Analysis and Recreation of Key Features in Selected Autechre Tracks from 1998-2005

Alexander Nicholas Mesker

BA (Music), Macquarie

This thesis is presented for the degree of Masters of Arts (Research)

Division of Humanities,

Department of Contemporary Music Studies,

Macquarie University, Sydney

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Abstract

Analysis and recreation of key features in selected Autechre tracks from 1998-2005

Autechre are contemporary electronic musicians from Suffolk and London. Having an active recording career since 1993, Sean Booth and Rob Brown are highly regarded in their field by academics and musicians alike, despite their lack of formal musical training. Whilst not limited to working within a particular musical framework, Autechre's works incorporate a range of musical approaches with compositional elements emerging from chance-based operations, atonal and rule-based techniques, to more contemporary methods of sound synthesis and sample playback manipulation.

This thesis aims to explore the nature of Autechre's stylistic tendencies through an analysis of a selection of recurring themes throughout their work, including their characteristic use of percussive rhythmic complexity, irregular rhythm and dynamically changing tempos, complex evolving event control structures and melodic patterns, audio effects, and the combination of these approaches that makes their work identifiably 'Autechre'.

This thesis consists of a written research project combined with practical recorded examples. The written thesis firstly gives an overview of Autechre's works prior to 1998 and isolates particular elements peculiar to Autechre. The next sections provide the core focus on the duo's works from 1998 to 2005 during which sample manipulation, spectral manipulation and more radical effects and signal processing move to the fore. The author's own background in popular music studies is used as a basis for the analysis of Autechre's works. The results of this analysis are discussed with regard to technical methods for (re)creating Autechre-like works.

Focussing on Autechre-like material and processes, the practical recorded works use the Max/MSP software environment as a compositional aid to texture musical input (both MIDI events and audio) and to generate musical output. The musical content generated is used to drive synthesis hardware and software, as well as to manipulate and rearrange audio samples. Examples of the programs written in Max/MSP are discussed and their musical output is illustrated throughout the thesis, facilitating discussion of the use of algorithmic processes in musical generation.

This research on Autechre's creative practices aims to highlight examples of contemporary electronic music practices that expand traditional compositional methods and resist traditional Western musicological methods of discussion and categorisation by focussing on abstracted techniques for musical creation such as meta-level pattern control. As such, a focus on process as compositional aesthetic emerges over and above the discussion of surface-level musical text.

Declaration

I certify that this work has not been submitted for a higher degree to any other university or institution. The work herein is entirely my own, except where acknowledged.

Alexander Nicholas Mesker

November 2007

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Introduction

Autechre[1] are electronic music artists operating in the field of contemporary experimental popular electronic music[2]. Their sound and style has been forged over the last fifteen years through their releases on the UK label Warp Records. The early 1990s saw the public debut of Autechre with the release of Warp's *Artificial Intelligence* compilation (1992). Over the subsequent thirteen years the sound and structure of Autechre's work has changed considerably, however their aesthetic aims have remained largely constant. This research project aims to analyse key features and concepts apparent throughout their career, and will explore these concepts with an application to a creative work that incorporates prominent features and ideas common to Autechre's oeuvre.

Before delving further into this topic, it is essential to locate Autechre within the broad genre of electronic music. Holmes in *Electronic and Experimental Music* (2002) suggests that "[a]ll music today is electronic." (Holmes, 2002:1) He arrives at this point by considering experimentation in and the impact of electronic development in music over the past one hundred years. Although the impact of electronics has greatly influenced the recording, production and performance of music today, I would suggest that it is somewhat erroneous to conclude that all music is now electronic. Most recorded sound today relies on electronic means in the process of encoding and retrieving an audio signal, but to assert that the inclusion of electricity and electronics somewhere in the process of today's technology defines the end product as 'electronic music' is misleading. A distinction must be drawn between the use of electronic equipment in the conveyance of the medium and the content conveyed. However, this notion can become complicated when examining principal methods of electronic musical composition; for example, techniques employed in *musique concrète* where mechanical electronic means are used to re-arrange and play back

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[1] Autechre or Ae: (pr. n.) refers to the duo Sean Booth and Rob Brown – distinguished from *autechre* (n. & adj.) denoting the musical sound and style of the duo. Booth and Brown refer to the music they create as *autechre* – naming a small and composer-specific stylistic subset of the electronic-music genre. The term *autechre* is used in place of the more general term music when referring to the sound produced by the duo, Autechre. To avoid confusion (in places) between the two, I will refer to the duo as 'Autechre' and their sound product as '*autechre*'.

[2] This categorisation of 'experimental electronic music' here is an attempt to ground the reader and give a reference point to surrounding forms of electronic music. It should be recognised that Autechre would dispute this distinction. Experimental electronic music is used here not so much as genre classification, but as a descriptive tag denoting their non-adherence to popular or conventional electronic music styles. This point is re-addressed in the Autechre section in Chapter 2.

existing (or non-electronically generated) sounds. Therefore, to define electronic music one must take account of both *sound* and *process*. For the purposes of defining *electronic music* in this research project, I will be focussing primarily on the notions of process and manipulation of both acoustic and electro-acoustic sound sources. Electronic music (as I choose to define it) is thus dependent on engaging with technology to produce an audibly electronic, non-natural sound through alteration of features such as timbre or the linear order of sampled sounds.

Holmes furthermore distinguishes the difference between *purely electronic music* and *electroacoustic music*. (ibid.) Although this elucidation serves to distinguish the significance of the role of electronics in musics, it raises questionable boundaries around the limits of cross-talk between the two, as a particular style may contain varying amounts of the two and be classified as electronic or non-electronic music. To further clarify the definition for the purposes of this research project, *electronic music* will be considered as music that is constructed primarily from electronically generated sounds, or organised and processed by means of electronic techniques such as sequencing and digital signal processing. With a less contentious definition, Chadabe (1997) classifies the notion of *electronic music* very simply.

> *Electronic music includes all music made with electronics, whether specifically with computer, synthesizer, or any other special equipment. I view the term in much the same way that we'd use the term orchestral music, for example, to designate music played by an orchestra.* (Chadabe, 1997:x)

Considering this association between creative means and stylistic classification helps highlight the area in which Autechre are situated. However, whilst this aids the clarification of the features that unify electronic music forms, the variety of possibilities that 'electronics' present to us in sound composition and organisational approach necessitates that the field of electronic music acts as an umbrella term that encompasses a range of sub-genres. This range of inter-genre stylistic differences is evident in the present popular electronic music scene, as well as in the avant-garde and experimental community during the twentieth century. In this thesis, I will first attempt to provide a brief history of the emergence of popular and computer-based electronic music and various important concepts and techniques relevant to a narrower focus on the research matter. A focus on the genres that produced Autechre and the aesthetic that has shaped them since will lead to an investigation into Autechre's compositional approaches, as well as an exploration of methods for producing works that share stylistic similarities to *autechre*.

Chapter 1: Literature Survey and Methodology

The History of Electronic Sound

Joel Chadabe's *Electric Sound: The Past and Promise of Electronic Music* (1997) provides a comprehensive history of the role of electronics in the field of music. In his preface to the history and transformation of electronic sound and music, Chadabe postulates a technological determinism – that the emerging technology available at a period in history shapes the creation of new sounds[3]. From the pre-industrial era giving rise to the violin, to the moving parts in the piano of the nineteenth-century, he addresses the importance of electronic circuits in the music of the twentieth-century. Writing as an advocate, he asserts:

> *[T]he electronic musical instrument in its myriad of forms, has particular promise. It may well turn out to be the most beneficial to humans and the most enjoyable, rewarding, and expressive instrument that has ever existed.* (Chadabe, 1997:viii)

Chadabe marks notable milestones in the progress of electronic music, namely: the development of early electronic instruments; the 'opening up' of music to all sounds; the growth of synthesisers; the formulation of new ideas for making music and playing [new] instruments; and the next imminent milestone being "the resolution of still-unresolved design issues and the crystallisation of still-forming concepts into the many potential forms of the electronic musical instrument." (Chadabe, 1997:viii) These 'milestones' provide a structure for historical analysis in the progress of electronic sound for this research thesis. (A more in-depth timeline of electronic sound is discussed in Chapter 2 of this thesis, *A Brief History of Electronic Music.*) In addition, Chadabe (1997) documents the profound impact of the past century's advancements in electronic applications on music, discussing the roles of key figures such as Cage, Varèse and Stockhausen, the impact and flow-on effect of technological advancements, and innovations in electronic instruments. Chadabe outlines the history of electronic music by using interviews and first-hand reports from seminal figures such as Max Matthews, Miller Puckette and David Zicarelli[4]. (ibid.)

