is featured throughout the major works with dynamic filtering and other processing performed live via MIDI controller mapped to various effects parameters.

A wide range of *spatial elements* of interest were identified in the analysis of the selected key works, these utilised in the genre studies and built into the CBPI. With an emphasis on live performance a key design criteria for the CBPI, the recordings of the major works were made in a performance environment with attendant spatial elements such as natural reverb and placement of instruments in ‘real’ spatial field. Other spatial elements were incorporated via the output of the CBPI including: the random placement of sounds throughout the quad field in “Hit”; the rapid panning of sound in sync with global tempo at a 1/16th note subdivision in “Scrape”; and the manual performance of

spatial trajectories in “Drag”. The drum samples were performed and recorded in stereo with the placement of individual parts across the stereo spectrum in various configurations with kick and snare drums usually centred, and higher frequency elements panned left and right. During the mixing process the stereo image of the 1/16th note hi-hat (or similar timbre) patterns was dynamically revolved around the surround field at varying rates. This panning was ‘performed’ with a graphics tablet used to record panning automation within Pro Tools.

The conceptual *programmatic association* origins of the major works are discussed briefly above in reference to selection of *sound source*. Further, at a conceptual level, the four titles reflect the overall theme of this research, an examination of conserved and emergent technological compositional methods: acoustic instrument gestures, “Hit” and “Scrape”, and computer/digital instrument gestures, “Click” and “Drag”. The text in “Hit” extends this theme, invoking a human/mechanical division with reference to ‘objects’ and ‘people’ with the former being ‘obedient’, and ‘whirring’ whilst the latter are ‘hungry’ and ‘forgetful’. Other word pairs referring to processes are stated: ‘making/shaping, directing/cajoling’. The text is applicable as a conceptual driver for all the works and resonates with my grappling with the ‘objects’ in Max/MSP and ‘people’, i.e., the performers, in the creation of the works. At the level of reception, the repetitive and syncopated rhythmic aspects of the drum samples and various instrumental/sampled loops, provide somatic/dance elements which derive largely from stylistic elements of EDM and rock genres.

Interaction occurred on a range of levels during the performance of the major works. On a basic gestural performance level, I cued the entrance and exit of parts/instruments

based on the graphic form charts (see Figures 8.1, 8.5, 8.11 and 8.16). Improvised musical interaction occurred between performers in solo/accompaniment and collective improvisation contexts within melodic/harmonic (i.e., *pitch*), *rhythmic*, *timbral* and *textural* domains. Various restrictions as to the nature of improvisation were imposed in each of the works. For example in "Hit", the percussionist was instructed to 'improvise randomly', 'avoid recognizable patterns' and 'begin in the middle of the glockenspiel range'. In the introduction of "Scrape", the saxophonist was limited to key clicks and breath sounds and given no other directions. In a more traditional jazz vein, in "Drag", the soloist (violin) was directed to improvise over the harmonic framework of the 'head'. Drawing on techniques used in many of the improvised works analysed, the guitarist was directed to accompany the soloist in a manner that blurred the line between solo and accompaniment by playing single note lines or arpeggiated chords.

8.3 Development of Works

Three of the major works ("Hit", "Scrape" and "Click") were conceived and prepared in two months prior to the live and recorded performances (November, 2006) documented here. "Drag" is a rearrangement of a work written in 2005, originally performed by the contemporary jazz quartet Liquid. The programmatic conceptual driver for the works and the bottom up play process employed with the CBPI in the development of the works has been discussed in sections 8.1 and 8.2 above. This section presents the details of the key inputs for each work, performer instructions, rehearsal processes and details of the processes and performance on the CBPI.

Demonstration stereo audio versions of each work were prepared and sent to each performer and the engineer two weeks prior to rehearsal (and are included in Appendix C). I felt this was necessary for two reasons: firstly, in order to demonstrate timbral, textural and structural aspects of the works to the performers, and some of the spatial aspects for the engineer, and secondly, whilst notated parts were provided, I was keen to pursue an aural approach to learning parts where possible. This reflects the processes involved in the development of most of the works analysed herein, particularly those in the EDM and rock genres. The demonstration versions were realised in my home studio using Max/MSP and Pro Tools by overdubbing the various CBPI and instrumental parts. I played bass, guitar, keyboard and violin parts on a Roland XP30 synthesiser and programmed basic drum sample loops using Stylus and Reason.

8.3.1 "Hit"

Table 8.2 details the key inputs utilised in "Hit" in relation to the relevant 'Elements of Interest'. (For the complete 'Elements of Interest' see Table 7.1).

Table 8.2. *Selected Elements of Interest and Elements of "Hit"*

Parameter		Elements of Interest	Elements of "Hit"
Sound	**Sources**	• Vocal (all genres). • Combination of acoustic instruments and electric/sampled sound sources (all).	• Instruments: including glockenspiel, clave, guiro, bells, castanets, shakers, violin, bass guitar. • Glockenspiel samples, wavetable synthesis. • Synthesised bowed strings • Spoken female vocal • Vocal samples
	Objects	• Live instrument sounds (all). • Short vocal phrases/spoken word fragments (EDM, Electronic). • Synthesised/sampled instrument sounds (all). • Range of heterogenous objects (all).	• Live instrument sounds. • Processed glockenspiel samples. • Sustained mid frequency synthesised string pad. • Sustained low frequency bass pad. • Processed vocal, violin and synth pads.

	Object processing	• Delay (all). • Filtering (all). • Compression (EDM, Impro, Rock). • Reverb (EDM, Impro, Rock). • Variable speed playback (EDM, Electronic, Rock).	• Delay, variable speed and reverse playback, of glock sample. • Band-pass filtering and amplitude modulation of vocal, violin and synth pads. • Delay applied to guitar synth sound in mixing. • Compression, equalization, room reverb and noise reduction applied in mixing.
Rhythm	**Pulse**	• Constant (EDM, Impro, Rock). • No pulse (Electronic, Impro).	• Implied pulse from 2'49" onwards (approx. 38bpm) for all parts except glock sample.
	Metre	• 4/4 (EDM, Impro, Rock). • Ametric (Electronic, Impro).	• Introduction ametric. • Glock samples ametric throughout). • 4/4 at 2'49" onwards.
	Patterning	• Repetitive, non-syncopated elements (EDM, Rock). • Repeating one, two and four-bar phrases (EDM, Impro, Rock). • Free (Behrman, Interface, Lewis, Oliveros).	• Opening free. • Glock samples free throughout. • Vocals freely spoken. • Synth strings repeating four-bar phrase, four whole notes. • Bass pad: constant drone. • Violin: repeating four-bar phrase featuring repeated two-bar sequence with variation.
Pitch	**Selection**	• Tonal with some chromatic elements (EDM, Impro, Rock). • Polytonal elements (EDM, Electronic, Impro). • Microtonal elements (Electronic, Impro). • Mostly non-pitched or indeterminate pitch (Electronic, Impro).	• Combination of pitched and non-pitched elements. • Introductory glock features random chromatic notes. • Processed glock adds microtonal elements. • 2'49" onwards features tonal, with some chromatic and polytonal, elements.
	Vertical structures	• Chord structures and voicings based on extensions and alterations of diatonic harmony as per jazz style (EDM, Impro, Rock). • Somewhat random vertical alignment of pitch elements (Electronic, Impro). • Range of intervals from semitone to octave utilised for melodies (all). • Mostly small intervals used in melodic phrases (EDM, Rock).	• Glock intervals vary from semitone – octave. • Glock sample features recurring ascending fourth, ascending second figure (e.g., at 58" – 1'22") • Synth pad features six note chords built in thirds, i.e., 1, 3, 5, 7, 9 & 11 of Maj7#11. • Violin melody features mostly stepwise movement. • Bass pedal one note after 2'49".
	Vertical patterning	• Static harmony or pedal point (EDM, Impro, Rock). • Repeating diatonic or non-diatonic chord progression (EDM, Impro, Rock). • Random (Electronic, Impro).	• Introduction random. • At 2'49" bass drone (G#) with synth pad outlining four chord progression (parallel movement): Emaj7#11, Gmaj7#11, Bbmaj7#11, Cmaj7#11. • Processed glock random throughout.
	Horizontal structures and patterning	• Repeating one, two or four bar patterns for some instruments – particularly rhythm section (EDM, Impro, Rock). • Motive development, use of sequences, diminution, augmentation etc., (EDM, Impro, Rock). • Perceived random elements (Electronic, Impro).	• Introduction mostly random with repeating three-note figure of sampled glock in various transpositions. • At 2'49" repeating four bar pattern for some instruments (pads, violin). • Violin melody features four-bar sequence, repetition with development of melody after third repeat.
	Dynamics	• Shifts due to texture (all).	• Shifts mostly due to texture with peak at 5'07" – 5'53".
	Texture	• Homogenous (all). • Major shifts marking sections or start/end of solos (all). • Staggered layering of elements (EDM, Impro, Rock).	• Introduction fairly homogonous with live glock, glock samples and hand percussion. • At 2'49" staggered layering of other elements (see form chart, Figure 8.1).
	Timbre	• Mostly static timbres throughout (EDM, Impro, Rock). • Exploration of minimal sound sources (Electronic, Impro, Rock). • Transformation and blending between	• Introduction features blending of live and sampled/processed glock. • Mostly static instrumental timbres with transformation via replayed filtered elements, e.g., at 5'28" onwards.

		electronic and *concrète* sources (Harvey).	
	Spatial elements	• Creation of 'unreal' acoustic space (all). • Placement of sounds within spatial field (all). • Multiple speakers (i.e., > 2) (Electronic). • Same or similar sounds placed in different parts of spatial field (EDM, Harvey). • Blurring of source of multiple timbrally similar sounds (Chadabe). • Foregrounding soloists in solo/ accompaniment texture (Impro, Rock). • Foregrounding vocal (EDM, Rock).	• Live instrument sounds placed within spatial field with varying degrees of localisation/diffusion. • Processed glock begins centred, gradually wider random placement of some elements. • Vocal and violin (i.e., melody) parts foregrounded.
	Programmatic Association	• Random, 'non-human' feel at times (Electronic, Impro). • Complex and multiple meanings possible (all). • Absence of gestural connotation due to perceived randomness of sounds (Electronic, Impro). • Vocal fragmentation disrupts meaning (EDM, Electronic). • Movement from centered to dispersed achieved by range of parameters including spatialisation, instrument roles, melodic/harmonic aspects, structure and effects (Davis).	• Title reflects prominent means of sound production in introduction. Also, in popular forms, vocals necessary for a 'hit'. • Intended movement from sparse to dense via texture and note density. Layered percussion introduction, culminating in introduction of sustained sound of synth pad, i.e., gradually 'filling up' with sound. • Text invokes binary of 'human'vs 'mechanical', i.e., 'objects' vs 'people' and what can be done with each. E.g.,'Objects' are 'obedient', 'whirring', people 'forgetful', 'hungry' etc. Reinforces notion and processes of old/new technologies.
	Structure	• Sectional with irregular divisions (Electronic, Impro). • Free (Impro). • One constant texture with development occurring through layering and spatial aspects (Xenakis).	• Sectional: A: 0" – 2'49", B: 2'49" – 6'24". C: 6'24" – end. • Sections marked by major textural shifts. Introduction/removal of synth pad provides main section marker. • Processed glock provides constant texture throughout.
	Interaction	• Solo/accompaniment sections with some accompaniment parts 'locked' (Impro, Rock). • Collective improvisation sections between two or more sources (Impro). • On timbral and textural levels (Lewis, Interface).	• Introduction (A) freely improvised with directions to move from sparse to dense. • Spoken vocal and violin melody somewhat free with deliberate overlapping of phrasing. • Most instrument/vocal introductions and endings cued.
	Score	• Graphic score (Stockhausen, "*Studie I*").	• Graphic score provided to all players; notated parts provided for violin, guitar, bass; text provided for vocal.
	Presentational Format	• DVD (Electronic).	• DVD produced from recording of live performance.

Figure 8.1 is the graphic form chart for "Hit" given to the performers and shows the basic textural shifts and structure of the work. "Hit" features three sections, A, B and C which are marked accordingly on Figure 8.1.

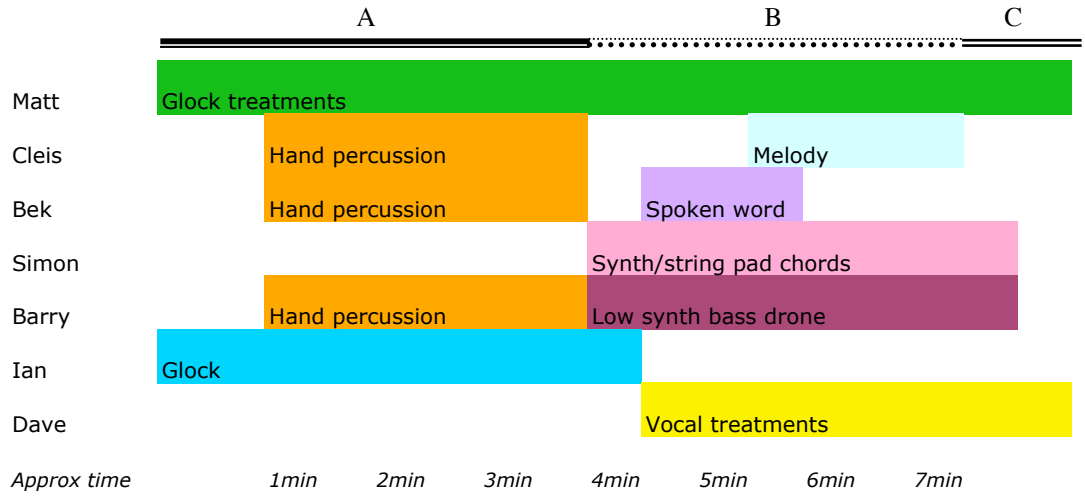


Figure 8.1. "Hit": Graphic form chart.

Section A is a feature for the glockenspiel with live and sampled versions playing. The initial instructions given to the percussionist were:

> Beginning section (4 – 5 minutes): Improvise randomly, avoid recognizable patterns. Begin very sparsely in middle of glock register, gradually increase activity and range. After 3 minutes or so begin to decrease activity. Fade out when synth pad/strings chords begin.

Additional percussion is heard in section A and is performed by three players given the instructions: "hand percussion, random and sparse". In rehearsal these instructions were reiterated but otherwise little direction was given.

Section B features a repeating four-bar chord progression and melody (Figure 8.2) with the following set text to be freely spoken:

I feel like I've worked with objects, more than I've worked with people
making / shaping
directing / cajoling
fantastic lessons / inadvertent plying
obedient / forgetful
whirring / hungry

The first line of the text is from an interview from an extras package of the DVD of the film *Girl with a Pearl Earring* (Webber, 2004), and the demonstration version includes the actual audio sample of this line. In performance the saxophonist Rebecca McHutchison speaks the text.

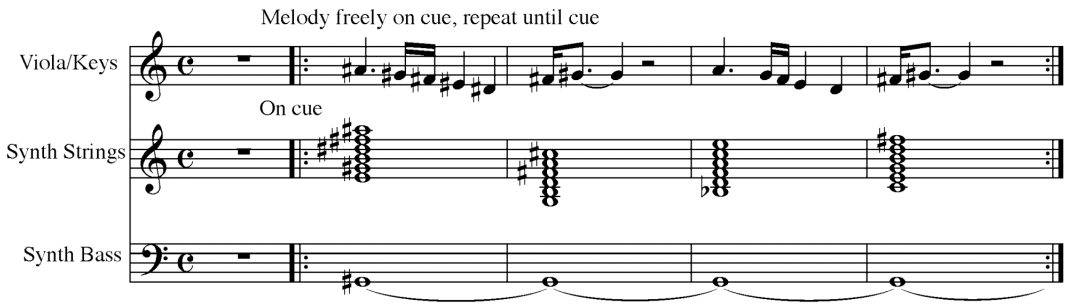


Figure 8.2. "Hit": Section B notated parts.