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[3] On a different front and perhaps worth noting is a viewpoint Reynolds presents in the documentary *Modulations: Cinema for the Ear* (Lee [dir], 1998), postulating the existence of a symbiotic relationship between contemporary music evolution and changing drug use. Whilst it may provide a correlation between the popularity of styles over time, I believe it is not reflected in the evolution of Autechre, and hence will not be discussed here in detail.

[4] Founder of Cycling '74 (developers of Max/MSP/Jitter)

Preceding Chadabe, Griffiths (1979) discusses the origins and history of electronic sound up to the late seventies, and places an increased focus on new techniques and approaches to musical sound inspired by foundations laid throughout the electronic revolution of the twentieth century. Similar histories of electronic music and technological change are illustrated by Taylor (2001) and Théberge (1997). *Strange Sounds: Music, technology and culture* (Taylor, 2001) documents the interaction between technology and music culture and brings a more contemporary look at the current state of popular electronic music through his analysis of the current culture surrounding this broad genre and its relationship to other non-dance music genres. *Any Sound You Can Imagine: Making Music/Consuming Technology* (Théberge, 1997) focusses on the changing notions of instruments and instrument design as music and technology converge. Théberge offers both a technical and cultural examination of the evolution of technology and the changing concepts of what defines contemporary music. *Audio Culture: Readings in Modern Music* (Cox & Warner [eds.], 2005) contains a collection of essays relating to the many genres and aspects of contemporary electronic music. Musical theories and practices are detailed at length by both musicians and academics, outlining links between current and pre-existent musical movements and genres.

Kettlewell (2002) documents the pioneering work of electronic musicians across the globe throughout the sixties and seventies with a retrospective look at the foundations of electronic sound, and provides interviews with prominent figures that have had a strong influence on music technology. His writings supply a historical context through which to view the progress made by these pioneers, with a reference to technological progressions in music. Reflecting the dynamism of this technologically driven field and its relationship with other musical areas, he states:

> *It has been said by many that to play an instrument from another culture properly, the musician must first understand the tradition of that instrument and then go beyond it to find his/her own voice. This way of thinking has much in common with the philosophy of electronic music. The entire aesthetic concept of music is perceptually being redefined, and our expectations from music are greater than ever before.* (Kettlewell, 2002:10)

Over the last four decades, there has been a rise in the possibilities of the 'virtual' modelling of musical phenomena. Whilst the methods and models of hardware structures and ideas developed by early pioneers is still widespread, an increased amount of focus in current writing and research is centered around the virtual (or

software based) medium. This identification of the computer and its increasing role as an acoustic phenomenon emulator (Roads, 2001:2), is mirrored by Paradiso's comment:

> *The synthesizer as an external piece of hardware is an endangered species; it will quickly become a set of rules and algorithms followed by a computer program. This process, started by Max Matthews at Bell Laboratories four decades ago, is blending diverse populations such as academic composers and techno musicians; both are now using the same sets of tools. By running algorithms based on physically derived models, software synthesis is shedding its static, pristine clarity and acquiring the expressiveness of acoustic instruments or the grunge of the early analog synths.* (Paradiso interview, in Kettlewell, 2002:9)

Online resources such as the *Electronic Music Foundation*[5] (EMF) provide an extensive and up-to-date history documenting new electronic applications to music, with sections such as *The EMF Institute – A History of Innovation in Music and Sound*[6]. Established in 1994, the EMF acts as a hub for other satellite projects concerning broad applications of electronic forms of music through sections devoted to areas such as software distribution, CDs and publications, electronic art-forms, and communities dedicated to professional work and events in the field. The EMF is a not-for-profit organization with supporters and active members including key figures in the development of 20th century electronic music, such as Donald Buchla, Max Mathews, Robert Moog, Jean-Claude Risset, Iannis Xenakis, ICMA (International Computer Music Association), IRCAM (Institut de Recherche et Coordination Acoustique/Musique), E-mu Systems, Steinberg, Cycling 74, Skyboy Productions, and Symbolic Sound Corporation[7]. A similar online resource, the International Computer Music Association[8] (ICMA) aims to accommodate all modes of electronic (or computer) music with relation to technical, creative and performance aspects of computer music, with the purpose of serving composers, computer software and hardware developers, researchers, and musicians who are interested in the integration of music and technology[9].

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[5] http://www.emf.org/

[6] http://emfinstitute.emf.org/

[7] http://www.emf.org/aboutus/history.html

[8] http://www.computermusic.org/

[9] About ICMA - http://www.computermusic.org/about_icma/about_master_frameset.html

Online (and hardcopy) publications such as the *Leonardo Music Journal*[10] (LMJ), the *Computer Music Journal*[11] (CMJ), the *Journal of New Music Research*[12] and the Cambridge journal *Organised Sound*[13] focus on technological developments in the field of new music, research into new music, and aesthetic and technical issues in contemporary electronic music. The medium in which these journals and resources are presented allows their content to be constantly updated with the possibility of broad input. This is an important factor when analysing a dynamic field such as that of electronic music. I will return to an assessment of specific essays in these journals later.

With a particular reference to *electronic music* and *dance music* culture of the eighties and nineties, the video documentary *Modulations* (Lee [dir], 1998) examines the origins and styles of its various sub-genres, focussing on their emergence and stylistic metamorphoses. This documentary features prominent artists who represent the various sub-genres within electronic and dance music such as electro, house, techno, jungle and rave. In addition, interviews with seminal figures in the history of electronic music, such as fusion experimentalist Bill Laswell, *Planet Rock* producer Arthur Baker, producer Giorgio Moroder[14], synthesiser pioneer Bob Moog and *musique concrète* pioneer Pierre Henry are interspersed with assertions of writers in the field of contemporary and electronic musics such as David Toop, Simon Reynolds and Kodwo Eshun. Toop describes the nature of electronic music as being:

> *[A] very direct reflection of the environment. In one sense I think there is more of a sound awareness in our culture now, which is related to why music is taking the turn that it is, maybe it's the awareness of constant electronic and industrial processes makes us more conscious of a certain kind of sound."* (in Modulations, 1998)

Comprehensive accounts of dance musics of the nineties have been documented by Reynolds (1998) and Rietveld (1998) with reference to musical differences between sub-genres, influences and localities. Reynolds (1998) documents the history of

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[10] http://mitpress2.mit.edu/e-journals/Leonardo/lmj/sound.html

[11] http://addendum.mit.edu/e-journals/Computer-Music-Journal/Documents/index.html

[12] http://www.szp.swets.nl/szp/journals/jn.htm

[13] http://journals.cambridge.org/jid_OSO

[14] Producer of Donna Summer's *I Feel Love* and Blondie's *Call Me*

various forms of dance music including *techno* and *house* with regard to their international origins and local and sound-inspired manifestations. Similarly, Rietveld (1998) provides an account of the social consumption of dance music and the culture of music sub-genres. These readings are culturally focussed with little emphasis placed on analysis of the genres' sonic texts.

Bogdanov et al. (2001) present one of the most comprehensive resources dedicated to electronic forms of music, with sections focussed on genre divisions, sub-genre relationships and influences, and a detailed history of artists and documentation of their releases and sample reviews. A great amount of attention is paid to genre definitions and classifications of artists within particular subsets of genres, regarding defining uses of sound and electronic instrumentation.

In terms of classification and with perhaps greater relevance to Autechre, Nyman (1999) considers experimentation in forms of electronic music through an analysis of John Cage's music and techniques, with, as Brian Eno puts it, a focus on "process rather than product." (in Nyman, 1999:xi) Nyman aims to identify the essence of experimental music. He cites Cage's 1955 assertion that:

> *Objections are sometimes made by composers to the use of the term experimental as descriptive of their works, for it is claimed that any experiments that are made precede the steps that are finally taken with determination, and that this determination is knowing, having, in fact, a particular, if unconventional, ordering of the elements used in view.*[15] (Cage, cited in Nyman, 1999:1)

Considering Nyman's approach to defining experimental music, this model is applicable to *autechre*. Nyman (1999) seeks to differentiate experimental, avant-garde and other forms of musics, and the features of these different genres/styles will be identified in reference to Autechre's releases at different stages of their history in the main body of this work.