As seen in the chart, the melody was initially intended for keyboard and viola however in rehearsal solo violin performance proved more suitable. On the recording the melody stated twice as written before being taken up an octave. The six-note chords resulted from the original composition process where I played a root position, closed voice major seventh chord with a Roland synthesiser. The particular synthesiser patch added a perfect fifth above each note creating a six-note chord. The original synth part (heard on the demonstration version included in Appendix C) was looped and triggered from Ableton Live (by David Brammah) in the final performance of the work and reinforced by

the guitarist doubling upper voices with a synth string pad sound. The ‘synth bass’ part was performed on electric bass with volume swells and thus does not sustain as notated, instead the swells follow (approximately) the amplitude envelope of the synth pad.

Glockenspiel samples (taken from the Rock Study) are played via one groove module and both wave modules of the CBPI. The wave modules’ output is heard throughout “Hit” and Figure 8.3 shows the approximate settings of these.

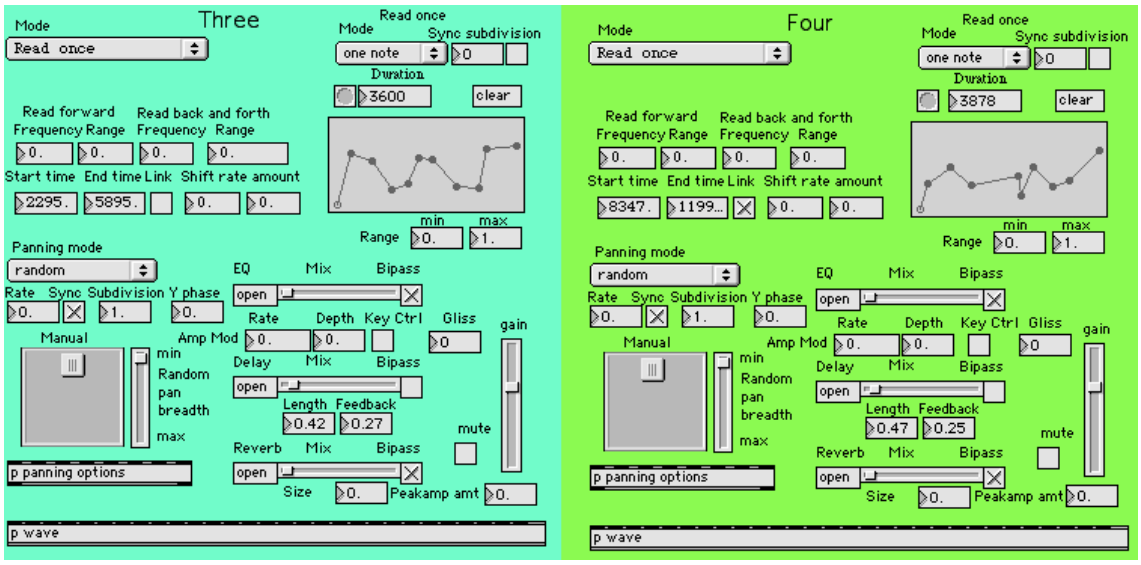


Figure 8.3. “Hit” section A: Approximate ‘wave’ modules’ settings.

Using the ‘Read once’ mode, sounds were triggered by the computer keyboard (letters ‘n’ and ‘m’ – see Section 7.3.2, Figures 7.15 and 7.4.8, Table 7.4). The line graph (function object) in the top right of each ‘wave’ module was varied throughout the performance of “Hit” and corresponds to the direction and rate at which the portion of the glockenspiel sample was read. The sounds were panned via the random panning mode (that changes the position of sounds in the quad field randomly at a constant rate). The ‘Random pan breadth’ control was moved gradually from ‘min’ to ‘max’

throughout section A, gradually widening the possible spatial placement from the centre ('min') to the extremities ('max').

The output of the 'groove' module is heard from 1'00" – 3'05" and the basic settings are shown in Figure 8.4.

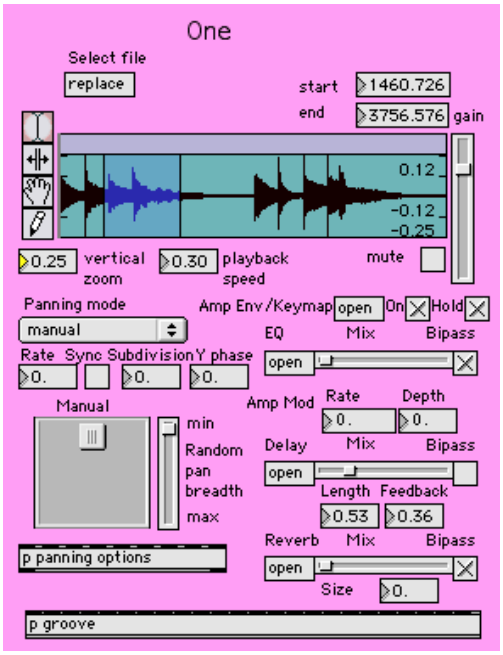


Figure 8.4. "Hit" section A: Approximate 'groove' module settings.

The playback speed of a fixed portion (2296ms duration) of the glockenspiel sample was varied via the keyboard of the MIDI controller. The selected portion featured three distinct pitches (one without the original attack) that are transposed according to the improvised variations in playback speed.

In the form chart (Figure 8.1) David Brammah (samples) is instructed to perform 'vocal treatments' throughout sections B and C. In the recorded performance he sampled the spoken text, violin, synth pad and bass parts and reintroduced these elements as a

processed loop from 5'27" onwards. These elements were not rehearsed or discussed beforehand and introduced only in the final performance. However, given my previous working experience with David, I was comfortable with providing him minimal direction and confident he would make suitable contributions to the overall work.

8.3.2 "Scrape"

Table 8.3 details the key inputs utilised in "Scrape" in relation to the relevant 'Elements of Interest'.

Table 8.3. *Selected Elements of Interest and Elements of "Scrape"*

Parameter		Elements of Interest	Elements of "Scrape"
Sound	**Sources**	• Combination of acoustic instruments and electric/sampled sound sources (all). • Keyboard instruments (all).	• Violin sample, wave table synthesis. • Instruments: chimes, triangle, saxophone, electric guitar, bass guitar, hi-hat, snare, congas, violin, electric piano. • Sampled drumkit. • Guitar synth lead
	Objects	• Live instrument sounds (all). • Synthesised/sampled instrument sounds (all). • Range of heterogenous objects (all).	• Live instrument sounds. • Sustained low frequency bass pad. • Bowed string sample slowed down to provide low-mid frequency oscillating pad. • Slow attack, synth lead. • Processed violin samples. • Processed drum samples.
	Object processing	• Delay (all). • Filtering (all). • Compression (EDM, Impro, Rock). • Reverb (EDM, Impro, Rock). • Variable speed playback (EDM, Electronic, Rock).	• Delay, variable speed and reverse playback, amplitude modulation of violin sample. • Filtering, bit reduction (distortion), delay, compression and gating of drum samples. • Compression, equalization, room reverb and noise reduction applied in mixing. • Amplifier and microphone recording emulation on acoustic guitar sound and bass.
Rhythm	**Pulse**	• Constant (EDM, Impro, Rock). • No pulse (Electronic, Impro).	• Oscillating pad provides slow pulse in A section. • Constant pulse in middle section (B and C) (104bpm).
	Metre	• 4/4 (EDM, Impro, Rock). • Variations (Impro, Rock). • Ametric (Electronic, Impro).	• A section ametric, melody free. • 4/4 for B section. • Repeating pattern: three bars 4/4, one bar 2/4 in C section.
	Patterning	• Repetitive, syncopated elements (EDM, Impro, Rock). • Repetitive, non-syncopated elements (EDM, Rock). • Repeating one, two and four bar phrases (EDM, Impro, Rock). • Mostly eight or sixteen-bar sections	• A section melody free over slow constant oscillating pad. • B section: Violin sample panned at constant 1/16th note rate, loops unrelated to bar length; bass, guitar and violin repeating four-bar syncopated patterns; hi-hat and rim shot repeating one-bar pattern accenting

		(EDM, Impro, Rock). • Strong backbeat (EDM, Impro, Rock). • Constant 1/8th or 1/16th note phrases in solos (Chadabe, Davis, Douglas, Hancock, Pine). • Free (Behrman, Interface, Lewis, Oliveros).	backbeat; sampled drums feature constant 1/16th note hi-hat with syncopated kick and snare accents. • C section: bass – repeating four-bar pattern; guitar- repeating two-bar (i.e., eight beat) pattern; conga – half time with backbeat accents; sampled drums – similar to B. Melodic backing figure at 7'50" features half and whole notes, repeating eight-bar phrase. • Sax and violin solos feature range of note values, from constant 1/16th phrases to sustained whole notes.
Pitch	**Selection**	• Tonal – diatonic/major scale harmony, including modes (EDM, Rock). • Tonal with some chromatic elements (EDM, Impro, Rock). • Mostly non-pitched or indeterminate pitch (Electronic, Impro).	• Combination of pitched and non-pitched elements. • A section melody from five note diminished scale fragment. • B and C sections tonal, E dorian minor.
	Vertical structures	• Chord structures and voicings based on extensions and alterations of diatonic harmony as per jazz style (EDM, Impro, Rock). • Range of intervals from semitone to octave utilised for melodies (all). • Mostly small intervals used in melodic phrases (EDM, Rock). • Bass plays root notes or notes of basic 7th chord (EDM, Impro, Rock).	• A section: bass pedal; melody features semitone – minor third intervals. • B section: bass – mostly stepwise or third intervals, outlining root movement; guitar – arppeggiated E 6/9 and Emin11 chords, open voicings; violin – diads and single note figure featuring stepwise and ascending fifth intervals; violin sample outlines 5, 6, 1; sax solo mostly stepwise – thirds intervals. • C section: bass – ascending tenth, descending seventh and stepwise figure; guitar diads (fourths) and single note; violin –range of intervals step to octave utilised; backing figure features descending fourth and diminished fifth.
	Vertical patterning	• Static harmony or pedal point (EDM, Impro, Rock). • Repeating diatonic or non-diatonic chord progression (EDM, Impro, Rock).	• Mostly static harmony. A section: E dim/E pedal; B section: bass outlines three bars E min (I) with movement through IV and V in bar four; C section: bass outlines i, IV, V movement, other pitch elements static.
	Horizontal structures and patterning	• Repeating one, two or four-bar patterns for some instruments – particularly rhythm section (EDM, Impro, Rock). • Short (one-beat to two-bar) phrase lengths combined to form eight-bar sections (EDM, Impro, Rock).	• A section melody features three-note sequence repeated three times (with F# as third note second time) with C note ending. Whole phrase repeated. • B section: guitar, bass and violin – repeating four-bar phrases with slight variation; violin sample repeating figures not synced to bar lengths; sax solo. • C section: guitar – repeating eight beat phrase; bass – repeating four-bar pattern; violin solo; backing figure – three note sequence with two note pickup to transposed (down a fourth) second half of phrase.
	Dynamics	• Shifts due to texture (all). • Peaks and troughs creating tension and release (EDM, Impro, Rock).	• Shifts mostly due to texture with peak at 7'50" – 9'08" (backing figure under solo).
	Texture	• Basic texture includes: drumkit, bass, guitar/keyboard, (Impro, Rock). • Major shifts marking sections or start/end of solos (all). • Staggered layering of elements (EDM, Impro, Rock).	• Introduction features combination of low frequency pads and high frequency metal percussion. • Staggered layering of instrumental parts, mostly in four bar sections (see form chart, Fig. 8.5).
	Timbre	• Mostly static timbres throughout (EDM, Impro, Rock). • Foregrounding of timbral transformation (Electronic, EDM, Impro). • Multiple drum/ percussion sounds,	• Blend of live instrument and sampled/electronic sounds throughout. • Three separate guitar sounds (synth lead, acoustic and clean electric) featured. • Sampled drums feature dynamic filtering

		including percussive noise elements (EDM). • Exploration of minimal sound sources (Electronic, Impro, Rock). • Transformation and blending between electronic and *concrète* sources (Harvey).	and other processing throughout. • Blending of violin samples and live violin (particularly in B section).
	Spatial elements	• Creation of 'unreal' acoustic space (all). • Placement of sounds in spatial field (all). • Multiple speakers (i.e., > 2) (Electronic). • Sound trajectories in multi speaker system (Electronic). • Same or similar sounds placed in different parts of spatial field (EDM, Harvey). • Blurring of source of multiple timbrally similar sounds (Chadabe). • Foregrounding soloists in solo/ accompaniment texture (Impro, Rock). • Kick and snare drums centred (EDM, Impro, Rock). • 1/16th note bass pattern, alternate left and right panning of notes (Summer).	• Live instrument sounds placed within spatial field with varying degrees of localization/diffusion. • Oscillating low frequency violin sample in A section doubled and panned to left and right sides of quad. • Violin sample dynamically panned (at 1/16th note rate synced to pulse) left to right throughout B and C sections. • Sampled drum 1/16th notes dynamically panned manually during mix. Stereo image rotated around surround field at a rate of eight bars per cycle.
	Programmatic Association	• Repetitive, syncopated rhythmic aspects providing somatic/dance aspect (EDM, Impro, Rock). • Use of production (e.g. effects, spatialisation) to reinforce possible meanings (all).	• Title reflects sound production means for violin sample and featured soloist – violin. (A section - oscillating pad produced by 'read back and forth' mode, akin to scraping back and forth over sound file). • Repetitive and rhythmic aspects, four-bar syncopated repeating parts, provide somatic/dance elements.
	Structure	• Sectional with regular (i.e., multiples of four) bar lengths (EDM, Impro, Rock). • Free (Impro).	• Sectional A: 0' – 2'33", B: 2'33" – 6'29", C: 6'29" – 10'22", A2: 10'22" – end. • Sections marked by major textural shifts i.e., change in violin sample, introduction of sampled drums, changes to guitar/bass riffs.
	Interaction	• Solo/accompaniment sections with some accompaniment parts 'locked' (Impro, Rock).	• Section lengths open with parts cued during performance. • In B and C sections - sax and violin solos, with other parts accompanying with minimal variation, i.e., 'locked'.
	Score	• Graphic score (Stockhausen, *"Studie I"*).	• Graphic score provided to all players; notated parts provided for sax, violin, guitar and bass.
	Presentational Format	• DVD (Electronic).	• DVD produced from recording of live performance.

The form of "Scrape" is basically ABA with the B section in two parts, one featuring a saxophone solo, the other a violin solo. Figure 8.5 shows the graphic form chart given to performers with the sections marked accordingly.

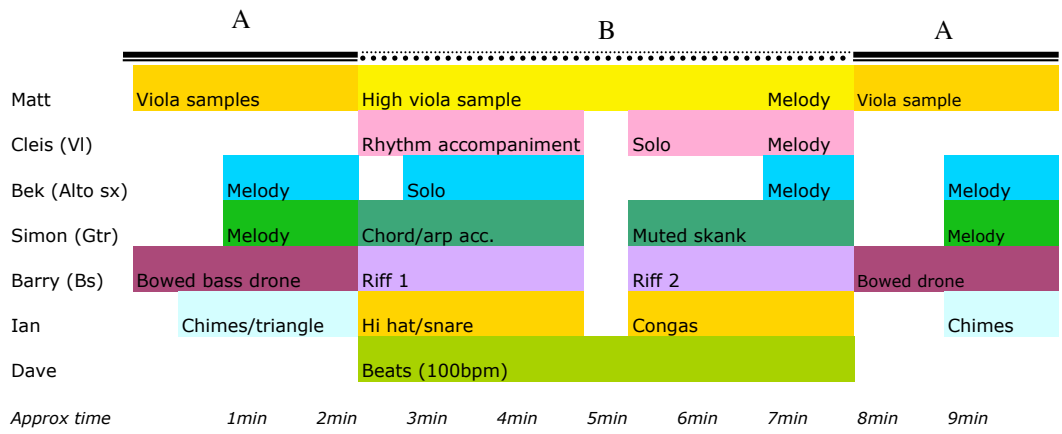


Figure 8.5. "Scrape": Graphic form chart.

The 'bowed bass drone' was originally intended to be performed on double bass but is replaced in the final version by electric bass using volume swells. This timbre was explored in rehearsal and found to be suitable. Other fine tuning occurred in rehearsal. For example, numerous permutations of guitar and saxophone register and guitar synth timbre were explored in rehearsal before the final combination for the A section melody was decided. In the recorded version, a directed, staggered entry of parts in the B section is heard although this is not indicated on the form chart. The shift from section B back to A is indicated as an abrupt textural shift whereas the recorded version contains a gradual fade on the drum samples, bass and guitar with the melodic figure foregrounded before the re-entry of section A parts. Figure 8.6 shows the notated parts given to the violinist, saxophonist, guitars and bassist (saxophone parts, shown in concert pitch here).

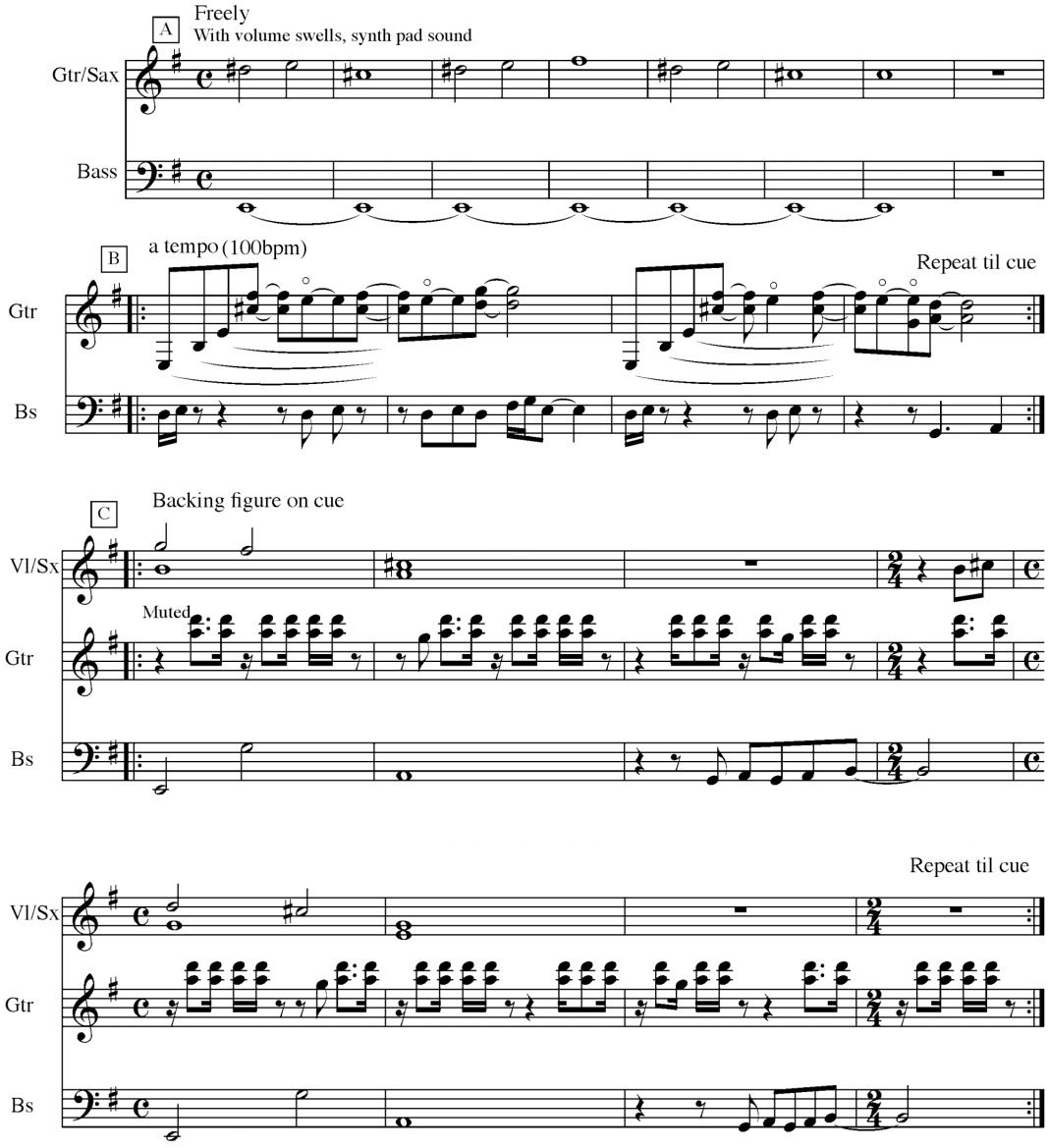


Figure 8.6. “Scrape”: Notated parts.

The rehearsal letter ‘C’ corresponds to the second part of section B in the form. The melody at ‘A’ is stated twice in the first A section and once in the second. The top line of the backing figure (rehearsal letter ‘C’) is initially played in octaves on electric piano with the lower part taken by the saxophone. The violin joins the melody on the third repeat and continues to improvise around the backing figure. The guitarist was instructed to begin the second half of section B (i.e., rehearsal letter ‘C’) with the muted

‘skank’ and later free up the part as he desired. Other variations to the chart include, on the bassist’s suggestion, the bass performing the G and A notes in the first two bars of ‘C’ as natural harmonics (i.e., pitched an octave above written) from 8’00” onwards.

The percussionist was directed as to instrumentation but not given specific parts, and created the live hi-hat, snare and conga patterns heard in section B. The drum sample parts originated from a four-bar loop I had selected from preset loops in Stylus. (This loop is heard on the demonstration version). David Brammah edited and processed the loop, slicing it into the various transient hits, and creating multiple loops within Nuendo. The edited loops were then transferred to multiple channels of an Ableton Live session for performance. During rehearsal, the tempo was increased to 105bpm. Figures 8.7 and 8.8 show transcriptions of the drum sample parts in section B.

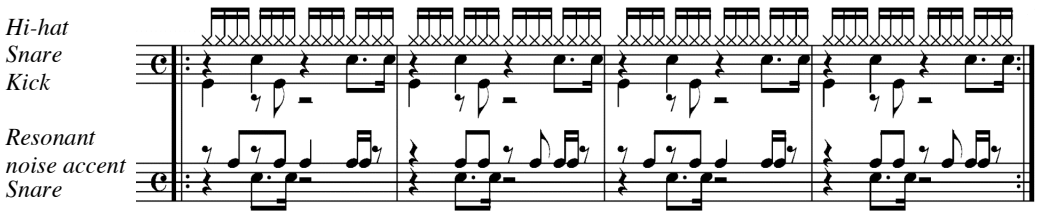


Figure 8.7. “Scrape”: Drum samples pattern, section B, part 1.

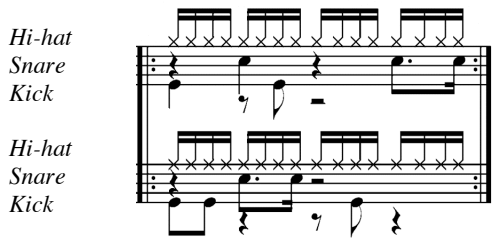


Figure 8.8. “Scrape”: Drum samples pattern, section B, part 2.

A slight swing feel is applied to the constant 1/16th note hi-hats in the bottom stave of Figure 8.8, contrasting the straight 1/16th hi-hats in the top stave. The swung hi-hats are at much lower volume but contribute to the overall groove/feel of the work. As noted above, the second part of section B features three bars of 4/4 metre and one bar of 2/4 metre, i.e., a fourteen-beat pattern. Thus the repeating four-beat drum pattern moves in and out of phase every two cycles of the instrumental parts.

A sample of a bowed viola trill and a single note on electric piano, from a recording of the group Transmission (myself, Cleis Pearce and Barry Hill) is the sound source used in the CBPI throughout "Scrape". In section A, the sample is read in the 'back and forth' mode of the two wave modules with the sound module 'three' panned to the left side and module 'four' to the right of the quad field. Figure 8.9 shows the initial settings of one of the wave modules, the other is identical except for the panning placement.

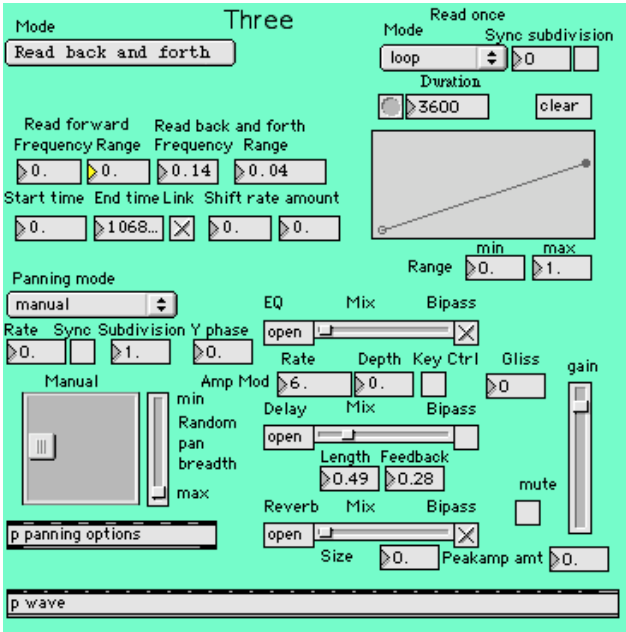


Figure 8.9. "Scrape": 'Wave' module settings.

During performance the amplitude modulation depth was gradually increased from 0 to 2 (on the recording between 0'31" and 1'05"). The low 'frequency' and 'range' values produce the low frequency oscillating sound. At 2'24" the higher pitched sampled viola sound is gradually brought in and continues throughout section B. This sound is output via the two groove modules and the settings for 'one' are shown in Figure 8.10. In "Scrape", groove module 'two' has identical settings except for the playback speed parameter that is doubled, producing the higher octave sound. The panning rate on both groove modules is synced to the global tempo (provided by David Brammah's computer) and moves from left to right at a rate of a 1/16th note subdivision.

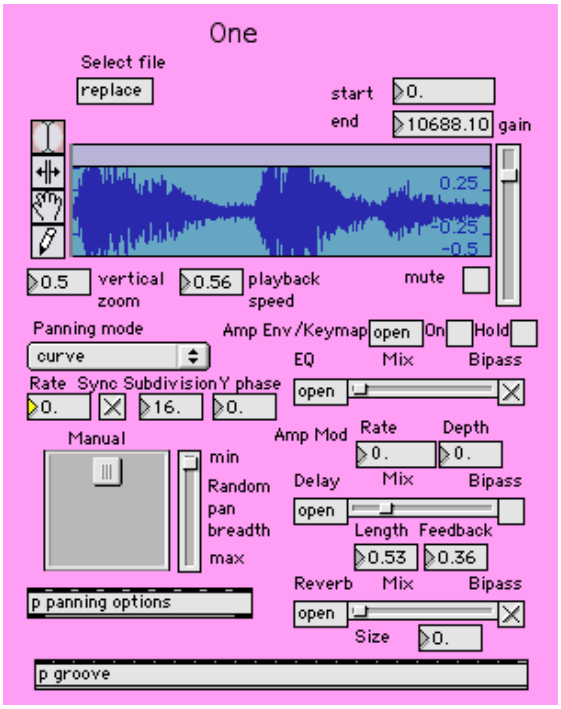


Figure 8.10. "Scrape": 'Groove' module settings.

Apart from the amplitude modulation adjustments mentioned above, and the fading in and out of gain levels, no other parameters were altered in performance. Instead, the

viola sample part was 'locked' in a manner similar to the other accompaniment parts, i.e., bass, guitar and drums.

8.3.3 "Click"

Table 8.4 details the key inputs utilised in "Click" in relation to the relevant 'Elements of Interest'.

Table 8.4. *Selected Elements of Interest and Elements of "Click"*

Parameter		Elements of Interest	Elements of "Click"
Sound	**Sources**	• Vocal (all genres). • Combination of acoustic instruments and electric/sampled sound sources (all).	• Saxophone samples. • Instruments: saxophone, bass, violin, guitar, tambourine, shaker, conga, cowbells • Female vocal • Sampled drumkit.
	Objects	• Live instrument sounds (all). • Short vocal phrases/spoken word fragments (EDM, Electronic). • Synthesised/sampled instrument sounds (all). • Range of heterogenous objects (all). • Noise elements - including vinyl 'hiss', percussive noise and part of synth pads (all).	• Live instrument sounds – including extended techniques on sax, key clicks and breath sounds. • Sax samples provide percussive clicks, short attack saxophone notes in mid - low register. • Processed drum samples including hi-hat, clicks, ride cymbal, kick and snare drums. • Vocal sounds – short duration, open mouth, predominantly vowel 'a' and 'ah' sounds.
	Object processing	• Delay (all). • Filtering (all). • Compression (EDM, Impro, Rock). • Reverb (EDM, Impro, Rock). • Variable speed playback (EDM, Electronic, Rock). • Distortion (Rock, EDM).	• Variable speed playback, delay, filtering (mid-high frequency boost on 'wave' module sax samples), 'peakamp' control of ampmod rate of 'groove' module (one) sax samples. • Filtering, bit reduction (distortion), delay, compression and gating of drum samples. • Guitar distortion. • Compression, equalization, room reverb and noise reduction applied in mixing.
Rhythm	**Pulse**	• Constant (EDM, Impro, Rock). • No pulse (Electronic, Impro). • Multiple tempos/pulse (Electronic, Impro).	• A section: initially no pulse, looped elements provide multiple pulses. • B section: constant pulse (128bpm).
	Metre	• 4/4 (EDM, Impro, Rock). • Ametric (Electronic, Impro).	• A section ametric. • B section 4/4.
	Patterning	• Repetitive, syncopated elements (EDM, Impro, Rock). • Repetitive, non-syncopated elements (EDM, Rock). • Repeating one, two and four-bar phrases (EDM, Impro, Rock). • Strong backbeat (EDM, Impro, Rock). • Constant 1/8th or 1/16th note phrases in solos (Chadabe, Davis, Douglas, Hancock, Pine).	• A section: free, looped sampled elements create rhythmic patterns. • B section: sax samples - constant 1/16th notes throughout until ending, gradually increase note subdivision, i.e., 1/8th, ¼, ½ notes etc.; sample drums – repeating one-bar pattern, syncopated 1/16th note hi-hat/clicks, accented backbeat, kick 1/8th note pair on beat one, upbeat accents after beats two and three; bass repeating one

		• Short repeated sections of *concrète* materials create rhythmic patterns (Electronic). • Free (Behrman, Interface, Lewis, Oliveros).	note, beat one phrase or constant ¼ note walking line without repetition; melody (at 3'58") repeating eight-bar phrase featuring 1/8th note pair on beat two; violin, guitar and sax feature mostly constant 1/16th note phrases with ending similar to sax sample part; tambourine and shaker occasional backbeat accents; cowbells and conga fills.
Pitch	**Selection**	• Limited pitch set (Electronic, Impro). • Tonal – diatonic/major scale harmony, including modes (EDM, Rock). • Tonal with some chromatic elements (EDM, Impro, Rock). • Polytonal elements (EDM, Electronic, Impro). • Mostly non-pitched or indeterminate pitch (Electronic, Impro).	• Combination of pitched and non-pitched elements. • A section features somewhat random pitched elements including prominent Bb and C pitches. • B section: sax samples initially restricted to Bb, C, Db, Eb, F, G notes, at 5'51" other random pitches introduced; melody and initial violin solo notes from Bb dorian minor; guitar/sax solo initially Bb melodic minor; all soloists move in and out of chromatic elements after 8'42".
	Vertical structures	• Chord structures and voicings based on extensions and alterations of diatonic harmony as per jazz style (EDM, Impro, Rock). • Somewhat random vertical alignment of pitch elements (Electronic, Impro). • Range of intervals from semitone to octave utilised for melodies (all). • Mostly small intervals used in melodic phrases (EDM, Rock).	• B section: sax samples initially restricted to semitone – major 6th, random intervals; violin/vocal melody features descending semitone or tone, solo features mostly stepwise and third movement; guitar and sax mostly stepwise/thirds with some larger intervallic movement; bass mostly stepwise/thirds movement. • Ending (at 9'55") features random note selection from all players.
	Vertical patterning	• Static harmony or pedal point (EDM, Impro, Rock). • Random (Electronic, Impro).	• B section: Bass provides Bb pedal (3'35" – 4'57" and 6'12" – 6'57") with mostly static harmony (Bb minor) until 5'35" when random chromatic elements enter; ending random.
	Horizontal structures and patterning	• Repeating one, two or four-bar patterns for some instruments – particularly rhythm section (EDM, Impro, Rock). • Motive development, use of sequences, diminution, augmentation etc., (EDM, Impro, Rock). • Perceived random elements (Electronic, Impro).	• B section melody features repeating eight-bar phrase - descending Bb dorian minor scale, beginning on C; sax samples constant random 1/16th notes throughout; violin, guitar and sax feature range of phrase lengths, from short two-note trills to ascending or descending scalar patterns, some repeated rhythmic elements.
	Dynamics	• Shifts due to texture (all). • Peaks and troughs creating tension and release (EDM, Impro, Rock).	• Shifts mostly due to texture with peak at ending.
	Texture	• Homogenous (all). • Thick diverse, heterogenous (all). • Major shifts marking sections or start/end of solos (all). • Staggered layering of elements (EDM, Impro, Rock).	• A section features fairly homogonous blend of saxophone samples, breath and click sounds. • Staggered layering of parts in B section (see form chart, Fig. 8.11).
	Timbre	• Mostly static timbres throughout (EDM, Impro, Rock). • Foregrounding of timbral transformation (Electronic, EDM, Impro). • Use of extended instrument techniques (Impro). • Multiple drum/percussion sounds, including percussive noise elements (EDM). • Exploration of minimal sound sources (Electronic, Impro, Rock). • Transformation and blending between electronic and *concrète* sources (Harvey).	• Blend of live instrument and sampled/electronic sounds throughout. • Sax samples timbre variations via amplitude modulation (A section) and via large register shifts due to variable speed playback (B section). • Violin features note/harmonic ambiguity at times (e.g., 6'17" – 6'59"). • Sampled drums feature dynamic filtering throughout.