Holmes (2002) provides a comprehensive view of broad applications of experimentation in electronic forms of music, considering musical precedents such as: the origins of the avant-garde (with regard to areas such as alternate pitch systems); materials and techniques (such as synthesis methods and hardware-

[15] This statement clarifies my use of the term 'experimental' to describe Autechre's style at the outset of this essay.

based sound control and manipulation); and an examination of the fundamentals of sound. Holmes delineates an all-inclusive history of the evolution of electronic sound from early experimentation with electronically driven instruments up to applications of software-based algorithmic process and contemporary manifestations of experimentation in experimental music. With regard to the flexibility of working with sound in the electronic domain, Holmes writes:

> *One of the key differences between electronic music and music composed for traditional instruments is that its sonic vistas are limitless and undefined. The composer not only creates the music, but [also] composes the very sounds themselves.* (Holmes, 2002:9)

Holmes also identifies a key concept in the creation and conception of electronic music:

> *One thing I have noticed in speaking with electronic music composers is a fascination with* process*: the steps needed to get from one point to another in the realization of a piece of music. Sometimes the process itself becomes the piece of music.* (Holmes, 2002:50)

This notion of *process* can be linked to Cage's quote above, linking experimentation with determination. Riddell (2001) draws out a similar distinction focussing on *process* as a creative aesthetic. This opens up a much-needed point of analysis when considering complex music of digital forms, such as that of Autechre where "the concepts of *process* and *data*, inherent in the technology of contemporary music, are contributing to a new musical practice and aesthetic." (Riddell, 2001: 337) A study centered on processes apparent (or known) in a musical text that might be characterised as resistant to traditional forms of musicological analysis therefore provides a tailored approach to sonic deconstruction.

> *Musical interest in* process *has intensified this century with the progressive 'electrification' of sound. From transfer, recording and synthesis to the current aspirations of the digital signal environment, technology bestows pragmatic credence and relocates musical activity closer to the abstraction of science and mathematics. The computer, in this respect, is the instrument par excellence, inspiring and instigating the idea of a scientific/technological art unbounded in the present and future while simultaneously encapsulating and concentrating activity in a focused, highly structured and codified context.* (ibid: 338)

Riddell thus regards the use of organisation, or *process over product*, as a new alternative for gaining recognition in a somewhat overcrowded genre due to cheaper and progressively more widely available technology.

> *A far more radical alternative to the production of sound is the production of*

> *musical software. This growth area is further evidence of the desire of musically minded people to make a musical statement that somehow goes beyond sound. Musical ideas when presented as music sometimes meet resistance in the usual forums; but an idea translated into a working piece of code that generates music, or transforms or analyzes it, is often met with much greater interest. Ways of thinking about music that go beyond MIDI, or the note, which offer new musical aesthetics, encoded as software, are surely an exciting point of departure for an open-ended musical future that involves the listener in a participatory gesture not found in the transmission of audio.* (ibid: 340)

Areas such as algorithmic process are explored in detail by Cope (2000), with a more specific focus on algorithmic methods and styles in composition and sound construction. Alongside the generation and recording of sound, the computer has in many ways become a *compositional* instrument.

This notion of the computer as the compositional instrument extends into the areas of sound construction through algorithmic and generative process with programs such as Max/MSP, PureData and SuperCollider, and is a worthy area to examine in an analysis of Autechre's sonic text. In the process of remixing other artists' works, Autechre have commented on and actualised the use of sonic deconstruction-to and reconstruction-from the basic elements (or individual samples) of digital sound. This process, specific to the digital medium, is precisely expressed by Riddell through his assertion that "[t]he power of musical data (the audio signal) is not always in the sound, whether completely or partially presented, but also in the ability to do something with the data." (Riddell, 2001:342) In contrast however, Riddell also asserts that:

> *[T]he design and construction of processes that cast sound into music ideas is not about the reduction of music to "perceptual datum," but rather a means of thinking through music with an initial and, perhaps, deliberate absence of sound.* (ibid.)

and:

> *By imposing silent composition or a music of process, it seems possible to approach a future of technological composition that is not only unique but more closely aligned to a new sonic aesthetic.* (ibid.)

Although Autechre have provided few insights into the compositional methods underlying their creative processes, I suggest that their processes (demonstrating aspects of this 'new sonic aesthetic') generate musical outcomes that preclude wide acceptance by mainstream public listeners. More simply, the nature of Autechre's

sound is distanced from the realms of popular music due to their incorporation of the sonically less-explored. A scathing report written by Tom Jenkinson (aka Squarepusher[16]) about the state of music, youth and mainstream cultural movements states that "no punks have yet been punk enough" with regard to mainstream acceptance of its counterculture, and carries an underlying suggestion that *his* (electronic) music was more punk[17] than the punk aesthetic.[18]

Riddell's article (2001) delves into why such an aesthetic is being formed. The notion of electronic and computer music as a dynamic, technologically driven musical form warrants the creation and application of a *changing* methodology in providing an equal method of analysis of *autechre* over time.

> *We have used a new kind of technology. We have placed this technology in a position that guarantees not only change but a momentum for change as well. Meyer describes this as a "fluctuating stasis". Living in this state means that the forces changing music no longer have the appearance of a singular direction that once characterized Western music as little as 30 years ago.* (Riddell, 2001: 338)

Not so explicitly based on process, but rather on product, Roads (2001) documents the creative application of working with minute particles of sound to produce new, complex, and otherwise unattainable timbres and sounds. Roads' book on this topic, *Microsound*, is supplemented with a CD of compositions utilising granular methods of sound construction and manipulation.

The works of Roads (1996, 2001) provide a fundamental grounding in the areas of computer music and the manipulation of sound in the digital medium. A primary aim of Roads' *Computer Music Tutorial* (1996) is to acknowledge the rich technological history that has preceded current events in electronic and computer music. A comprehensive account of digital audio concepts, from recording and the digitisation of sound signals, to synthesis techniques and signal processing is provided. Roads also focusses on areas such as sound analysis, musical interface design and input devices, performance software, algorithmic composition, MIDI, synthesiser

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[16] An artist operating within a fusion of styles (and not strictly adhering to any of them) distributed by the same record label as Autechre, Warp Records.

[17] Tom's Manifesto from Do You Know Squarepusher reproduced at:
http://squarepusher.watmm.com/articles/TomsManifestoFromDoYouKnow.shtml

[18] Although not directly associated with the motive of this paper, this statement would provide an interesting ground-point to document and analyse the transferral of [experimental] aspects of this new sonic aesthetic into areas of popular music.

architecture, system interconnection, and psychoacoustics. This text serves as both a reference and a study into modern approaches in digital manipulation of aural signals.

A reference text with a more refined focus is *Microsound* (2001), which delves into granular synthesis methods and sonic manipulation on fine temporal levels, discussing processes that have recently become possible through technological advancements in computing. Aesthetic issues and analyses of applications of techniques discussed in *Microsound* (2001) are explored in various articles such as Thomson's "Atoms and Errors: Towards a History and Aesthetics of Microsounds" (2004) and Fischman's "Clouds, Pyramids, and Diamonds: Applying Schrodinger's Equation to Granular Synthesis and Compositional Structure" (2003).

Analysing the Sonic Text

Hayward (1998) cites the difficulty of approaching contemporary popular music with regard to classical musicological analysis. This disjunction of analytical approaches has particular relevance when considering the music of Autechre. The nature of Autechre's sound and the structure of musical events[19] in their music is such that it would be virtually impossible to analyse based solely upon conventional musical notation and classical musicology. Hayward addresses the "under-development and inadequacy of musicology's address to contemporary popular music" (1998:7). Classical musicological analysis will not be the main method for analysing the sonic text in this thesis as contemporary electronic music (perhaps even more so than contemporary popular music) exhibits musical notions that have only recently been forged or explored. Through the ideas of Middleton (1990), we would be applying an inappropriate set of criteria[20].

> *The primary reason for [avoiding musical notation and keeping classical musicology to a minimum] has been the difficulty of reading popular music within the tenets of orthodox musicology, a form which was developed specifically to study distinct attributes of western classical music, only some of which are shared by contemporary popular music. Consequently, the loose consensus amongst Popular Music Studies scholars in the 1980s was that*

[19] The term 'event' here refers to the use of an individual sound (percussive, atmospheric, unique timbral instance etc.) as opposed to a musical 'note'. 'Event' encompasses the 'pitched musical note' so it will be used in place.

[20] This will be addressed with further detail later in this chapter. The Methodology section details sets of analyses that reside outside the realms of a solely musicological deconstruction.

> *(classical) musicology was unnecessary and inappropriate to the study of popular music, in that it could not adequately explain any significant aspect of that music.* (Middleton, 1990 cited in Hayward, 1998:7)

However, this does not mean that musicological terms and definitions will not be used. Rather, such a set of analytical tools will provide a basis that will be expanded upon. Differing methods of analysis that extend conventional forms of musicological analysis and deconstruction to the digital medium pertaining to structure present in *autechre* can be applied when deconstructing the sonic text. These analytical tools include digital forms of notation (using MIDI patterns and arrangements); assessment and recognition of algorithmic processes; and common terms referring to aspects of synthesis and sound generation and manipulation (frequency, waveshape, reverberation etc.). In terms of percussive and rhythmic elements, I will use a set of terms loosely based around Roads' time scale classes[21] and some custom-coined terms to describe aspects of events in time. When considering music as complex as that of Autechre, structures of note placement must be viewed in light of the programs and processes used to organise these events. This will be explored further in the *Methodology* section and the main body of this work.