	Spatial elements	• Creation of 'unreal' acoustic space (all). • Placement of sounds within spatial field (all). • Multiple speakers (i.e., > 2) (Electronic). • Sound trajectories in multi speaker system (Electronic). • Same or similar sounds placed in different parts of spatial field (EDM, Harvey). • Blurring of source of multiple timbrally similar sounds (Chadabe). • Foregrounding soloists in solo/accompaniment texture (Impro, Rock). • Kick and snare drums centred (EDM, Impro, Rock).	• Live instrument sounds placed within spatial field with varying degrees of localisation/diffusion. • Melody, violin and voice (at 3'58") foregrounded. • Sampled drum 1/16th notes dynamically panned manually during mix. Stereo image rotated around surround field at a rate approximating filter sweeps.
	Programmatic Association	• Random, 'non-human' feel at times (Electronic, Impro). • Repetitive, syncopated rhythmic aspects providing somatic/dance aspect (EDM, Impro, Rock). • Complex and multiple meanings possible (all). • Use of production (e.g. effects, spatialisation) to reinforce possible meanings (all). • Absence of gestural connotation due to perceived randomness of sounds (Electronic, Impro).	• Title reflects 'key clicks' sound production in A section, and notion of playing to a 'click', i.e., sampled drums and constant 1/16th sax samples provide the 'click'. • Exploration of tension between 'free' and 'locked' states throughout. Movement from free to locked suggested by lack of tempo in A section and metronomic tempo in B section. Reverse movement perceived in B section by movement from set tonality (Bb minor) to random. Tension between repetitive 4/4 metre of drum samples and lack of repetition in sax samples part. However with exception of bass part, instrumentalists frequently play sequences and patterns.
	Structure	• Sectional with irregular divisions (Electronic, Impro). • Free (Impro). • Rhythmic patterning forms basis of structure (Cage).	• Sectional A: 0' – 3'04", B: 3'04" – end. • B section features sub-sections indicated by the following parts: Bass pedal | melody | bass pedal (violin solo) | bass walk (guitar enters) | bass pedal (sax enters) | bass walk | drums fade | cued sustained notes.
	Interaction	• Solo/accompaniment sections with some accompaniment parts 'locked' (Impro, Rock). • Building intensity at end of sections (EDM, Impro, Rock). • Collective improvisation sections between two or more sources (Impro). • Blurring of role between soloist/accompanist (Impro). • Computer interaction (Impro). • Non-hierarchical environment (Behrman, Lewis). • Computer interaction based on rules – match, oppose or ignore (Lewis).	• A section freely improvised with emphasis on timbral and textural interaction. • B section features collective improvisation between all instruments with building intensity towards end. • B section features sax samples and staggered entry of violin, guitar, sax. Instructions to soloists include: listen to computer samples, begin 'inside' Bb minor, gradually add chromatic/free elements and listen to other soloists. • Sax samples in B section generated from 'interact' module using 'match', 'oppose', 'ignore' and 'switch' rules. Range of 'groove' module 'one' initially restricted, gradually increased.
	Score	• Graphic score (Stockhausen, *"Studie I"*).	• Graphic score provided to all players. Melody learnt aurally.
	Presentational Format	• DVD (Electronic).	• DVD produced from recording of live performance.

Figure 8.11 shows the graphic form chart provided to the performers for “Click”. The two sections (A and B) are distinguished by the major shift in texture marked by the introduction of the drum samples.

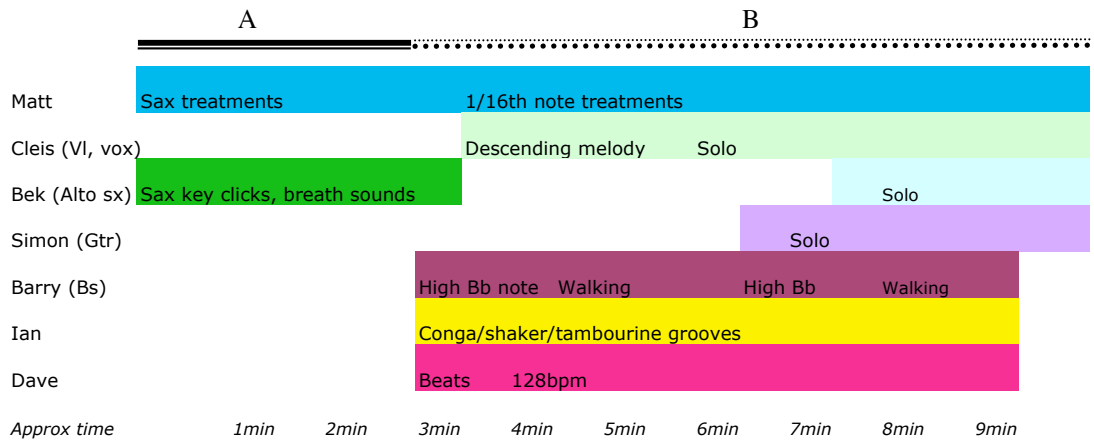


Figure 8.11. “Click”: Graphic form chart.

In the recorded version the division between sections is blurred by the gradual introduction of sparse and filtered beats entering at 2’35” with the full kick and snare entering at 3’04”. The A section sax treatments continue until approximately 3’15”, the percussion and sampled 1/16th note stream enters at 3’19” and bass at 3’35”. The descending melody is played by the violinist *pizzicato* and doubled by her voice. The melody was learnt aurally and originally intended as written in Figure 8.12, however in rehearsal I was satisfied by her interpretation, i.e., using an 1/8th note instead of 1/16th note rhythm.

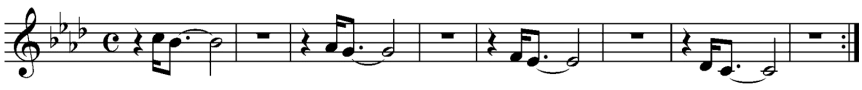


Figure 8.12. “Click”: Section B melody.

The drum sample parts were created in the same manner as “Scrape”, i.e., the demonstration CD contained a sample loop that provided the sound sources and desired groove ‘flavour’ for David Brammah to work with. A transcription of the final drum sample pattern is given in Figure 8.13.

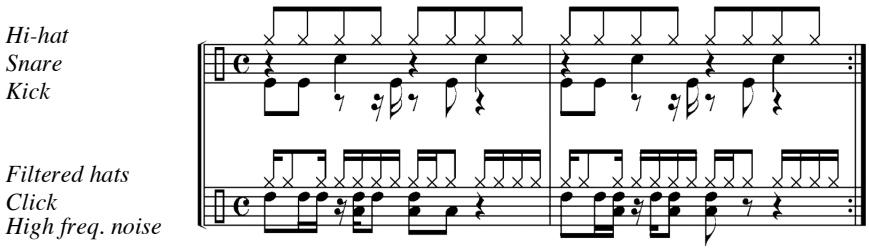


Figure 8.13. “Click”: Drum sample pattern.

Additional parts are heard and not shown above, for example a three 1/8th note ride cymbal pattern replaces the top stave hi-hat at 5’12” to 5’49”.

As in “Scrape”, the percussionist was directed as to instruments but not exact patterns. The parts in “Click” are generally quite sparse, for example, during the melody a two-bar repeating pattern is heard with shaker accents on beat two of each bar and a tambourine accent on beat four of the second bar. At 7’24” onwards, somewhat random cowbell fills are heard and during the ending fills on the conga accent the final sustained notes.

The initial directions given to the soloist in section B were to improvise randomly, with constant 1/16th note phrases, and to alternate between ‘matching’ or ‘ignoring’ the output of the CBPI stream of 1/16th notes in terms of pitch, rules corresponding to two of the ‘interact modes’ of the CBPI. However, after attempting this a few times in rehearsal, it was clear to me that this was not working for three reasons. Firstly, there

were numerous technical problems in getting the drum samples to sync with the CBPI and much rehearsal time was spent fixing this issue. Secondly, the contrast between the constant repetition of drum sample patterns and the randomness of the CBPI 1/16th note stream presented difficulties for the soloists who were being directed to focus on the CBPI output. Thirdly, and on reflection, I was seeking improvisation without repetitive rhythmic or scalar patterns and whilst I did not reinforce this direction, I felt the soloists had difficulty playing quickly without resorting to habitual patterns. For the final performance, the directions to the soloists were revised, instead asking them to play constant 1/16th note phrases, beginning 'inside' Bb minor tonality (i.e., same as initial CBPI output) and gradually introducing more chromatic elements.

The ending for the work features the gradual increase of note values for the soloists followed by a series of conducted sustained random notes. The latter was a suggestion of Cleis Pearce and came after numerous other endings were attempted. On the final version, a second take of the ending was recorded and is edited in at 9'55". The second take was necessary as I neglected to perform volume fades on the CBPI output whilst conducting the rest of the group on the first take.

The sound sources for the CBPI throughout "Click" are two alto saxophone samples, played by Rebecca McHutchison from a recording by the group Torakina. In section A all four source modules (i.e., both groove and wave modules) of the CBPI are used and the settings for each are shown in Figure 8.14. The control and sound output of three of the modules are intertwined with the performed changes in groove module 'two' affecting, in turn, the sound output of wave module 'four' and groove module 'one'.

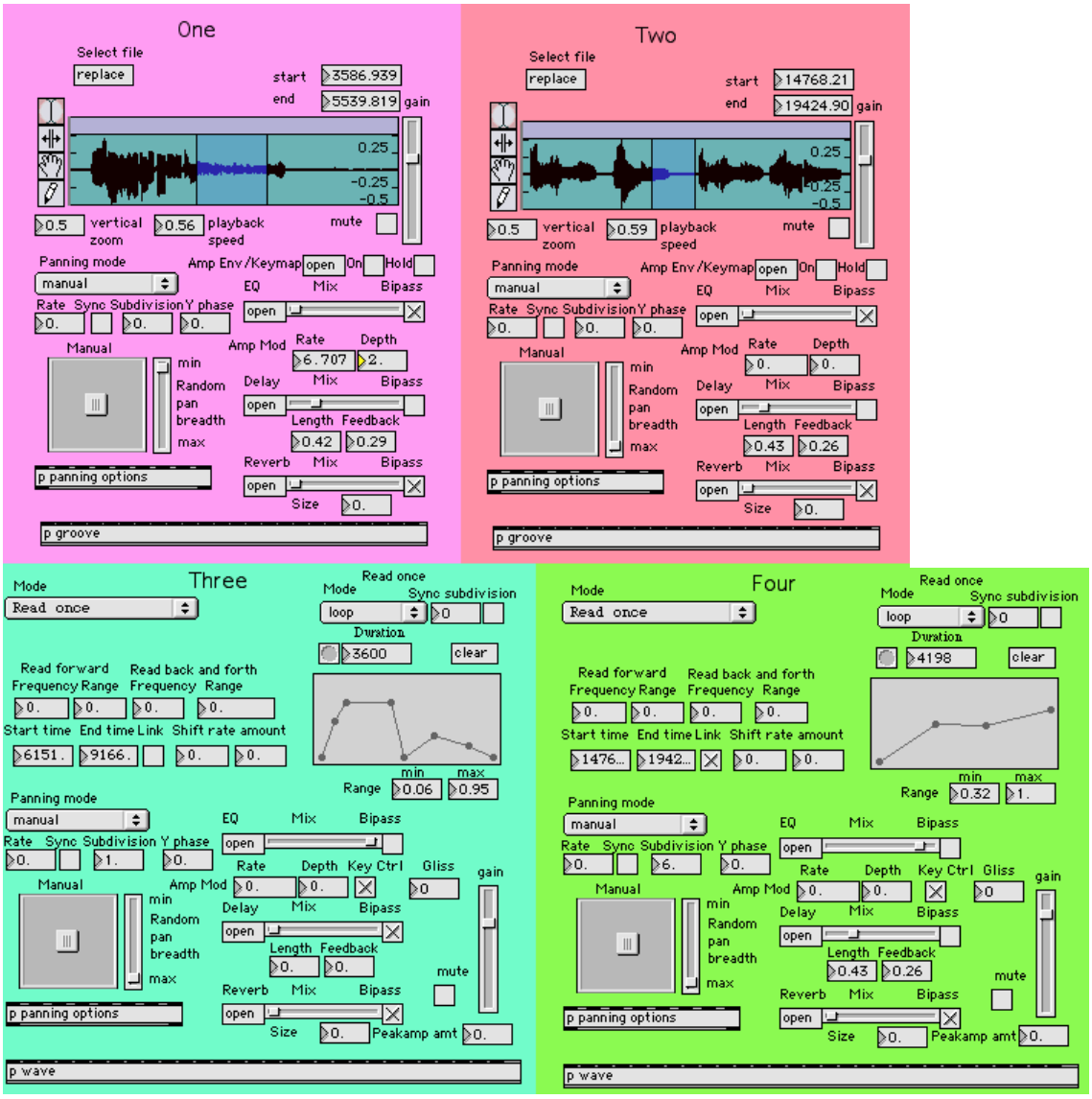


Figure 8.14. "Click": 'Groove' and 'wave' module settings for section A.

The entry of the output of each module is staggered through the first 1'30" (via the external control of each gain slider) with wave module 'three' (bottom left of Figure 8.14) heard first at 12". The percussive, noise based sound is created by using the 'loop', 'read once' mode, on a 3015 millisecond section of the saxophone sample (selected in the first groove module) featuring a key click and breath sound. The wave module 'three' repeatedly reads through this section of the sample at a rate and direction determined by the line graph (function object). The duration of this loop is set to 3600

milliseconds and the line graph is left unaltered throughout section A. All frequencies between 130Hz and 20000Hz have been boosted by equalization with a 24dB gain centred at 3100Hz.

The output of groove module 'two' is introduced at 40" and is initially heard as a distinct Bb3 saxophone pitch. This results from the selected start point of the sample (the graphic depiction of the waveform and selection is seen in Figure 8.14). During performance the start and end point of the sample were continually changed (using the computer mouse) with selection alternating between the gaps in the waveform (i.e., little or no output) to sections including the saxophone sound.

The output of wave module 'four' is heard first at 1'12" as an (approximately) F#4 pitched sound. The section of the saxophone sample to be read using the 'loop', 'read once' mode is linked to the selection made in groove module 'two', i.e., the start and end points used by wave module 'four' change throughout section A. The line graph settings for module 'four' are not altered in performance and thus a continuous 4198 millisecond loop is made from the current selection in groove module 'two'. The two distinct ramps on the line graph create short pitched sounds heard when saxophone sounding portions of the sample are selected in groove module 'two'. The clearly audible clicks heard, for example, at 2'00", 2'05", 2'14", 2'22" and 2'27", are part of the output of wave module 'four' and result from the deliberate selection of a start and end point within a saxophone note sounding portion of the sample.