To date, much of the literature regarding *electronic* and *dance* music provides a history of electronic sound and the culture of its sub-genres, as opposed to critical perspectives in, and analysis of, the sonic text. To a large extent, approaches to criticism and analysis of the sonic texts of electronic music lie in virtual arenas such as discussion forums, mailing lists, web-logs, online reviews and fan-based sites[22]. Since there is no definitive method of analysis, opinions differ with regard to classification of fringe practices within subsets of genres. Furthermore, there is often a blurring of the distinction between review and analysis, as the nature of such a peer-based virtual space invites opinion over objective assessment. The practically limitless compositional possibilities present through electronic music are such that an understanding of processes or levels of knowledge about content and context of electronic sound can also influence one to decry simpler uses of the technology.

In the music of Autechre, notating musical events presents us with a problematic

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[21] From *Microsound* (2001), reprinted in the Appendix I section of this thesis.

[22] Such as the IDM mailing list and beepSNORT web-log and forum. In my opinion, the analyses of Autechre presented often mistake the tracks as having a 'meaning', and (oddly) because of the complexity, presuppose them with human traits - thereby shifting focus onto rhetorical questions such as "Is it Art?" and focussing on "Why?" as opposed to "What?"

situation. With regard to which particle of the sound we are analysing[23], the structure of their sound (and compositional approach) goes below the note-level and varies from track to track. An Autechre track may exhibit repeating motifs or effects that evolve over the course of the piece, and a reliance on classical musicological analysis would ignore the level at which the musical change is actually operating. In a recent collaboration with The Hafler Trio (2003), Autechre present a sixteen-minute sound metamorphosis. To notate this track in classical musicological forms would not present an adequate description of the sound text (eg. how the note/sound fades in and sustains), and to analyse it, one would have to describe the sound, at best, through subjective and descriptive terms. As an example, the following is a rough textual description of their contribution to the collaboration by the author:

> *A noise, roughly in the pitch of 'A' (with a slowly evolving fundamental tone that suggests microtonal inflections upward in the higher noise's frequency) with additional metamorphic timbral-glissandos – with a fundamental-sample change (however, still roughly in the pitch of 'A') at around 4:21, with a microtonal change to a lower B pitch over the next seven minutes, with frequencies moving in and out of phases of 'agreeable' zones, creating 'beats' of harmonic and timbral dissonance.*

The terms used above describe changing events, but the nature of sound cannot be adequately conveyed. To discuss the nature of sound is to rely on conventions outside that of classical musicology. Questions are raised as to whether the sound text is to be regarded as many sounds or if it is to be considered as one polyphonic and poly-timbral instrument. In *autechre,* an analysis of processes based upon factors such as precise events, change, and the nature of sound would more aptly describe (as well as have more meaning and relevance to) the sound text, than the documentation of pitch and structure alone. The supplementary creative work to this thesis will provide a means to link the textually described content to aural phenomena.

In an analysis of Autechre, the nature of the sound is vitally important. New musical research in journals such as the *Leonardo Music Journal* and the *Computer Music Journal* provide countless articles of relevance that focus on specific aspects of electronic sound. Although compositional methods and sound construction available to electronic musicians allow virtually infinite possibilities, the means and individual processes are finite. The sum of these process-specific explorations in sound

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[23] See the Methodology and Appendix I sections for Roads' (2001) deconstruction of sound layers into time scales

generation and manipulation have a profound influence in forming a methodology for analysis of contemporary forms of experimentation in electronic music, and hence apply well to *autechre*. Of special relevance to this research is the work of academics such as Collins (2003) and Stuart (2003) who have documented the creative processes of artists such as Squarepusher, Yasunao Tone and Oval by examining their recorded product, and by producing programs/algorithms and processes to recreate similar effects and compositional practices.[24] In addition, the work of Andreatta[25] and Wannamaker (2008) share a similar intent to my own – identifying, analysing and attempting to recreate the creative processes of Xenakis and Tenney respectively, through describing generative and rhythmic analogs of their works and offering new analytical approaches and questions for musicologists.

Couprie's article (2004) addresses issues involved in the analysis and representation of electroacoustic music. Couprie proposes models for analysis, much of which will be explored, adapted and used throughout this study. Similar articles, like that of Donin (2004) also discuss the problems associated with the analysis of electroacoustic music, and aim towards creating a method for organised listening, quantifying listening methods (attempting to expand subjective observations to objective models for discussion).

Stuart (2003) examines the use and result of error in processes through his study, *Damaged Sound: Glitching and Skipping Compact Discs in the Audio of Yasunao Tone, Nicolas Collins and Oval* with reference to what [Nicolas] Collins refers to as "benevolent catastrophe." (Collins, cited in Stuart, 2003:48) He discusses the creative practices of the aforementioned artists whereby treated CDs are played back (or decoded through treated CD players) incorrectly, thereby expanding upon modern forms of process and chance in sound construction, "sound expansion, chance-generated composition, [and] indeterminate performance." (ibid.:47) Stuart's account of these experimental approaches to sound and music can be viewed in one sense as being algorithmic/indeterminate composition based upon a set of input values (ie. errors created on the disc), decoded by a machine that returns the result of a rule-of-process, "altering pitch, timbre, rhythm and speed of the piece." (ibid.:48) These compositional approaches appear to represent contemporary technological

[24] Collins has extended this research into his own creative work, using his own algorithmic beat cutter, bbcut to produce works such as a perpetual breakbeat creator.

[25] http://recherche.ircam.fr/equipes/repmus/moreno/ProductionScientifique.html

manifestations of instruments such as Cage's prepared piano.

Schulze (2003) provides a brief history of "aleatoric games and heuristic strategies in the classical avant-garde as well as in postmodern follow-ups and late-20th-century pop music" (61) with reference to artistic process, and a close focus on the practice of remixing:

> *[The remix is] a filtering process. Present records and new samples are the sources. We decide "which bits will be used in what order." We* choose *elements and* organise *them in new patterns. If we "enhance all the sounds," this means northing more than assimilating or differentiating the* cohesion *of our selected elements via filtering, deformation, linking, rhythmatizing. This does not happen randomly but requires "a ton of decisions."* (Schulze, 2003:63)

A strong distinction must be made between aleatoric processes and conscious forms of quantum decisions (including set rules) when analysing the sonic text of *autechre*. The process may involve the use of algorithmic processes; however, Autechre remain adamant[26] that their method of composition never relies on purely random data[27]. This is an important point when focussing on Autechre's approach to remixing and reinterpretation of their own tracks, and those of other artists – especially the tracks present on their release *Envane* (1997). Each of the tracks on this release originate from the same structure and sets of musical data and rules, although the way the data is manipulated and evolved acts as a form of remix.

Citing specific methods and presenting actual examples, Collins (2003) outlines the use of recursive audio cutting, and applications of software technology involving algorithmic processing, to existing sounds via programs such as SuperCollider and Csound, with a brief reference to Reaktor and Max/MSP. This is granular iterative feedback presented above the note (or *sound object*) level, and this article extends applications of his own research pertaining to breakbeats. Collins also refers to Roads' time scales (2001:3) and asserts that recursive cutting of an audio signal can be applied at any level.

Roads' previously mentioned books, *Microsound* (2001) and *The Computer Music Tutorial* (1996) provide a background into granular processing and synthesis of

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[26] http://www.cocksocket.org/articles/seanbooth.html

[27] In the event that an element of randomness is used, it is most often highly controlled randomness within specified probability distributions

sound. In *Microsound* (2001) Roads documents the various software applications that utilise particle synthesis, various methods for treating and transforming grains of sound algorithmically, and the use of microsound in composition. *Microsound* (2001) takes one aspect of sound pertinent to computer music (ie. quantum acoustics) and extrapolates the possibilities of working with samples of sound. *The Computer Music Tutorial* (1996) provides a broad and detailed approach to synthetic sound and process.

De Poli, Piccialli and Roads [eds.] provide a scientifically based method for sonic analysis in *Representations of Musical Signals* (1991). They discuss the histories and useful features of powerful applications of computers in areas such as timbre imitation by analysis and modular synthesis, with regard to nonparametric analysis or objective representations of acoustic structure. Regarding the digital analysis of sound and quantifying the nature of acoustic evolution, Risset asserts that "the development of time-shifted short-time analysis windows allows us to characterize the development of the signal in time by means of a set of parameters." (Risset, in De Poli, Piccialli and Roads [eds.], 1991:12) The analysis undertaken in my research will not be so rigidly scientific in its method, although a recognition of spectral change and synthesis methods will be discussed through analysis of the sonic text.