The output of groove module 'one' is first heard at 1'27" and results from a 1953 millisecond loop of a sustained portion of a saxophone note slowed down to produce a

constant C4 pitch. Using the peakamp module, the amplitude output from wave module 'four' is used as the control signal for the amplitude modulation rate of groove module 'one'. The settings for the peakamp module are shown in Figure 8.15

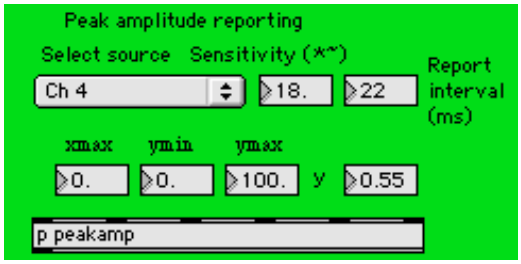


Figure 8.15. "Click": 'Peakamp' module settings.

In section B, the CBPI output is via the two groove modules, using the same samples from section A as a sound source. The constant stream of 1/16th notes, entering at 3'19", is produced by the automated variation of playback speed of the same selected portion of the saxophone sample in groove module 'one' used in section A. A range of playback speeds is generated by the 'harmony tables' module (driven by the external tempo/click and random modules – see 7.4.5 and 7.4.6 for details of this process) initially corresponding to a random selection of the first six notes of a Bb melodic minor scale beginning on Bb2.

At 5'47" the output of groove module 'two' is heard and results from the interact module determining the playback speed of a selected portion of the saxophone sample. The playback speed is dictated by the selected interaction mode or rule, i.e., 'match', 'ignore', 'oppose' or 'switch' (see details of each in 8.4.4). At 5'47" the 'match' mode is selected, however the sounding pitch output is not necessarily 'matching' due to the different samples used by the two groove modules. The interact mode is changed during the performance and is set to 'switch' after 7'46" at which point the mode automatically

changes every eight bars. Between 8'58" and 9'54" the note subdivision of the random module is gradually increased from 1/16th notes to whole notes causing the playback speed on the groove modules to remain constant for gradually longer periods.

The version heard on the accompanying DVD features two edits, firstly, the additional ending as describe above, and secondly, the whole CBPI track was shifted 15 milliseconds forwards in order to compensate for latency caused by the external sync, i.e., the groove of the drum samples track did not 'sit' with the stream of 1/16th notes from the CBPI in section B. This delay was not noticed in performance or during the recording but became apparent when mixing the work.

8.3.4 "Drag"

Table 8.5 details the key inputs utilised in "Drag" in relation to the relevant 'Elements of Interest'.

Table 8.5. *Selected Elements of Interest and Elements of "Drag"*

Parameter		Elements of Interest	Elements of "Drag"
Sound	**Sources**	• Combination of acoustic instruments and electric/sampled sound sources (all) • Keyboard instruments (all). • Computer generated samples/synthesis (all).	• Guitar samples. • Cosine wave oscillator. • Instruments: violin, guitar, electric piano, bass, triangle, hi-hat, snare, cymbals, • Sampled drumkit.
	Objects	• Live instrument sounds (all). • Synthesised/sampled instrument sounds (all).	• Live instrument sounds. • Guitar samples and cosine wave oscillator provide low to mid frequency sustained resonant tones. • Processed drum samples including hi-hat, snare, kick drum.
	Object processing	• Delay (all) • Filtering (all) • Compression (EDM, Impro, Rock) • Reverb (EDM, Impro, Rock) • Variable speed playback (EDM, Electronic, Rock).	• Variable speed and reverse playback, delay, amplitude modulation (with audio frequency cosine wave modulator) of guitar samples. • Filtering, bit reduction (distortion), delay, reverb, compression and gating of drum samples. • Chorus and delay on guitar. • Compression, equalization, room reverb and noise reduction applied in mixing.

Rhythm	**Pulse**	• Constant (EDM, Impro, Rock). • No pulse (Electronic, Impro).	• Introduction free. • Constant pulse after electric piano enters at 1'04" (105bpm).
	Metre	• Other metres - including 12/8, 5/8, 3/4 (Impro, Rock). • Ametric (Electronic, Impro).	• Introduction ametric. • 3/4 after 1'04".
	Patterning	• Repetitive, syncopated elements (EDM, Impro, Rock). • Repetitive, non-syncopated elements (EDM, Rock). • Repeating one, two and four-bar phrases (EDM, Impro, Rock). • Free (Behrman, Interface, Lewis, Oliveros).	• Introduction guitar sample played via 'play back and forth' mode of 'wave' module at rate of 0.04 Hertz. • 1'04" – 7'06": Repeating forty-two-bar form (ABC) (see chart). Bass – (AB) six repeats of six bar phrase, C section – four dotted whole notes and two bar rest; electric piano – similar to bass with harmonic variation in B; violin – (AB) two phrases repeated with note added on repeat, 1/16th, 1/8th, ¼ and dotted whole notes used, C section features two against three feel for four bars; sampled drums feature three bar repeating pattern with snare accents on beat 1 of second bar, constant 1/16th note filtered hi-hats, constant ¼ note click, constant ¼ note kick introduced for second head; percussion features repeating two-beat triangle pattern, hi-hat and cymbal fills throughout solo section. • 7'06" – end (coda): six bar repeating patterns from bass and electric piano.
Pitch	**Selection**	• Tonal with some chromatic elements (EDM, Impro, Rock). • Microtonal elements (Electronic, Impro) • Pentatonic or blues scale for melodies (Impro, Rock).	• Combination of pitched and non-pitched elements. • Introduction features guitar sample with amplitude modulation at audio frequency equivalent to notes from D major pentatonic scale. • A and B sections feature E minor #11 (Bb harmonic minor/E) and E Dorian minor. • C section: shift to relative major of E minor, G major with G major pentatonic melody.
	Vertical structures	• Chord structures and voicings based on extensions and alterations of diatonic harmony as per jazz style (EDM, Impro, Rock). • Range of intervals from semitone to octave utilised for melodies (all). • Bass plays root notes or notes of basic 7th chord (EDM, Impro, Rock).	• A and B sections: electric piano features arppeggiated E 6/7/9 (no third) and Emin6 add 9 chords (see Fig. 8.17 for actual voicings); violin melody features mostly stepwise movement with last phase of B outlining closed voice F# major triad; guitar plays diads and single notes (see Fig. 8.17) with single note and chordal fills; bass features $\hat{1}-\hat{5}-\hat{8}$ ascending and $\hat{7}-\hat{6}-\hat{5}$ descending figure. • C section: electric piano – closed voice root position seventh chords; bass - root notes; violin – stepwise major pentatonic melody; guitar single note harmony in thirds/fourths. • Solo section and coda: violin features range of intervals within octave; guitar – single note and chordal fills featuring range of intervals; sampled guitar/sine wave – single notes with tone – two octave range.
	Vertical patterning	• Static harmony or pedal point (EDM, Impro, Rock). • Repeating diatonic or non-diatonic chord progression (EDM, Impro, Rock).	• 1'04" – 7'06": repeating forty-two bar form – Emin7#11 (24 bars) | A7/E (6 bars) | Emin7#11 (6 bars) | Gmaj7 | Cmaj7 | F#min7 | Fmaj7 (3 bars). • Coda: static harmony (Emin7#11) with chromatic elements.

	Horizontal structures and patterning	• Repeating one, two or four-bar patterns for some instruments – particularly rhythm section (EDM, Impro, Rock). • Motive development, use of sequences, diminution, augmentation etc. (EDM, Impro, Rock). • Short (one-beat to two-bar) phrase lengths combined to form eight-bar sections (EDM, Impro, Rock).	• A and B sections: electric piano and bass parts feature three-bar phrase, ascending-descending contour with repeat of ascending portion to for six-bar phrase. Bass one octave range, electric piano range two octaves. Melody features two phrases, first two notes, second one bar. Both phrases repeated with augmentation of second phrase on repeat. • C section features two phrase period with asending – descending contour, one octave range. • Solo and coda: range of phrase lengths, some use of sequences (4'58" – 5'02") and motive development (e.g., 4'40" – 4'50").
	Dynamics	• Shifts due to texture (all).	• Shifts mostly due to texture with peak in C section of final solo on form (5'42" – 5'48").
	Texture	• Basic texture includes: drumkit, bass, guitar/keyboard, (Impro, Rock). • Homogenous (all). • Thick diverse, heterogenous (all). • Major shifts marking sections or start/end of solos (all). • Staggered layering of elements (EDM, Impro, Rock).	• Staggered layering of elements (see form chart).
	Timbre	• Mostly static timbres throughout (EDM, Impro, Rock). • Foregrounding of timbral transformation (Electronic, EDM, Impro). • Multiple drum/percussion sounds, including percussive noise elements (EDM). • Exploration of minimal sound sources (Electronic, Impro, Rock).	• Blend of live instrument and sampled/electronic sounds throughout. • Sampled drums feature dynamic filtering throughout. • Introduction: Guitar samples shift in timbre due to variable speed playback and amplitude modulation signal at audio rate.
	Spatial elements	• Creation of 'unreal' acoustic space (all). • Placement of sounds within spatial field (all). • Multiple speakers (i.e., > 2) (Electronic). • Sound trajectories in multi speaker system (Electronic). • Foregrounding soloists in solo/accompanmiment texture (Impro, Rock). • Kick and snare drums centred (EDM, Impro, Rock).	• Live instrument sounds placed within spatial field with varying degrees of localization/diffusion. • Guitar samples/sine wave oscillator dyanamically panned throughout via keyboard performance. • Soloist (violin) foregrounded throughout. • Sampled drum 1/16th notes dynamically panned manually during mix. Stereo image rotated around surround field at a rate of one cycle per twelve bars.
	Programmatic Association	• Repetitive, syncopated rhythmic aspects providing somatic/dance aspect (EDM, Impro, Rock). • Complex and multiple meanings possible (all). • Use of production (e.g. effects, spatialisation) to reinforce possible meanings (all).	• Title reflected in four ways: (1) gestural quality suggested by 'read back and forth' mode used to generate sound in 'wave' module. (2) similar movement reflected in ascending-descending contour of bass/keyboard parts. (3) dynamic panning of guitar samples, 'dragging' sound around space. (4) use of guitar samples reflects my own inability (due to injury) to play guitar – a drag. • Repetitive and rhythmic aspects, six-bar syncopated repeating parts, provide somatic/dance elements.
	Structure	• Sectional with regular (i.e., multiples of four) bar lengths (EDM, Impro, Rock). • Free (Impro).	• Sectional: Introduction 0' – 1'04" | Head (ABC x 2) | Violin solo (ABC x 2) | Head (ABC x 1) | Coda 7'06" – end (repeating A). • Introduction and head marked by major textural changes.

	Interaction	• Solo/accompaniment sections with some accompaniment parts 'locked' (Impro, Rock). • Call and response between parts, instrumental and vocal (EDM, Impro, Rock). • Blurring of role between soloist/accompanist (Impro). • On timbral and textural levels (Lewis, Interface).	• Bass, electric piano and sampled drum parts largely 'locked' throughout with some variation in coda. • Violin featured as solo instrument with single note/chordal accompaniment of guitar and sine wave/guitar samples parts intended to blur solo/accompaniment • Some echoing/call and response of phrases between soloist and accompaniment. E.g., rising and falling pitch of all instruments at 4'58" – 5'36". • Slow attack of sine wave echoed by volume swells on guitar and bowing of violin (e.g., 5'36" – 5'41").
	Score	• Graphic score (Stockhausen, "*Studie I*").	• Graphic score provided to all players; notated parts provided for electric piano, violin, guitar and bass.
	Presentational Format	• DVD (Electronic).	• DVD produced from recording of live performance.

The form of "Drag" is similar to the 'head – solos – head' form of many jazz works with the addition of an introduction (0" – 1'04") by the CBPI and an extended coda (7'06" – 10'35"). The graphic form chart used in performance is shown in Figure 8.16

Figure 8.16. "Drag": Graphic form chart.

Variations between the performance form chart and the finished recorded version include the removal of the 'Little beats' and 'Light fills' parts in the first head, the length of the coda (extended in the final version) and the addition of a triangle part. The opening drum sample parts were removed in the editing/mixing stage because they

included a strong onbeat hi-hat accent (used for the timing/performance of the keyboard part) that, on reflection, I felt did not suit the work. The extended coda enabled the violinist to utilise an alternative harmony (altered scale) that was explored in rehearsal. As in the other major works Ian Brunskill wrote the percussion parts, including remaining tacit in the opening and the selection of the triangle for the second statement of the head. Figure 8.17 shows the notated parts given to the violinist, keyboard player, guitarist and bassist.

The electric piano part is sustained throughout (not indicated on chart) and was initially performed on a Wurlitzer. However, due to mechanical problems with the instrument (numerous keys sticking during the performance and recording) the part was overdubbed at a later stage using a Roland XP-30 synthesiser (the original is still heard as part of the room sound in the final version). The violin plays the top line of the melody throughout and the guitar plays mostly the lower part with the exception of phrases beginning in bars 12 and 24 where it plays both.

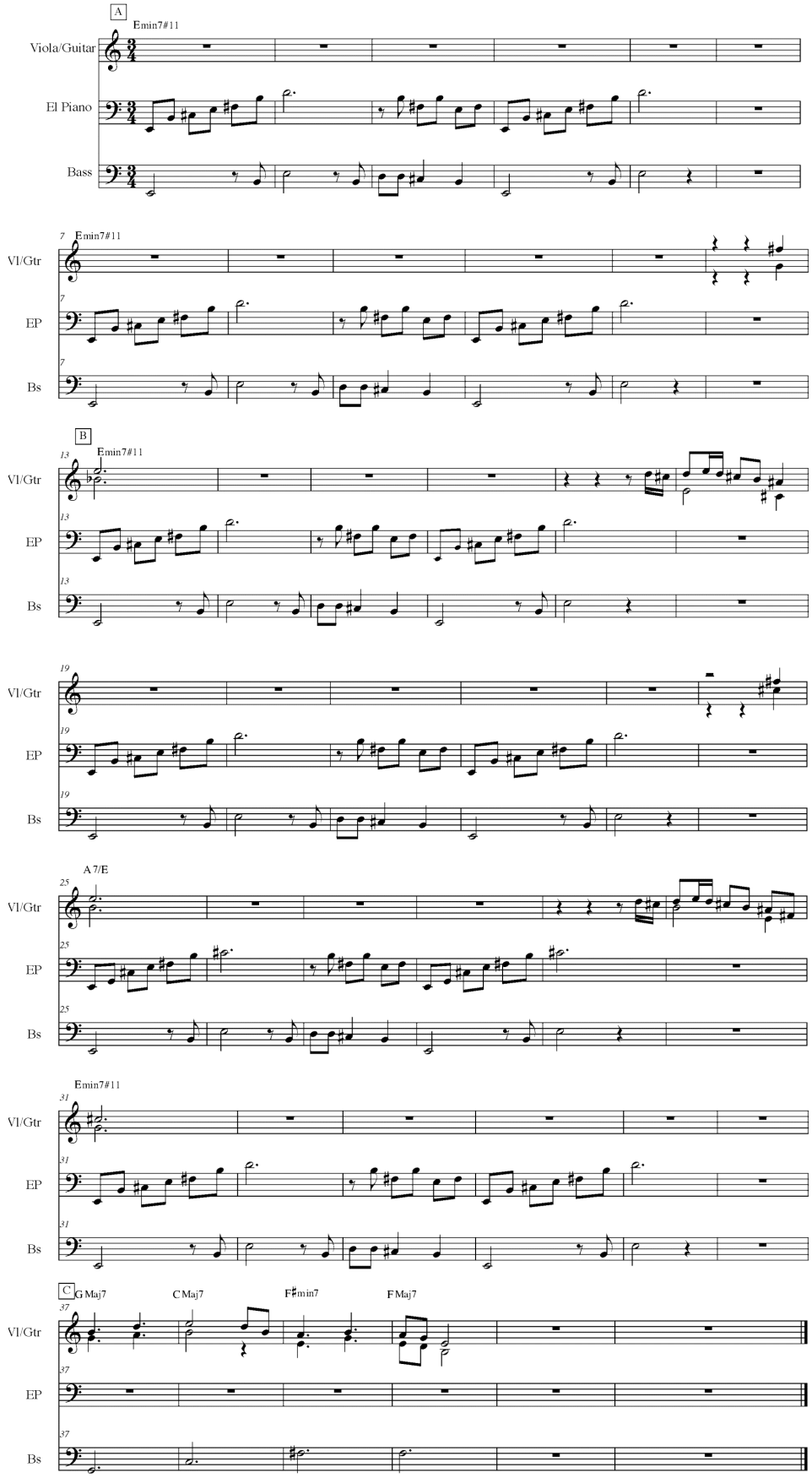


Figure 8.17. “Drag”: Notated parts.

Two three-bar drum sample patterns are heard in “Drag” and transcriptions of these are shown in Figure 8.18. The initial kick and snare drum pattern is a slight variation of the demonstration version of the work and David Brammah suggested the 1/4 note kick drum pattern (commencing at 6’00”) during rehearsal.

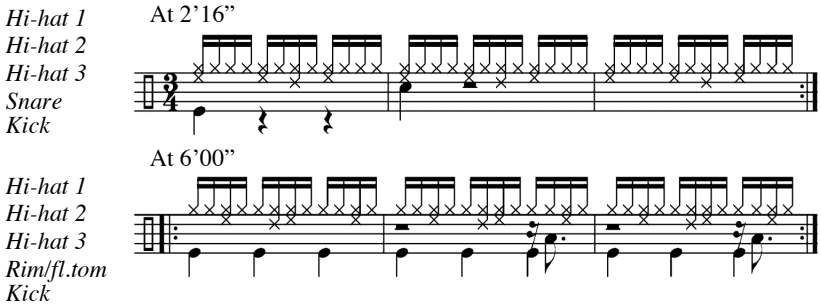


Figure 8.18. “Drag”: Drum sample patterns.

The snare hit on beat one of the second bar of the first pattern has a dotted 1/8th note delay added to varying degrees throughout. Filtering on the constant 1/16th notes was performed manually and is at a variable rate throughout.

The sound sources for the CBPI in “Drag” are the MSP cycle~ object (i.e., a cosine wave) and a c.a. one second sample of the guitar introduction to Pat Metheny’s “Travels” (2000). The introduction (0” – 1’23”) and the coda (7’06” – 9’52”) feature the output of wave module ‘three’, using a combination of the two sound sources and occasionally the sine wave output of wave module ‘four’. Elsewhere, wave module ‘four’ is the sole output source. The initial settings for both wave modules are shown in Figure 8.19.

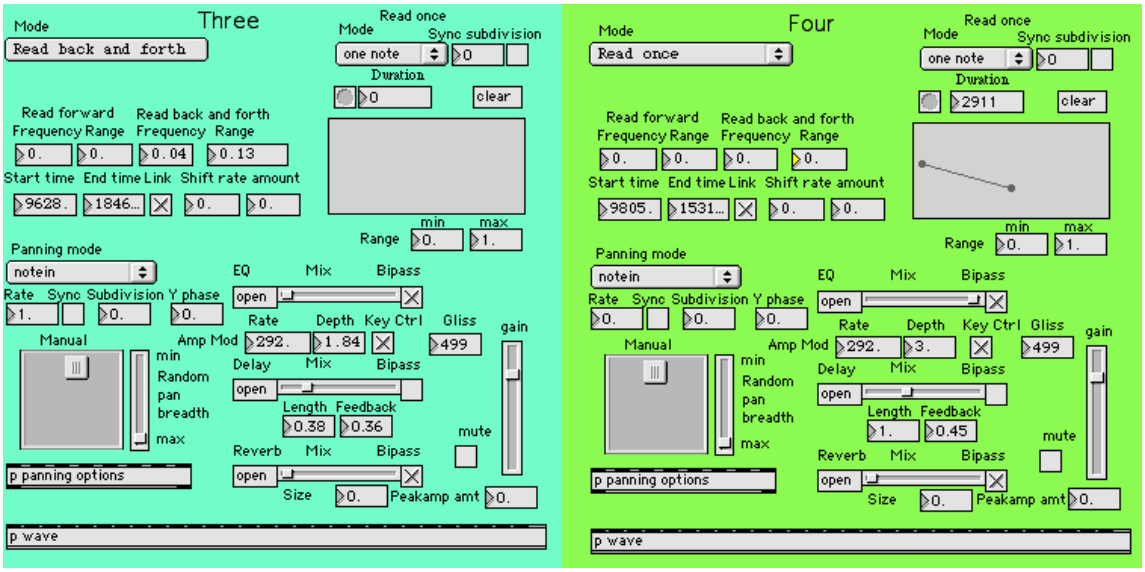


Figure 8.19. “Drag”: Initial settings of ‘wave’ modules.

In module ‘three’ the ‘read back and forth’ mode is used at a very slow rate over an 1149 millisecond section of the guitar sample. The amplitude of this signal is modulated by a cosine wave at audio frequency (e.g., 292Hz in Figure 8.19). A fixed set of amplitude modulating frequencies (corresponding to three and a half octaves of a D major pentatonic scale beginning on F#) are mapped to the keyboard of the MIDI controller and played in performance. The panning of the output of module ‘Three’ is also performed on the MIDI controller keyboard. The output of module ‘Four’ is initiated by triggering the ‘read once’ mode of any portion of any sample. The amplitude modulating frequency then becomes the sole sound source and the frequency and panning is controlled as in module ‘three’. Two knobs on the MIDI controller are assigned to the ‘gliss’ parameter (value in Figure 8.19 is 499ms) and are varied through the work. (This value controls the duration (in milliseconds) for the amplitude modulation rate to reach the selected value). In the introduction the ‘gliss’ value remains at 499ms and a low value is heard, for example, at 8’35” – 8’38”, and 9’52” – end. Module ‘four’ features a long delay setting that remains constant throughout the work.

8.4 Live and Recorded Performances

Two performances of the major works were given (on November 17 and 18, 2006) at Umbrella Studio, an art gallery space in Townsville, Qld. The first performance was open to the public, the second for recording purposes only. The stage plan for both performances is shown in Figure 8.20.

The stage plan enabled constant visual contact between myself and the other performers, necessary for the cueing of parts in each work. The two CBPI output speakers and three (left-front, centre and right-front) recording microphones at the top of Figure 8.20 were situated on a raised section (approximately 60cm) of the gallery. Video footage of the setup and live performances is included on the accompanying DVD submission.

Originally I had intended to record the first performance and a second performance was a contingency plan if necessary. Unfortunately, numerous technical problems were encountered and the second performance was required. At each performance, two additional works were presented, one before and one after the four major works discussed herein. The opening work featured all instruments and was intended as an opportunity for the engineer to fine tune recording levels. The closing work revisited elements of the first work, providing a somewhat balanced form to the whole performance.

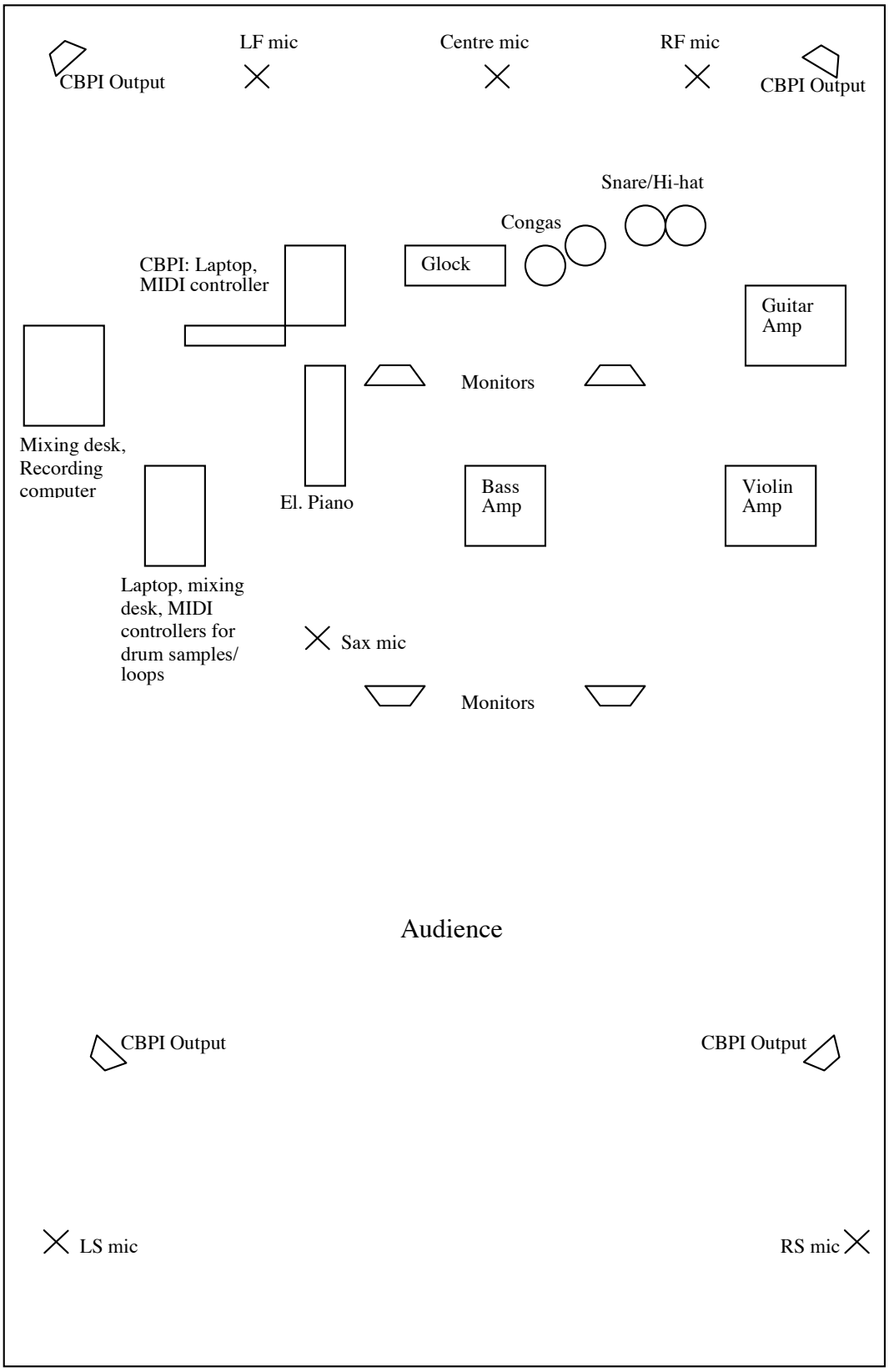


Figure 8.20. Stage plan for performance and recording at Umbrella Studio.

The performance was recorded using a Pro Tools TDM system and required a thirty-two-track session. Direct inputs were taken from the CBPI, drum samples/loops, bass, guitar, electric piano and violin. Microphones were used on the guitar amplifier, violin amplifier, percussion, saxophone, vocals and five ambient room microphones were placed in a surround configuration as shown in Figure 8.20 (the stage plan). The recordings submitted on the accompanying DVD are of mostly first, and only, takes recorded during the second (non-public) performance of the works. Some edits were made during mixing and are noted in section 8.3. Video footage of the recording of each of the major works is included on the accompanying DVD.

Mixing of the major works was completed with Michael Worthington at his home studio in Lismore, NSW. Many of the post-production sound processing and spatialisation aspects were suggested and realised by Michael Worthington. My role during mixing was akin to a rock producer, i.e., listening, making suggestions and clarifying compositional elements. Compression and equalization were applied to most individual tracks in order to introduce greater clarity and minimise resonant aspects of individual sounds. For example, in “Hit”, band compression was applied to the bass drone with a 5dB boost centred on 53Hz and 106Hz (corresponding to G# frequency of fundamental). In “Drag” band compression centred on approximately 2.5KHz was applied to the room sound in order to remove resonant percussive attacks. In “Scrape”, resonant peaks in the room sound at 275Hz, 734Hz, 2.99KHz and 6.43KHz were reduced via equalization. In all cases, resonances were identified aurally by sweeping a narrow band peak filter across the frequency spectrum of the particular track.

In terms of spatialisation, emphasis was placed on using the surround ambient microphones as the main source with individual channels used to reinforce parts where necessary. An exception to this is the introduction and first head of “Drag”, where the ambient microphone sound is minimized due to the unwanted drum sample and original electric piano parts (see section 8.3 for detail). After treating the room microphone tracks with noise reduction two or three copies of the resultant ‘room sound’ were made within the Pro Tools session for each work. Each copy was treated with different compression and equalization enabling different room ‘colours’ to be applied to the overall mix. For example, one room sound featured mostly low frequency content only, a second room sound featured only high frequency elements.

The major works are exemplars of the analysis/creation model developed for this research and offer an indication as to the potential scope of future applications of the CBPI. Reflections on the processes and sonic outcomes of the major works and directions for future development/refinement of the CBPI are discussed in the following concluding chapter.

CHAPTER NINE

REFLECTIONS, DIRECTIONS AND IMPLICATIONS

The research questions and aims of the study (see 1.4) focus the following concluding discussion. Section 9.1 addresses the first research question and the first part of the first aim (i.e., the identification and analysis of compositional methods at the intersection of conserved and emergent technological compositional methods). Sections 9.2 and 9.3 address the second research question and the second part of the first aim (i.e., the development of an analytical methodology capable of application to the creation of new musical works). Sections 9.4 and 9.5 address the second research question and the second and third aims of the study (i.e., the development of a series of works utilising selected compositional methods from the intersection, exemplifying the application of analysis to music creation, and the development of a computer based performance instrument). Section 9.6 addresses possible implications and future research directions in relation to the fields of music analysis, music technology and music education.

9.1 Identification and Exploration of Compositional Methods at the Intersection

Appendix B provides, in detailed and elemental form, a range of compositional methods utilised in the thirty-six works (nine in each genre) analysed for this research. The methodologies identified are summarised in sections 5.1.3, 5.2.3, 6.1.3, and 6.2.3, (i.e., each section titled *Ascertaining Compositional Methods / Mapping Genre Terrain*). The works analysed incorporate emergent and conserved technological composition methods to varying degrees and represent a cross section of works in musical genres of personal interest, i.e., electronic, improvised, rock and electronic dance music. The

following exposition and discussion of compositional methods identified in the four genres follows the form of the analytical template, i.e., the various parameters listed as *shaping factors* and *inputs* in Table 4.1, with reference to the *processes* given in Figure 1.1.

9.1.1 Compositional Methods: Processes and Shaping Factors

When considering the basic processes in each genre, many of the electronic works are of an individualised, *top down* nature with the design of a formal structure of a work preceding its realisation. In contrast, where discussed, the EDM and rock works often resulted from a collaborative, *bottom up* approach, where factors such as *play* are an integral part of the creative process. In the former, music technology is generally used as a means to achieve clearly defined conceptual goals whereas in the latter, the potential of a particular music technology is explored in a hands-on manner.

The processes involved in the improvised works resist categorisation as either top down or bottom up with elements of both evident to varying degrees. This is perhaps best reflected in Chadabe's (n.d.) notion of creating 'activities' as opposed to 'pieces'. In most of the works in the improvised genre the 'work' is the result of a meeting between a structure developed by the composer and a somewhat autonomous (to varying degrees) performer. In the works analysed, the structure could take the form of a harmonic framework of set duration (bar lengths) over which the individual performer improvises (e.g., works by Davis, Pine, Hancock and Douglas). On the other hand, the structure may involve an instrument (e.g., *Interface*), sound source (e.g., Oliveros) or an

interactive computer application (e.g., Behrman, Lewis, Chadabe) with which the performer improvises.

In most of the works in electronic, rock and EDM genres, roles such as performer, composer, engineer and producer are blurred. A basic categorisation might begin with the following: electronic – composer, improvised – composer/performer, rock – performer/producer, EDM – producer. However, in the process of producing a recording, individuals or collaborators involved move between roles, and utilise the studio as a creative tool. In this way, recording technology becomes an integral part of the music making process. For example, the labour intensive tape construction used by Stockhausen in *"Studie I"* is comparable to the multiple sample construction of the rhythm track for Public Enemy's "Fight the Power". In the improvised works, recording is generally just a means to capture the performance moment and therefore a clearer distinction between roles of performer/composer and engineer/producer. Exceptions include Macero arranging Davis' "Bitches Brew" from various taped performances and Douglas' desire to create a recorded product distinct from a live documentation on the album *Freak In* (including the track "November"). On the other hand, a studio construction can also involve a performance by various technicians and engineers, for example, in bouncing tracks between four-track recording machines with appropriate effects and mixing levels, as in the case of the Beatles' "Tomorrow Never Knows".