Representations of Musical Signals (1991) features writings of prominent figures in the field such as Jean-Claude Risset, whose *Bell Lab Catalog* of instruments (for the Music 5 software program) attempted to document the various timbral and temporal natures of electronic sound. John-Philipp Gather's *Catalog of Csound Computer Instruments*[28] extends Risset's catalog of instruments with an application to software sound synthesis with the Csound software, and includes roughly 80 instruments that display various electronic acoustic phenomena[29]. This is of great value in the process of aural analysis of synthetic tones, as it documents and models synthesis techniques and unique features employed in generating timbres. Risset's writing in *Representations of Musical Signals* (1991) displays "interdisciplinary aspects of computer music and the use of analysis and synthesis methods... discussed in a

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[28] http://wings.buffalo.edu/academic/department/AandL/music/pub/accci/

[29] With relevance to Gather's catalog, Boulanger's *The Csound Book: Perspectives in Software Synthesis, Sound Design, Signal Processing, and Programming* (ed. 2000) provides an instructional and historical collection of software-based instrument designs and structures and methods of synthesis and audio processing.

broad cultural context" (ibid:5) with reference to his experience in the field. From both a creative and deconstructionist view, Risset asserts that "new sonic materials suggest new musical architectures." (ibid:7)

Methodology

The focus of this research project is threefold. Firstly, to explore the ways in which Autechre work with reference to software and hardware. Secondly, to analyse how they sonically structure their work; and thirdly, to draw on these methods to create a supplementary creative work. My research study into Autechre's creative practices will encompass: the structure of their tracks; temporal sound placement (ie. how a bar/measure of music is organised); repetitive and non-repetitive features and themes; track progression; evolution and duration; time signatures and rhythm; percussive structure; sound construction; melodic features and timbre; and Autechre's approach/ideology.

While some of Autechre's works can be broken down into a notated or symbolic structure, there will be no single formal method of sound analysis used. Roads (2001) provides a temporal framework to deconstruct or break down sound into 'grains' that enable the consideration of events operating within the music, on differing levels, stating:

> *Music theory has long recognized a temporal hierarchy of structure in music compositions. A central task of composition has always been the management of the interaction amongst structures on different time scales. Starting from the topmost layer and descending, one can dissect layers of structure, arriving at the bottom layer of individual notes... This hierarchy, however, is incomplete... Beneath the level of the note lies another multilayered stratum, the microsonic hierarchy.* (Roads, 2001:3)

Recent developments in Autechre's creative style place emphasis on sound constructed at the *micro* level as opposed to the *sound object* level of their earlier work. I would argue that this is to a certain extent technologically deterministic, drawing on the technological progression and flexibility of software and computational speed of hardware. These methods of granular sound construction and signal-rate processing allow for the creating of music and sound on the *meso* and *macro* levels with modular bits. Hence, I would also argue that *autechre* works on at least two levels. Much of Autechre's recent sound construction involves granular permutations of samples and effects at the *microsonic* level. In a superset

level, the sum of these microsonic particles and their changes become note events, and even *macro* level soundscapes. This level of distinction is warranted, as a hallmark of Autechre's sound is the complexity of the arrangement of *sound objects*. This dense arrangement of *sound objects* and the attention to detail on multiple time scales (including levels beneath the *sound object*) is a recurring feature of their sound and creative process.

As Autechre's sound and structure have evolved over time, a fixed methodology for a study of this music would not be suitable. Rather, a dynamic methodology that evolves throughout the analysis of their progressive works would be a more effective way to treat the sonic text. Autechre's work in the time frame under analysis moves slowly through Roads' distinction of temporal modes, cited below:

> *The most precise and flexible electronic music instrument ever conceived is the digital computer... the computer's power derives from its ability to emulate, or in scientific terms, to model phenomena. The models of the computer take the form of symbolic code. Thus it does not matter whether the phenomena being modelled exist outside the circuitry of the machine, or whether they are pure fantasy. This makes the computer an ideal testbed for the representation of musical structure on multiple time scales.* (Roads, 2001: 2)

Unravelling the intricacies of Autechre's corpus from 1998-2005 involves a knowledge, familiarity and understanding of the sonic text. As comparatively reclusive artists, information about the duo and their perceptions and attitudes towards music and sound creation is limited and my analyses of these aspects will rely on interviews, articles, reviews, and live performance practices. Their work will be discussed with reference to the broader field of experimental electronic music, a genre that encompasses, utilises and reflects techniques and styles present within sub-genres of electronic music. I use the term 'experimental' in the sense that Autechre's music does not conform to a particular established sub-genre. My research will also involve a documentation of the history of their work and releases, outlined in Chapter 3.

Autechre's unique approach to experimental electronic music means that there is no single existing framework of study and analysis pertinent to their music. Hence I intend to use a confluence of existing analytical methodologies combined with a discussion of concepts that I consider to be distinctive to their work. Autechre exhibit an unwillingness to reveal aspects of construction and method in their work in interviews etc. To analyse the recorded works of Autechre is similar to reverse-

engineering a piece of software; while it is evident on the surface what a compiled computer program *does*, the means and methods beneath the final product are hidden. Regarding the creative supplement to this research thesis, a sound knowledge of process and effect must be present in order to understand what is occurring on the 'uncompiled' level. Roads' time scales (2001) combined with a knowledge of the foundations of electronic sound synthesis, effects including time/ delay effects and signal processing, granular synthesis/resynthesis, event control, and algorithmic compositional practices will be used as the foundation of sonic, timbral and structural analysis.

Taking inspiration from Cole's study into *Creative Practices in Australian Techno and other Electronica* (1999), graphical representations will be used to illustrate concepts such as pitch against time (in forms like the "drum editor", "piano roll" or "key editor" where interpretations through the musical score are inappropriate), percussive structure, note velocity/amplitude, panning, changes in dynamic events, and overall structural arrangement of individual tracks as well as compositional routines and structures.

Aspects of sound and structure can be approached using the application of adapted musicological terms and notions such as Nattiez's immanent, poietic and esthesic descriptions (1990), however in their use it will become apparent that other methods of analysis need to be investigated and addressed. The way in which Autechre create music with regard to how *sound* is constructed that is, not only from the generation of electronic sounds, but also in the way those sounds are employed, means that their music is derived not only from the sound *sources*, but the way in which the sounds themselves are processed and rearranged.

Autechre's compositional approach necessitates the invention of an appropriate methodology in order to analyse their work. This methodology must therefore include new analytical concepts and terms with which to describe methods of employment of process and data in the sonic text. This research thesis will encompass an exploration of the ways in which Autechre interact with software and hardware, and the sound manipulation and construction techniques in their work.

It is important to keep in mind that this methodology is being applied to works originated in the period 1997-2005. Since *autechre* (the nature of their sound) is

continuously changing and being defined as it is created, new approaches may be required for future works. This approach may be considered a meta-methodology that is dynamically applicable due to the nature of changing concepts of methodological analysis. To clarify, as the music is evolving, so must the methodology also evolve. Hence to an extent, this research will aim to provide a snapshot of existing manners and modes present on all levels of *autechre*. These levels include conceptual processes and ideas behind their works, sonic implementations of these ideas, an assessment of the employment of these ideas and the final *Gestalten* product.

I deliberately omit speculation of underlying (extra-textual) meanings in Autechre's sound, and of their music's constructs or motives. This is a research study into *methods* and *techniques* of sound production and composition, not an aesthetic review or an attempt to imbue sounds with extra-musical meaning. Nor do I wish to assign meaning to compositional choice. If a sound creates an effect, then I do not wish to pursue that with a reasoning of why Autechre might find it pleasing. Furthermore, I do not offer commentary on the way Autechre's works are interpreted by consumers and critics, and do not include a subjective view based on taste. This research study is a focussed analysis of Autechre's sound text based on occurrences of sonic motifs and methods of structures and patterns.

The Creative Audio Component

Supplementary to the written work of this thesis is a creative audio component that serves two purposes. The first is to demonstrate key concepts explored in the written work. The second is to reify and focus the conceptual material into an audio product that can be compared and contrasted with Autechre's works, and hence be a measure of success or failure of their deconstruction. As a written deconstruction may be at the same time too shallow and too complex (in description and explanation), an aural counterpart will provide a useful medium for reference.

In the creative component, if different software and hardware equipment is used by the author and Autechre (or if similar equipment used in a different way), the success of the outcome is not to be reliant on these common tools or differing uses, as Autechre's structure is not defined by any hardware or software, but by the creative processes and practices of Booth and Brown themselves. The known common

threads prior to the creation of this audio work include some pieces of software and hardware, however the nature of these similarities are based on the fact that they are both highly customisable and modular.