Of the works analysed for this research, the division into 'art' and 'popular' music categories, at the *shaping factors* level, hinges on education and source of funding. In the analyses, these aspects are considered in the *theoretical* and *budget/resources* parameters. Composers of the electronic and the improvised works (i.e., 'art' music)

emerge from a Western art music tradition with university/conservatorium training whereas most of the rock and EDM (i.e., 'popular') artists are either self-taught or have low-level formal instrument training. Most of the works in the art genres are supported financially via the public sector whereas popular music works rely on private enterprise.

In terms of many of the other *shaping factors* parameters, the art/popular division is not evident. For example, most of the electronic, improvised (art) and rock (popular) works were produced in well-resourced studios employing full time technicians and engineers. This is in contrast to the 'do it yourself', home studio production of many of the EDM works. There are exceptions, such as the production of Kraftwerk's "Autobahn" and Donna Summer's "I Feel Love" which align more closely with a rock studio production model. Xenakis' "rather primitive facilities" (Harley, 2002, p. 37) used for the production of "*Concret PH*" are more analogous to the home studio environment of Autechre or the Chemical Brothers than to the well-resourced studios utilised for many of the other electronic works. The art/popular division is also not apparent when considering the *timeframe* parameter. The duration of production of the electronic and rock works share a timeframe of months to year(s) whilst the improvised and EDM works are mostly completed in a matter of day(s) to month(s). All the works share the *macro environmental* factor of origin in Western developed countries, i.e., from Europe (France, Germany, Italy and the UK) or the USA.

9.1.2 Compositional Methods: Inputs

9.1.2.1 Sound

The most obvious and direct impact of music technology on compositional method has been via the expansion of the range of possible *sound sources*. Although it is possible to consider all instrument invention and development as contributing to the gradual expansion of a sonic palatte, this research has considered examples such as *musique concrète*, various forms of synthesis, digital sampling and effects processing from mostly the mid to late twentieth century. The exploration and utilisation of new sounds has entailed the following:

- Development of (largely) new forms (e.g., many of the electronic works);
- Shifting or expansion of existing forms (e.g., some of the improvised and EDM works);
- Supplementing/substituting of timbral resources within established styles (e.g., some improvised works and many of the rock works).

For example, for all the electronic works, with the possible exception of Cage's "Imaginary Landscape #1", the *sound* is crucial to the work, i.e., it is not possible to substitute another sound source and maintain the identity of the work. Whilst it could be argued that the substitution of, for example, Jimi Hendrix's or The Edge's (from U2) guitar sound for another 'generic' guitar sound within those works would substantially alter the identity, the degree to which this applies in most electronic works is far greater. Schaeffer's "*Etudes Aux Chemins de Fer*" or Harvey's "*Mortuos Plango, Vivos Voco*" are two examples where the work is inescapably bound to the sound source.

In relation to the second category above (i.e., the shifting or expansion of existing forms), many of the composers in the improvised and EDM genres consider their work as an extension of traditional forms. Lewis' "Voyager" "is conceived as a non-hierarchical, interactive musical environment … that is modeled in terms of African-American musical forms" (Lewis, 2000, liner notes). Interface suggest that their work represents "a new approach to electronic chamber music" (Bahn, Cook & Trueman, 2000, p.1) through the use of 'inside–out' speaker arrays and instruments played in the manner of traditional strings. Less explicitly, Public Enemy call attention to a tradition by a lengthy list of influences (e.g., 1960s and 70s funk and soul artists) cited on the album cover and via the use of recognisable samples of a "pantheon of black figures" (Katz, 2004, p. 155). Although the examples cited here are similar to the electronic works inasmuch as they are bound to the *sound*, the invocation of traditional forms by improvisers and EDM composers contrasts the modernist 'art music' paradigm of many of the electronic works.

In relation to the third category above, new sound sources or effects have been utilised to expand/substitute timbral resources whilst maintaining most other style elements. This is most evident in improvised works such as Hancock's "Chameleon" or Pine's "Oneness of Mind" where synthesiser and turntable respectively were incorporated within a jazz fusion/funk setting. In rock, new instruments have been incorporated or used as substitutes. For example, Wonder's "Isn't She Lovely" incorporates synthesisers and Prince's "Sign o' the Times" substitutes drum machine/samples for drumkit. The gradual evolution of production techniques and recording technologies has not lead to the abandonment in rock works, for example, of 4/4 metre, backbeat, verse/chorus structure, pentatonic melodies and a basic texture of drumkit, bass and

guitar/keyboards.[13] Instead, changes have occurred most notably at timbral and spatial levels as discussed below.

9.1.2.2 Rhythm

In terms of *rhythm*, new sound objects with durations above or below written note values have complicated traditional Western notions of pulse and metre. Many of the *concrète*, synthesised and/or electronic sounds used in works by, for example, Varèse, Chowning, Harvey, Oliveros and Interface are sustained/timbrally evolving sounds which lead to an absence of constant pulse. On the other hand the density of sub-note level duration sounds heard in Xenakis' "*Concret PH*" or the multiple pulses heard in the works by Subotnick, Stockhausen ("*Studie I*") or Lewis involve a complexity that cannot be represented in traditional notation.

Other technological rhythmic elements are more readily represented by traditional notation. For example, the transcription of the rhythmic aspects of turntable performance is attempted in the analysis of Pine's "Oneness of Mind". However, this transcription is only intended as a guide, in much the same way as jazz solo transcriptions do not capture a particular swing feel. It would also be possible to transcribe, for example, the duration of filter sweeps in EDM works by Autechre or Roni Size as these generally occur in regular repetitive patterns. Such transcription enables the new timbral resources within these works to be linked to existing music theoretical frameworks.

[13] However, the most recent rock works analysed here, Radiohead and Björk, do not have most of these.

Music technology has also enabled a strict quantization and repetition of rhythms beyond the capacity of human performance. This is most evident in the EDM and Rock works that utilise synthesised drumkit sounds. In some cases (e.g., "Planet Rock", "Can You Feel It", "Brown Paper Bag", "Blue Monday" and "Everything in its Right Place") the transcription of such rhythms is straightforward and represents, aurally, a perfect performance previously idealised in a score form only. However, the situation is complicated by *timbral*, *sound processing* and *spatial elements*, for example, the presence of multiple drum sounds (e.g., "Fight the Power"), use of effects (e.g., delay in "Montreal" and "Sign o' the Times"), or the panning of same/similar percussive timbres across the stereo image (e.g., "I Feel Love", "Montreal" and "All Along the Watchtower").

9.1.2.3 Pitch and Dynamics

In the works analysed, *pitch* elements have been treated in one of the following ways: maintained from traditional models (e.g., many of the rock, EDM and improvised works); complicated by an emphasis on frequency as opposed to pitch (e.g., "*Studie I*", "Stria", "*Mortuos Plango, Vivos Voco*"); discarded altogether through the use of noise-based or broad frequency band sound sources or tonally unrelated samples/sources (e.g., "*Etudes Aux Chemins de Fer*", "*Concret PH*", "Bye Bye Butterfly"); incorporate a combination of two or more of the previous (e.g., "*Poème Électronique*", "*Gesang der Jüngling*", "Voyager", "Scrb", "Tomorrow Never Knows", "Fight the Power"). At a more specific level, pitch glissandi are prominent in works such as "Bye Bye Butterfly", "Voyager", "Scrb", and "*Mortuos Plango, Vivos Voco*" and pitch is the key determinant in the interactive computer setting utilised in "On the Other Ocean".

In most of the improvised, rock and EDM works *dynamics* are a function of *texture* with dynamic levels corresponding to the density of layered parts. In the electronic works, with the exception of "*Concret PH*" dynamics are largely independent of texture. The dynamics of the component frequencies of synthesised sound objects in "*Studie I*", "Stria" and "*Mortuos Plango, Vivos Voco*" are independently controlled and in the latter two examples lead to evolving/shifting timbres of sustained sound objects. Recording production and reproduction technology enables dynamics to be utilised to create proximate/distant spatial effects. However, as Emmerson (2000) suggests, our understanding of the relationships between sound and source has moved beyond one gained solely from the physical world as we are continually exposed to sounds from loudspeakers. This is particularly relevant to rock and EDM works where, for example, 'unaturally' loud tambourine parts do not appear out of place. In such a case, I would suggest that, for the composer/producer/ mixing engineer, the dynamic controlled spatial element is secondary to the timbral qualities of the 'loud' tambourine in relation to the whole song texture.

9.1.2.4 Spatial Elements, Programmatic Association and Structure

A range of *spatial elements* is employed in the works analysed, including the placement and movement of sounds within a stereo or multi-channel sound field, the creation of 'real' and 'unreal' sonic environments and the transformation of a perceived acoustic space. The differences between my own listening to the works and the original mode of presentation is no doubt significant in some cases, e.g., the 350 speaker system which originally presented "*Poème Électronique*" and "*Concret PH*", or the mono radio broadcast of "Imaginary Landscape #1". In many of the multi-track improvised, rock and EDM works (i.e., not live recordings) static timbral layers (e.g., separate instrument

parts) occupy discreet regions of the stereo field. When, for example, instrumental texture thickens, the density, breadth or depth of the spatial field increases.

In most cases, with the exception of "*Mortuos Plango, Vivos Voco*" and "Voyager", explicit *programmatic association* or the composers intended meaning of the works or aspects of the work are not given in the literature. My own responses, and others from the literature, are given and provide a somewhat cursory view of possible meanings. Whilst the perception of referential qualities is no doubt a function of my own subjectivity, comments from others included in the *Literature* column of the analyses enable some comparison to be made. All of the above inputs (e.g., *sound objects, processing, pulse, pitch, timbre, spatial elements* etc.) contribute to the reception of meaning. For example, syncopated, repetitive rhythmic patterns and the textural norm of drumkit, bass and keyboards/guitar in most rock, EDM and some improvised works highlight the somatic aspects of these works. Individual sound objects, in particular those deriving from new technology can be perceived in an entirely acousmatic sense (e.g., "*Concret PH*" or "Stria") or provide explicit referential qualities (e.g., car samples in "Autobahn"). The majority of sound objects encountered in the works analysed for this research afford a range of meanings in between the acousmatic-referential poles.

In terms of *structure*, the utilisation of top down (e.g. in electronic works) and/or bottom up (in rock or EDM works) compositional processes is discussed in 9.1.1. In some cases, a top down conceptual structure is derived from or only achievable via emergent technological means (e.g., Stockhausen's "*Studie I*" or Chowning's "Stria"). However, the sectional forms evident in most of the works analysed do not inhere solely in the particular technological means, instead such means are placed within or expand

established forms. This is most evident in rock and some improvised works where traditional verse/chorus or head/solos forms are maintained. In many of the EDM works sections feature a gradual thickening of texture with additional layers added at regular four, eight or sixteen bar intervals. Freely improvised forms are evident in the works by Oliveros, Behrman, Lewis and Interface.

9.1.2.5 Interaction, Score and Presentation Mode

In the analyses, *interaction* was considered in terms of performance, and as such is only considered in works realised via live performance to some degree. Tension and release principles are evident across improvised, rock and EDM works and are achieved via a number of parameters including *pitch*, *dynamics*, *rhythm*, *texture* and/or *structure*. In the improvised works, interaction occurred in a variety of different forms ranging from the traditional jazz soloist/accompanist(s) model (e.g., Douglas, Hancock, Pine) to a blurring of such roles (e.g., Behrman, Chadabe, Davis, Interface, Lewis, Oliveros). In terms of performer autonomy, the interactive computer work "Voyager" represents the most explicit 'non-hierarchical' structure, whereas the works by Davis, Douglas, Hancock and Pine all incorporate 'locked' parts to some degree. Interaction between performers/ computer on textural and timbral levels is most evident in "Voyager" and "Scrb".

Given that the identity of most works is constituted in a recording, a written *score* is largely superfluous. With the exception of the graphic score of Stockhausen's "*Studie I*" (Stockhausen, 2001), composer working notes and/or scores are not readily available in the literature. Whilst some transcriptions of pitch and rhythmic elements are presented

and sonograms of "*Concret PH*" are given (Di Scipio, 1998), no comprehensive or complete transcriptions for the works were found in the literature.

Whilst my analysis of the works focused on listening to recordings via compact disc player or computer (i.e., Mp3 format) the original *presentational format* of the works include the following modes: radio broadcast (e.g., Schaeffer and Cage); live concert performance, either from tape or via human performance (e.g., Stockhausen's "*Gesang der Jüngling*" and works by Interface, Lewis, Varèse and Xenakis); quadraphonic vinyl LP (e.g., Subotnick); and stereo vinyl LP/single (e.g., Beatles, Davis, Hancock, Hendrix, Kraftwerk, Summer etc.). A parallel can be made between the intended audience for many of the works in the electronic and EDM genres: the former, a public gathering in the concert hall, the latter, a public gathering in a nightclub. On the contrary, many of the improvised and rock works are intended for private, individual consumption. In the electronic and EDM genres the recording is the central identity of the work, whereas in the improvised and rock genres, the recording is often an adjunct to the live performance activities of the artist/group. This correspondence between genres further disrupts an art/popular division.

9.2 Applications of Analytical Methodology

In this section the application of the analytical methodology to works in the four genres is discussed. Insights gained through the analytical process are reflected on and suggestions for further refinement of the analytical template, the current and future use of supplementary presentation tools, and the potential for an ethnographic approach are given.

The analytical template was refined throughout the course of the research in response to the nature of particular works. A uniform, 'one size fits all' template was maintained throughout in order to enable the comparison of elements between genres. The *interaction* parameter was added when working on the improvised works, and then considered for the other genres where appropriate. A *text* category was also originally included. However, the transcription of, for example, song lyrics seemed unnecessary, as these are readily available from other sources (e.g., internet). Instead, the discussion of *text* elements appears within the *programmatic association* parameter.

Having completed thirty-six analyses, I would recommend future refinement of the parameters via the incorporation of *timbre* within the description of individual *sound objects* and an expansion of *programmatic association* to include sub-parameters such as *gestural reference* (following Middleton, 2000), *signification/connotation* and *intrinsic/ contextual recognition* (following Wishart, 1996). These latter parameters were considered in the analyses for this research. However, the detail that can be brought to these parameters warrants separate categorisation. When reliant on aural means alone, the categorisation of *sound sources* into, for example, live instrument performance or instrument sample, is not possible and renders this parameter somewhat superfluous. In these cases the necessary information can be presented within a description of *sound objects*.

In many cases it has proved useful to supplement the text descriptions with other presentation tools such as conventional notation (when dealing with traditional pitch/rhythm elements), sonograms and graphic form diagrams. In Appendix B the latter are presented in a manner that reflects the standard computer based sequencers with tracks listed on vertical axis and a timeline of events created along the horizontal axis.

Recreating a work in this manner creates a visual representation similar to that used to create the work, thus reinforcing the *analyst/creator* model. Furthermore, such a figure could be augmented to include detailed descriptions of individual sound objects and perhaps even incorporate *effects settings, panning, inserts, auxiliary sends*, etc., in order to replicate the computer interface producing the work. For example, I could envisage the recreation of a Pro Tools session or the creation of an interactive multimedia environment as a useful presentation of analyses. One could extend Moore's notion of the 'sound box', with axes for register (vertical), stereo image (horizontal), perceived distance from listener (depth) to present a 3D animated 'sound box through time' (Moore, 1993). Such presentation would help to capture the interplay of the various parameters as they unfold over time, an aspect missing in the current analytical template.[14] These suggestions are particularly relevant in analytical or musicological contexts but not necessarily appropriate in the context of music creation, the intention of this research.

A comparison of information presented in the *Literature* column of the analyses illustrates another general distinction at the art/popular level. In many of the electronic and improvised works, composers provide detailed commentary of processes undertaken. This is to be expected as institutions, most likely requiring such as part of an acquittal procedure, commission most of the works selected in this genre. However, in rock and EDM works, such commentary is rare. For these works, the majority of literature is of a journalistic nature and only in specialist industry magazines (such as *Sound on Sound,* or *Audio Technology*) do interviews with artists, engineers or producers address specific studio processes. Thus, where no indication of the particular

[14] Hirst (2005) provides a useful model for the presentation of an interactive study score for electroacoustic works, incorporating a timeline and graphic depictions of sound objects aligned with audio of the work. However, Hirst's model does not demonstrate processes in the manner I have indicated here.

equipment (e.g., for sound sources and effects) is given in the literature, a combination of practical experience and comparison with other works is necessary. This is one area where producers and engineers have much to offer the field of music analysis, either as researchers themselves or as a key source of information for ethnographic research.

An ethnographic approach could also be used to probe collaborative processes. The relationships that develop within a studio environment between musicians, engineers and producers warrant detailed study in order to establish a thorough picture of the nature of music creation. This is most evident in rock works where numerous personnel and multiple studios are utilised over a timeframe of months to years. Such a study would require grounding in both psychological and sociological methodologies that are perhaps beyond the scope of one researcher and require an interdisciplinary approach from a research team.

A final issue in relation to the *literature* aspect of the analyses, is the reliance on the presence of material to provide supplementary and sometimes contradictory information re the various parameters. In this way, only works that have a high profile in the literature are suitable and thus the method is reinforcing the canonisation of a limited number of so called *great* works. A possible solution to this would be to interview the creators of works (after the *experiential* column of the analysis is completed) and for this to be included in the *literature* column. However, the scope and timeframe of this study precluded such an approach here.

9.3 Reflections on Analysis/Creation Model

The extension of analysis to creation was demonstrated in this research by the genre studies and major works. The compartmentalisation of musical inputs as discrete elements enabled the creation of a storehouse; an accumulation of discrete elements (i.e., compositional methods) at/from which I could ponder, select, combine or appropriate in the creation of the new practical works. The separation of elements contributes to the rupture of combinations of elements affording notions of a particular style. For example, the combination of a strong backbeat (usually part of broader rock or EDM styles) within an interactive computer environment (seen only in freely improvised context in this research) becomes plausible. This combination is utilised in the major work "Click".

Whilst the somewhat free selection of musical *inputs* from the storehouse is possible, many of the *shaping factors* remain either fixed or confined by particular context. For example, education (considered within the *theoretical* parameter), *macro environmental* and *listening* factors are relatively fixed for an individual composer, or only change over a timeframe of years. Similarly, the *budget/resources* and available *timeframe* for a particular work will be limited. Thus the shaping factors elements highlight individual agency and offer a starting point for consideration of the impact of such factors as gender, class and race on music creation.

9.4 Computer Based Performance Instrument (CBPI)

The degree to which the identified compositional methods are embedded in the CBPI is raised in Chapter Seven, i.e., not all of the parameters identified as musical inputs in the analysis template are included in the CBPI. For example, aspects of *rhythm*, *pitch*, *programmatic association* and *structure* remain as compositional concerns separate to the function of the CBPI. This reflects the music making practices encountered in many of the works analysed (e.g., many works in the improvised and rock genres) and personal practice where improvisation, collaboration and performance are central elements. To this end, the CBPI successfully incorporated the selected methodologies with some of the potential sonic outputs demonstrated in the major works.

As discussed in section 7.4.8 and 7.5, the system testing is ongoing and refinement is expected to continue after the completion of this research as new performance and composition projects arise. Initially, I intend to explore the use of alternative MIDI controllers as the knobs and sliders on the model used for the research proved too physically demanding in performance (see 7.5.3). Difficulty in establishing a secure external sync with other digital sources (see 7.5.1) is a problem that will need to be addressed in order to continue collaborations of this nature.

The partly pre-composed nature of the CBPI elements in all of the exemplary works in some ways reflects my reservations for the CBPI as an instrument for free improvisation. In order to utilise the CBPI in such an environment, one refinement would be the immediate availability of a mass of samples (currently requiring a click and selection from file, interrupting audio output), possibly pre-classified according to

various parameters. This could be achieved by pre-loading a large number of samples in separate *MSP* buffer~ objects. However, I would prefer the entire contents of my sample library, in addition to incoming live audio, to be available. The incorporation of the software sampler, such as Halion, as a VST plugin could also provide a broader sonic palate immediately upon loading.

9.5 Reflections on Practical Works

9.5.1 Processes

A range of processes, drawn from those utilised in the works analysed, was involved in the creation of the practical works. These include the top down, individual creation of the Electronic Study, and the bottom up, collaborative creation of the Rock Study. The exemplary works incorporated a range of processes through the development of the CBPI to the production of demonstration versions, rehearsal, performance, recording and mixing/mastering.

The relatively large ensemble (in comparison to much of my previous experience) involved in the major works presented some challenges for my role as musical director. A diversity of experience within the ensemble, coupled with my own varied levels of confidence in each performer led to a need to present musical ideas/suggestions in different ways. For example, David Brammah (beats and loops) was presented with audio examples of drum patterns as a starting point and given minimal direction thereafter. Other performers received traditional notation with parts set to varying degrees. My prior performance experience with and enjoyment of Cleis Pearce's

(violin) improvisation skills led to minimal directions for both solo and accompaniment parts, whereas the other players received more specific parts when not assigned solos.

The collaboration with Michael Worthington (recording, mixing and mastering engineer for the exemplary works) involved an extended timeframe with pre and post-production elements. My previous experience working with Michael over the past seven years has led to a refinement of collaborative processes and the development of generally efficient communication. Prior to the recording extensive email and phone correspondence was conducted regarding recording facilities and resources. A final decision as to the location for recording was not made until Michael arrived in Townsville a few days prior to the recording as he wanted to see and hear the available room options. Although this situation was not ideal (for example, I had to have two rooms booked on the recording dates), it was necessary as no experienced surround recording engineer was available in Townsville. The completion of mixing and mastering at Michael's home studio in Lismore, NSW had some benefits including Michael's familiarity with the monitoring environment and computer system. However, distance (Lismore is 1560km from Townsville by road) and different Pro Tools systems and plugins led to my reliance on Michael to make minor changes to the mix at a later date.

9.5.2 Sonic Outcomes

On reflection, some specific aspects of each of the four genre studies could have been improved. For example, at a broad compositional level, the first half of the EDM Study warrants editing due to an excess of non-drum/percussion parts (e.g., numerous synth pads and noises) inconsistent with the genre terrain for the EDM works analysed. The

chorus texture of the Rock Study is perhaps too full, with many, somewhat disparate, contrapuntal parts. In terms of mixing, the sampled hi-hat loop in the Rock Study needs a reduction in mid-range frequencies. At a more technical level, the application of short volume fades on the attack portion of the baby samples would have minimised some clicking heard in the Electronic Study. The tremolo speed on the keyboard part in the Rock Study is slightly annoying and could have been adjusted to fit the tempo or this part reduced in the mix.

For the major works, some compositional/instructional and performance issues emerge. For example, at a compositional/instructional level, the soloists (violin, guitar and saxophone) in the second half of "Click" did not achieve my intention of 'random' continuous 1/16th notes (this is discussed in detail in 8.3.3). The acoustic guitar part in "Scrape" (first heard at 3'20") needs revision or the transposition of the whole piece (down a tone, with the guitar and bass low E tuned to D) in order to allow more use of open strings. In hindsight, the inclusion of a guitar solo in "Drag" would have been appropriate and the guitar parts heard at the end of the violin solo seem to suggest a guitar solo to follow.

At the performance level, some parts stand out as requiring further rehearsal. For example, the hand percussion at the start of "Hit" seems too random and aimless and becomes too dense too early in the work. The saxophone solo in "Scrape" is too busy and does not connect strongly enough with the rhythmic and timbral aspects of the accompaniment. The substitution of a synthesised, keyboard bass for electric bass (e.g., the same bass sound used in the demonstration version of the track – see Appendix C) would have given this section the particular funk feel I intended (i.e., keyboard bass

driven, e.g., Wonder). On the other hand numerous improvised aspects of the performance were enjoyable. These include the violin solos throughout (with the exception of "Click", noted above), the filtered sample loop introduced at 5'25" in "Hit" and the collective improvisation apparent between violin, guitar and samples in the second half of "Drag".

9.6 Directions and Implications

9.6.1 Music Analysis

This research has presented an analytical template applicable to works in electronic, improvised, rock and electronic dance music genres. The text-based, parametric approach incorporates observations made by the analyst (mostly on an aural basis) alongside insights from the literature related to the particular parameters. The analytical approach seeks to foreground elements of music technology neglected by traditional analytical methodologies such as *timbre*, *spatialisation* and *programmatic association* in addition to the consideration of a range of contextualising *shaping factors*. Thirty-six analyses are included in Appendix B and demonstrate the potential for a desk-based methodology to provide insight into works in the four genres. The degree of detail presented is somewhat less than in much of the literature, where analysis of an individual work (or a small sample of one composer/artists work) occupies, for example, an entire book chapter or journal article (e.g., Brown, 1997; Fast, 2000; Goodheart, 2001). Such detail was beyond the scope of this study, secondary to the desire for a multi-genre, historical overview directed towards the purpose of music creation and personal practice.

The use of supplementary presentation tools such as graphic form diagrams, sonograms, traditional and non-traditional notation have been utilised to some extent here. This could be extended, in a multimedia environment, to incorporate sound examples, 3D graphic/animation representation of dynamic spatial elements and re-creation of the production interface (e.g., a Pro Tools session). Such a presentation would enable greater insight into the interplay of the various parameters and be applicable to the fields of music analysis or musicology.

The application of the analytical methodology to other musical genres, including Western classical and non-Western genres, would provide useful comparisons between individual works and genres and further test the validity of the 'one-size fits all' approach adopted here. An expansion of the parameters currently considered as *shaping factors* or *inputs* would be one expected result of analysis in diverse genres, in the same way the analytical template evolved through the course of this research in response to works in various genres. In this way, the development of a final complete list of parameters is not an intended outcome. Instead, as parameters are added or refined an ever more comprehensive list is developed, with revision and updating of previous analyses an integral part of the process.

The benefits of an ethnographic approach are discussed in 9.2 above. The need to probe collaborative processes is particularly evident in the rock and EDM genres. The issue of canonisation, a concern derived specifically from the criteria for selection of works in this research (requiring a high profile in the literature), could be overcome by interviewing participants directly as opposed to relying solely on published material.

9.6.2 Music Technology

Section 9.1 presents an account of emergent technological composition methodologies in terms of *processes*, *shaping factors* and *inputs* as derived from the analysis of the thirty-six works in this research. The research offers a historical overview of music technology utilisation in four genres, covering mostly the second half of the twentieth century. This period is marked by developments in recording technologies (e.g., multitrack tape, digital recording); a proliferation of new sound sources (e.g., *musique concrète*, various forms of synthesis, sampling; digital processing) the emergence of rock and other contemporary popular music styles (including EDM), and the mass distribution of music in the form of records, tapes, compact discs and more recently digital downloads. However, the latter has exerted great pressure on the established record industry and threatens to shift music distribution from a pay per product basis to a pay for access (Kusek & Leonhard, 2005).

For much of the period examined here, access to new technology required high levels of funding. Electronic and electroacoustic music have been well supported in many countries in terms of public institutional investment (e.g., development of electronic music studios in France, Germany, USA etc., in the 1940s and 1950s) and these genres have an established tradition in universities in the UK, Europe and USA. Whilst the other genres (i.e., improvised, rock and EDM) examined in this research have had less public sector investment they have received greater support from private enterprise and commercial success. The innovative use of 'low technologies' by practitioners in EDM provided a forerunner, in terms of financial independence and adoption of technological means, to the current spread of low-cost computer based home studios.

Numerous digital and 'post-digital' works were analysed in this research (i.e., Autechre, Björk, Chemical Brothers, Douglas, Harvey, Interface, Public Enemy, Radiohead, Size and U2) and form part of the basis for the conclusions presented in 9.1. In order to ascertain if the current proliferation of digital modes of production, distribution and reception lead to music making practices which significantly differ from the conclusions above, further research needs to be conducted, focusing solely on works produced in the past few years. If, for example, the music industry evolves in the manner suggest by Kusek and Leonhard (2005), artists may receive much greater remuneration for their work, supported by a commercial infrastructure that is geared to providing vast amounts of digital content to a discerning public. I would expect such a model would lead to, even demand, an increase in innovative technological musical practices, particularly in rock and EDM genres.

The recontextualisation of conserved methods within emergent technological means was achieved in all the practical works. In most cases this involved utilising the digital equivalent of earlier analogue sound sources, production and/or recording techniques. Predictably, the digital equivalent involved less resources and time, however, whether this is a positive or negative for an individual music maker or is desirable/undesirable from an education perspective is debatable and requires further study. Further research focused on ascertaining the degree to which these divergent practices represent distinct forms of music creation or just an expanded palate of possible processes would be particularly relevant for the field of music education.

9.6.3 Music Creation

The storehouse approach to composition adopted here follows postmodern notions of relativism and pastiche and reflects the dislocation, spatially and temporarily between music performance and reception since the advent of recording technologies (discussed in 2.2). My own interest in a variety of genres, fed by availability and accessibility of recordings, leads to the hybrid compositional approaches adopted here. Ironic intent, one marker of postmodernism, partly contributed to the conceptualisation of the Electronic Study i.e., using a (thoroughly) human sound, baby vocalisations, within a formal framework of integral serialism. However, the other practical works follow a somewhat modernist paradigm, i.e., the analyses provides an overview of 'history' and the new works (particularly "Hit", "Scrape", "Click" and "Drag") present 'original works' that build on past developments.

The aural focus of the analysis and the direct linking of analysis to music creation constitute an extension of past personal practice via a systematic and detailed methodology, particularly in relation to the aspects considered as musical *inputs* in the analytical template. Previous composition, performance and general music making practices are detailed in 2.4 and this research, in many ways presents a culmination and crystallisation of the various methods sketched in 2.4. However, some notable aspects of personal practice, such as collaboration and improvisation, on reflection were not adequately probed in this research. The former (i.e., collaboration) results from the difficulties of examining such via a desk-based analytical method and points to the need for ethnographic study (discussed in 9.2). The latter (i.e., improvisation) also requires an ethnographic approach where performance practice is the central object of study (as opposed to the use of recorded works in this research). Berliner (1994) and Monson

(1996) provide useful models in a traditional jazz context but such models need to be extended to incorporate the practices of improvisation with emergent technological means, for example the recent proliferation of laptop performers/improvisers.

9.6.4 Music Education

With some adaptation according to level, the analysis/creation model presented here is expected to provide a useful tool for senior secondary and undergraduate tertiary education. The range of parameters given in the analytical template encourages a student/researcher to consider each in turn and develop appropriate vocabulary with the analyses presented herein supplying a model. The analysis of works in electronic, improvised, rock and EDM genres also provides examples in relatively underrepresented genres. The maintenance of traditional parameters such as *pitch, rhythm, dynamics* etc. enables comparisons with more traditional genres to be made. The supplementary presentation modes utilised in Appendix B and/or discussed above offer additional tools for students to engage in analysis at various levels and, in the case of multimedia presentations, offer cross-disciplinary opportunities with other curriculum areas such as Visual Arts, Graphic Design and Information Technology.[15] The extension of analysis into music creation demonstrated here offers a model for both genre related composition and composition in general.

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[15] The virtual reconstruction of the 1958 Philips Pavilion, including the incorporation of Varese's *Poème Électronique*, discussed in Lombardo et al. (2006) offers an example, in a research context, of the potential scope for multimedia presentation.

In this research I have sought to identify, analyse, define and explore a range of compositional and improvisation practices at the intersection between conserved and emergent technological compositional methods in selected musical genres over the past seventy years. The analytical model utilised in the research provides scope for the examination of emergent technological methods through the consideration of such parameters as *sound object processing*, *interaction* and *spatialisation*. The analysis/creation model developed for this research makes explicit the connection between musical analysis and music creation; a connection not made in the majority of existing analytical methods. The four genre studies and four major works (presented on the accompanying DVD) exemplify the application of analysis to music creation. The computer based performance instrument (CBPI) embeds many of the compositional methods identified in analyses within the Max/MSP environment and the major works employ some of the possibilities for the utilisation of the CBPI. Notwithstanding the reservations discussed in the preceding sections (e.g., the possible benefits of an ethnographic approach to analysis, the relative brevity of analysis of individual works and the need to further probe collaborative and improvisational process) the study has thoroughly addressed the research questions and aims of the research.

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