My approach to the supplementary sonic work is not singular. Attempts will be made early on to try to replicate Autechre's structure, approaches to sound creation, and the organisation of beats and melodies through an "analysis by synthesis" method[30]. The ultimate goal is to construct a selection of tracks that reconstruct and exhibit particular characteristics and tendencies that are identifiably similar to Autechre's methods of sound generation and structural organisation. Specific tracks exhibiting replicated features will be named, eg. *Gantz Graf* (2002)[31]. With regard to structural interpretation and recreation as research and analysis progress, I will combine musical elements to create original tracks in the style of Autechre. However, the inevitable introduction of personal choices and aesthetic differences in musical creation (ie. the very nature of how *autechre* is 'defined' by Booth and Brown compared with my attempt to 'recreate' *autechre*), implies that the resulting tracks will be wholly my works *influenced* by Autechre, rather than synthesised recreation of Autechre's musical approach.

Publication is not the primary aim of this research project. As Young (2005) writes in 'Warp' (a book in the 'Labels Unlimited' series about the *Warp Records* label):

> *While [Autechre's] methods may remain fixated on hands-on beat and sound processing, each successive album marks a new breakthrough as they twist their tracks into ever more perplexing and complex sonic alloys and plastics, as if the molecular structure of music has been broken down and reconfigured. Despite the frequent hyperbole and critical flights [Autechre's] music continues to inspire, Sean Booth tries to keep his feet on the ground.*
>
> *Booth: "What happens is, you put it out into the world and everyone tells you what a genius you are... some of the things are a bit different, you know, but... intrinsically we've never really valued originality that much. I think it's just the people that write about us that value it, and they seem to see it in what we do... maybe because we're taking more chances or something, I don't know."* (cited in Young, 2005:89)

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[30] This approach has been explored by vocal synthesis and speech recognition researchers and is discussed in Clark and Cook [eds.] (2004)

[31] Track emulation will also borrow conceptually from brute-force recreation and generative (or algorithmic) re-appropriation. Through my research, it has come to my attention that certain recordings that I assumed to have been created in a particular way, were in fact the result of a completely different approach. Excerpts from interviews with the duo cited in Chapters 3-6 will highlight this notion.

The above quote from Booth seems to contradict the preceding text from Young with regard to the complexity and originality of Autechre's works. I do not wish to suggest that Autechre are futurologists or contemporary manifestations of previously existing musical approaches. Rather, I suggest methods of reproducing key concepts in Autechre works, but do not try to suggest that these methods are necessarily used in the works under analysis.

> *Another perception [that Autechre are] at pains to debunk is that their music is the sole product of computer processing.*
>
> *Booth: "When we did [1997's] Chiastic Slide people thought it had all been done on a Mac, but probably 90 per cent of it [wasn't], it was just mixed on a Mac, you know? It's just because people assume... like, people now are all going, 'Oh, you use Max/MSP [software], you build your own [virtual] instruments'. I'm going, 'No, I've never built an instrument in MSP in my fucking life' – I used it for sequencers to do that five years ago; I haven't even used Max/MSP for the last three years. I think a lot of the time it's people just projecting their idea of what we get up to in our studio onto us. I mean, basically we still sit in there arsing around with drum machines and keyboards, we're not doing anything technically amazing and flashy. We're just really into it."* (ibid.)

For the precise reason that Autechre dislike the positing of processes in- and the over-analysis of- their work (or the pursuance of some extra-musical meaning in *autechre*), I would not want this work to be misinterpreted as such a statement of *how* Autechre are composing, nor *why* they are composing in that way. The overall purpose of this research is not an exposé of techniques, but a personal investigation into creative techniques, and an exercise in the analysis and methods for recreation of complex electronic forms of computer musics. It is also my intention not to contact the duo for reasons outlined above; and furthermore because this is a research essay into methods of arrangement, signal processing and structures of electronic music with Autechre's work as the subject matter. Much of the questions that I would ask Autechre have either been asked of them previously, or would relate to information they would not be willing to share as it would fall into the category of being perceived as a projected perception of their work as being "the sole product of computer processing." (Young, 2005:89) Lastly, this research is not aimed at being of use to Autechre, and thus likely to not provide the basis for any symbiotic relationship.

As a final disclaimer to prevent the idea that this is an all-inclusive approach to analyses of electronic and computer based musics, the choice of tracks for musical

analysis and discussion are subjectively chosen, and do not represent the entire oeuvre of Autechre's sound. This study is not a complete analysis of Autechre's sound and style, but rather an analysis of selected concepts and areas of electronic and computer music compositional styles employed by Autechre.

Chapter 2: Warp Records and Electronic Music

A Brief History of Electronic Music

> *The notion of having complete control over one's composition, of being complete master of all you survey, ... the prospect of having one's music performed and performed adequately, to hear one's music as it was conceived... It seemed to be a practical solution, a musical solution, a conceptual solution, and it removed one from an inappropriate milieu of presenting it to people who were not prepared and not interested.* (Babbitt, cited in Chadabe, 1997:18)

Milton Babbitt's quote above describes the notion of working with electronic instruments as not only a form of musical perfection, but of practicality. Early implementations of electronic technology paved a path toward revolutionary developments in electronic *instruments*, but there was a marked difference between development in the musical instruments and musical *ideas*. In the mid-twentieth century, many artists and composers used these new instruments to replicate old forms of performance or to perform previously existing compositions; in essence, there was a rift between the possibility of musical ideas and the employment of the musical instruments. To a certain extent, the public acceptance of musical possibilities was not ready for what the technology could convey. Synthesiser pioneer, Robert Moog stated that "at the beginning, I think everybody outside of the electronic music field thought that synthesisers were supposed to imitate traditional instruments whereas the people who were inside electronic music wanted to use synthesisers to make completely new sounds." (in Modulations, Lee [dir], 1998)

Preceding the birth of electronic music, different approaches toward musical concepts, such as alternate pitch systems, were incorporated into the Western musical canon. The (then) radical thinking of composers/musicians such as John Cage and Edgard Varèse helped bridge the gaps between music, sound and noise. In defining *music,* Varèse interchanged this somewhat sacred term with the phrase *organisation of sound*[32]. From the late 1930s onwards, Cage composed works based upon the structure and *organisation* of sounds. What the sounds were was irrelevant, as the sounds themselves could be non-sounds. Cage's compositions included instruments such as the prepared piano[33] as well as various noises or *found*

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[32] http://www.ems-network.org/IMG/EMS06-LLandy.pdf

[33] A modified piano with different objects wedged between strings so as to act like a percussive tool.

sounds such as electronic oscillators and variable-speed turntables. In the early 1950s, a split between the avant-garde musical approaches of composing with found sounds and composing with artificial sound and tones caused a formation of two distinct schools of musical thought. (Chadabe, 1997) In France, Pierre Schaeffer extended the notions of found sounds explored by Cage. The musical approach he developed is generally referred to as *musique concrète*.

> *This determination to compose with materials taken from an existing collection of experimental sounds, I name musique concrète to mark well the place in which we find ourselves, no longer dependent upon preconceived sound abstractions, but now using fragments of sound existing concretely and considered as sound objects defined and whole...* (Schaeffer, cited in Chadabe 1997:26)

In Germany, a different musical approach was developed, extending serialist ideas based upon the possibilities of electronic tone and sound generation, referred to as *electronische musik*. Although these two approaches toward sound construction and investigation stemmed from roughly the same foundations, they employed different techniques in sound composition, thereby creating two differing styles in the actualisation of electronic music. In 1957, an important turning point occurred in the progression of electronic music; as telecommunications engineer, Max Mathews (often referred to today as the father of computer music) created MUSIC I, the first computer-based music-synthesising program. This early synthesis program had limitations such as a monophonic output (which was also present in many of the previously existing hardware electronic instruments) as well as very limited control of sound dynamics. Versions of the MUSIC program evolved over the following decades and began to overcome the limitations of its first inception. (Chadabe, 1997)

From the late 1950s, Robert Moog began working on constructing theremins and began to experiment with constructing modular synthesisers that utilised frequency and amplitude modulation and various wave-shapes to generate rich, complex timbres. In the early 1960s, Moog began to create custom units of modular synthesisers. Complex interfaces that involved connecting modules via patchcords were gradually simplified and the first single-unit integrated synthesiser, called the *Minimoog*, was created in 1969. This allowed users to virtually 'patch' module connections with the touch of a button. Although the ease of the Minimoog's interface improved, it still lacked polyphony. (ibid.)

By the late 1970s and early 1980s, the popularity of the synthesiser had increased and early models of the sampler were emerging. The sounds of synthesisers were utilised and popularised by artists such as Kraftwerk, Roxy Music and Frank Zappa. Around the mid 1980s, the creation of MIDI[34] allowed users to control and synchronise a whole range of MIDI capable devices, allowing for forms of recording, precise control over manipulation, and automated playback. The price of synthesisers was greatly decreasing whilst the functionality of polyphony and the ability to store multiple banks of sounds improved. The late 1980s saw the first inception of software-based sequencers (with programs such as Steinberg's Pro 24 and Cubase), as well as hard-disk recording systems. The progression of computer speeds and efficiency over the last 15 years has seen an explosive rise in the creation and improvement of musical systems – from software based sequencing of external hardware devices, to composition-aiding systems, to software based sound generating programs and hardware effects units. (ibid.)

Despite its tenuous foundations in experimental music forms, electronic music technology has established a solid grounding in new music, not only as a means of generating sound, but also for recording and manipulating sound. As a result of technological advancement, the ability to produce and reproduce new and existing sounds and timbres opened up newer technologies that involved alternative inputs and treatment of note events on fine levels. Programs such as Max/MSP allow input from external non-musical devices, turning physical actions into gestural control mechanisms, as well as allowing for limitless possibilities of both sound generation and construction with its Max and MSP objects. Max/MSP's construction methods themselves are a throwback to the routines and signal path flow of early modular synthesisers, through the connections of patch cords from module to module.

Despite the dated perceptions[35] of *musique concrète*, *electronische muzik*, early explorations into tape-splicing, sample playback and manipulation, and synthesis, the techniques explored by early pioneers of electronic music still hold a great amount of flexibility and potential through their seemingly infinite modular possibilities. Much of the creative component and deconstructive analysis of this study will employ the

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[34] An acronym standing for Musical Intrument Digital Interface. MIDI is a standardised protocol allowing for communication between synthesisers, samplers, sound modules, drum machines and sequencers.

[35] In the sense that these methods of constructing sound have been superseded by much simpler methods.

above-mentioned concepts and techniques of composition and construction. They will however, be used in a modernised context with the aid of hardware and computer software.

Contemporary and Popular Electronic Music[36]

The Emergence of Techno

The origins of techno music can be located back as far as the early 1980s with the work of Juan Atkins, Derrick May and Kevin Saunderson in Detroit[37]. Their music combined aspects of the avant-garde explorations of electronic music from the late 1970s (from artists such as Kraftwerk and Yellow Magic Orchestra) with stylistic features prominent in the work of George Clinton, and borrowed features from the concurrently occurring electro movement. Described in the documentary film *Modulations* (Lee [dir], 1998) by techno producer Stacy Pullen as a music based on the experience of survival and oppression in Detroit in the late 1960s, techno music provided an outlet to dream of futuristic forms and places.

> *Detroit is such a desolate ... city, that you almost have to dream of the future to escape the reality of your surroundings, and I think that that was incorporated and instilled in the music.* (Juan Atkins in Modulations, 1998)

> *You can only dream of what rest of the world is like and you wanna find yourself trying to get outta there, put yourself in the position where whatever you think about, whatever you feel you wanna believe it's gonna help you get outta that city.* (Derrick May in Modulations, 1998)

Detroit's techno music comprised "minor-key melodies and spare, repetitive rhythms [exhibiting] a tragic, melancholic edge that seemed to ... directly engage the political and cultural issues of the late-20th-century urban America." (Bogdanov 2001:631) Techno emerged within the London acid-house scene in the late 1980s, and this 'new' direction became more popular in its rebirth in the UK than in its first underground beginnings in America. The acceptance in the UK of Detroit Techno laid the foundation for experimental approaches towards a reinvention and evolution of the techno sound. Although British techno borrowed sonic styles present in the first

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[36] A point raised earlier was an attempt to defy the necessity for genre classification when discussing Autechre, and that *autechre* is the best sonic-adjective and stylistically descriptive term. The following is an attempt to provide a setting for the emergence of Autechre and the evolution of styles associated with Warp Records.

[37] http://www.pitchforkmedia.com/article/feature/10251-from-the-autobahn-to-i-94

wave from Detroit, it concerned itself more with the exploration of this new sound style than engaging in political and cultural issues. Having stated this, political issues were not completely absent[38].

From a singular origin in Detroit, techno music in the UK began to fragment into further sub-genres. New syncretic techno styles emerged from different areas in England, forging sub-areas within techno such as *bleep* and *clonk* (closely associated with Sheffield, the names onomatopoeically symbolising the nature of the synth sounds and experimentation); *acid* (denoted by the abrasive nature of the TB-303 synth present in much of the music); *trance* (a high BPM form of techno, utilising repetitive structures and spacious sound-dynamic changes); intelligent techno/IDM (a sub-genre referring to the not easily classifiable and dynamically complex forms of electronic music, often described as 'braindance' or music that is more suited for the head than the feet); electro-techno; hardcore-techno; experimental-techno; and ambient-techno – boundary crossing permutations that appropriate and incorporate styles from different genres. (Bogdanov, 2001:pp.631-4)

The early recordings of Autechre were closely linked with the techno aesthetic, as were their attitude and approach to these sounds, as Booth describes:

> *[The] sort of analog electronic stuff that came out of Kraftwerk that was early electro and funk, was sort of human sounding or natural sounding but totally synthetic at the same time, and it was just a doorway into something for us. It was like "Hey, this is totally futuristic... what do you think?" and for kids it's brilliant because all you are thinking is 'sci-fi', 'space', 'future', "What's this?", 'excellent', 'computers', "Oh wicked, music made on electronic gear – I could do that."* (Booth in Modulations, 1998)

In the late 1980s, Sheffield, one of the largest cities in the north of England, and a city "still suffering under the divisive policies of Margaret Thatcher's Conservative government" (Young, 2005:8) was an prime location for a wave of creativity as a reaction against its industrial foundations.

> *Sheffield and Detroit ... are concrete examples of situations in which new social and aesthetic projects grew out of communities in crisis, projects in which the collective memory and individual consciousness found a new outlet in the use of new technologies. Founded as they are on the search for a lost*

[38] An example is that of Autechre's reaction against the Criminal Justice Bill (an attempt to outlaw rave parties through the banning of repetitive beats) with their track *Flutter* on their *Anti* EP, creatively bypassing the definition of 'repetitive beats' by having no two identical bars.

> *identity (Detroit), or a shared secret offering access to a parallel world (Sheffield), these two underground cultures are both mythic and their sites are temporally ephemeral (hangars, squats, wastelands, Internet) and culturally malleable (open to multiple influences, aesthetically porous). Such is their mythology, that of an empty frame... As a result of network and historical serendipity, Sheffield and Detroit, which were simply two nodes among many others on the web of underground connections, have brought about a lasting change in electronic music around the world.*
>
> (http://www.littledetroit.net/Features/SheffieldandDetroit.php)

Sheffield's Warp Records label embraced the swell of productivity and creativity in the wake of an expiring Manchester club scene. Warp Records' early years were spent supporting local musical innovators. (Young, 2005)

Warp Records

> *The name was perfect: it declared futurist leanings, and gave a clue to the soundworld the label would promote. Warp has overtones of science fiction: Captain Kirk's regular instructions to engineer Scotty to crank the Starship Enterprise up to warp drive in Star Trek. It carries the sense of distortion, to be physically or mentally twisted out of shape. So there's this twin meaning of fast forward motion and something bent out of the ordinary, unrecognisable. The word also occurs in the terminology of loom weaving and canal tow ropes, which imaginatively connects Warp to the industrial landscape of Sheffield. And finally, it stood as an acronym for a phrase with a quintessentially English ring: "We Are Reasonable People".* (Young, 2005:8)

In 1987, Warp's origins began in a Sheffield record shop named FON run by Steve Beckett and Rob Mitchell. By 1989, the two and producer Robert Gordon had the idea to start a record label to provide a base for local talent. Warp's early releases had groundings in forms of hardcore dance and techno known as *bleep* and *clonk*, two attempts at classifying much of Warp's style which very soon became pigeonholing descriptions of Warp's styles. (Young, 2005) The early releases acted as a precursor to future styles such as the now nebulously defined *IDM*, or *intelligent techno* – a blanket term referring to hard-to-classify genres that draw from various styles such as *house*, *techno*, *ambient* and *electro*. Warp's preferred classification of these hard-to-classify genres was 'electronic listening music'.

Warp's first wave of artists were the likes of groups such as Sweet Exorcist, LFO, Tricky Disco and Nightmares On Wax. The early 1990s saw moderate success with some Warp artists gaining chart recognition, however a mix of changing tastes and musical styles coming from abroad in the early 1990s were a signal for Warp to adapt.

> *For the first time, Warp felt the imperative to reassess, change with the times and keep moving forwards and away from the pack. Warp had brought a sense of self analysis to House that left it in an unanticipated position, but by Evolution Of The Groove it was in danger of coming full circle and ending up as another bland purveyor of crowd-pleasing anthems.* (Young, 2005:49)

Artificial Intelligence and Warp's Second Wave of Artists

In 1992, Warp released a compilation album called Artificial Intelligence[39] (1992), featuring tracks from six newly signed artists. This second wave of artists included The Dice Man (aka Richard James/Aphex Twin), Musicology (Mike Golding and Steve Rutter), Autechre (Sean Booth and Rob Brown), IAO (aka The Black Dog, containing Plaid members Ed Handley and Andy Turner), Speedy J (Jochem Paap) and UP! (aka Richie Hawtin/FUSE/Plastikman). Bringing a younger and more experimental side to Warp, "most were born this side of 1970, which put them in their mid-teens during the mid 80s, growing up on a diet of electro and hip-hop on compilations like the *Streets Sounds* series, as well as video games and early home computers." (ibid:51) The Artificial Intelligence compilation was the first in a series of recordings (the subsequent releases in the Artificial Intelligence series were albums by individual artists) and marked somewhat of a transition of *music of the dancefloor* to *music for the armchair listener.*[40]

> *[With the second wave of Warp's artists,] the difference was, there was no more chart successes like "LFO". It was less likely you'd ever hear the likes of Autechre, Black Dog or B12 on national radio. The music had wormed its way into a completely different [group] of listeners and fans, globally connected on internet message boards and discussion forums, which seemed to be its natural habitat. The stereotype of the 'bedroom songwriter' had evolved into the 'bedroom programmer'.* (ibid:55)

Warp had, by this stage established an aesthetic that promoted the future-looking experimentation of electronic non-conformists, encompassing and promoting a variety of electronic genres and bridges between them. Warp were recognised for

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[39] "Artificial Intelligence is not a term which was intended to be bastardised into the word Intelligent-Techno. The phrase was never intended to be aimed at 'intelligent people' (whatever they are) it was simply computer terminology which seemed appropriate to the style of music and was supposed to be a bit of a tongue-in-cheek dig at the people who said it was music made by computers that had no soul. We were trying to say that the computer was merely a tool to make music and that there was as much emotion in this music as in any other genre." (in Young, 2005:62)

[40] It is clear that this music was for listening to, and furthermore, it was music to listen to alone, preferably in the sepulchral, airtight space of the headphones. As Beckett explains: "That's why we put those sleeves on the cover of Artificial Intelligence – to get into people's heads that you weren't supposed to dance to it." (in Young, 2005:65). The compilation's cover art alluded to a modern day version of the previous classics, *Dark Side Of The Moon* by Pink Floyd and *Autobahn* by Kraftwerk.

their artist-based orientation, and this provided an environment conducive to artistic inventiveness, as "Warp [had] always been about reinvention, futurism, anticipating the next move and reshaping to meet it." (Young, 2005:17) Although it is common for record labels to adapt themselves to mainstream music trends, Warp's approach to and support of musical innovators is due to its continued success as a purely independent label. In recent years, Warp have relocated to London and continue to embrace new technologies, establishing the *Bleep* store – a large music store for distribution of non-DRM[41]ed downloadable material. Warp's approach to online music distribution is that customers should not be treated like potential thieves[42] – a feature of most mainstream downloadable media. Warp have continued to support a variety of styles by establishing subsidiary labels such as Lex Records for the distribution of hip-hop material.

Autechre

Sean Booth and Rob Brown met in the late eighties, sharing tastes in music and a fascination with hip-hop and mixing. "They were both turned on by hip-hop and electro, particularly Mantronix and Man Parrish, and by the increasingly wordless tracks emerging on pirate radio stations at the dawn of British Hardcore rave." (Young, 2005:54) The two shared a common past in graffiti, both having grown up in Rochdale, Greater Manchester. "The parallels between tagging and Autechre's later musical approach are not so far-fetched – keeping a step ahead, compulsive creativity for its own sake, outdoing the already done." (Stubbs, 2003)[43] As non-musicians growing up, the prospect of recording was a way for the pair to explore a personal style, and to express, contribute and actuate a unique idea, advancing the current state of Warp's musical creativity. Their approach was a throwback to a hip-hop and graffiti mentality, as both show creativity through working with other people's samples and 'leaving your mark'. When asked about musical approach, Brown states in an interview,

> *"When we were listening to tunes we had an ear for what we were into. Then we started mixing up people's music, like DJ mixes that were more customised than the norm. To the point where they were so customised that it was basically our drum patterns, our samples and our scratching and beats all over*

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[41] Digital Rights Management – a form of copyright protection for digital media

[42] http://www.bleep.com/faq.php

[43] Reprinted online at http://www.deelan.com/music/autechre/wire-230.htm

the top. To the point where we didn't use anyone else's material anymore and we realised we were making our own tracks. And I guess it was because we thought there was room for something that sounded like this. Maybe we were listening to Todd Terry and Mantronix, and Brian Eno, Kraftwerk, and loads of soul and stuff that was current, trying to find the best bits for us. It was quite rare to find them. So we were trying to put these bits together – not in a conscious way, but coming at it with no music training. We just got some kind of results and those results stuck out like a sore thumb to us." (BBC Collective, 2005, http://www.bbc.co.uk/dna/collective/A3895806)

"We like to do things properly, but whether 'properly' is the way that people have decided is a rule or not is irrelevant. We've been at this so long that we don't want to skimp on quality, or taste or style. All these things come from a hip-hop, graffiti, BMX background where you're showing off what you can do." (ibid.)

Autechre had minor and short-lived success, prior to their Warp signing. In 1992, they released a 12" called *Cavity Job* on a small Hardcore label, with Booth later attesting that "We had to make it, really, in order to get a deal, we had to make a balls-out Hardcore track. The B-side was a bit more adventurous but that's why it was the B-side." (The Wire, #230) Autechre's introduction to the wider music scene on the *Artificial Intelligence* compilation was followed by their first Warp release, *Incunabula* (1993, number 7 in the Warp *Artificial Intelligence* series) – described in their own words as a compilation of their existing works, due to the nature of track selection and length over which the tracks were made.

"[Warp Records] weren't interested [in the tracks that we had sent them] for like two years, and then suddenly [they] turned round and said, 'Yeah, we'll do the album', and that was Incunabula. *So we didn't really feel that it was much of an album because they'd picked out all their favourite tracks and then we put it together with them, and it was a bit more of a compilation of stuff that we'd done for pirate radio."* (Booth, cited in Young, 2005:59)

Subsequent releases such as *Anti* (1994) and *Amber* (1994) were more coherent snapshots of Autechre's early works – *Amber* was described by Brown as being the first genuine Autechre album put out on Warp Records. (BBC Collective, 2005)

Defining Autechre

Bogdanov et. al (2001) experience difficulty in classifying the style and sub-genre grouping of Autechre[44]. In diagrams explaining the links between the sub-genres of

[44] This is also apparent in CD music stores. Speaking from experience, many Australian record outlets find it difficult to place Autechre in one sub-genre within the electronic music shelf space, scattering releases throughout different areas within the same store.

techno music, Autechre appears under experimental techno, ambient/intelligent techno, and electro-techno categories. Although Autechre may have roots in these sub-genres, or had a particular sound/style of an album sum up the essence of a sub-genre, their style is constantly changing and cannot be summed-up as a whole with such a rigid distinction. A common classification of Autechre's style is *intelligent techno*. The *intelligent techno* and *IDM* terms are still fairly new but apply loosely to ways that composers work as opposed to styles in which they inhabit. These labels however, are often derided by the duo.

> *'Intelligent Techno' was laughable enough for it not to bother us. It was almost like, How ridiculous is that? OK, well, we'll go with it, because no intelligent person would ever read anything into it anyway: self-defeating proposition."* (Booth, cited in Young, 2005:58)

Perhaps a more apt categorisation (and conversely, a looser distinction) of Autechre's sound would be to state that they operate dynamically within the field of all electronica.

> *Electronica has become a manageable, one-word catch-all for a range of music styles which, taken together, many believe represent the next step in the evolution of Western pop... [E]lectronica in its broadest common significance refers primarily to artists drawing heavily on dance music styles such as house, techno, electro, and EBM (electronic body music) in ways not simply derivative of the dancefloor. Similar in some respects to the early working distinction between rhythm & blues and rock 'n' roll, electronica tends to involve an adaptation or mutation of dance music compositional elements to other-than-DJ/dancefloor ends; in the context of contemporary electronic dance music, that generally translates into dynamic (rather than static), composed (rather than programmed), listener-(rather than dancer- or DJ-) oriented "songs" (rather than "trax"). If the term's distinction appears to turn only on contrast – that is, by negative comparison to dance music – it's because many of the artists credited with innovating the music ...[Autechre inclusive]... saw themselves in contradistinction to dance culture and the limits it placed on its music. These artists were interested in producing music designed for other uses – home-listening, primarily – which allowed for a wider range of influences (ambient, classical, jazz, non-Western musics, etc.) and a higher index of experimentation. [T]hese artists brought a penchant for tunefulness and compositional dynamics – elements often lacking in club-borne dance music – to the creative fore.* (Bogdanov et al., 2001:634)

The easiest classification of Autechre's style is to refer to their sound as '*autechre*', as outlined in the introduction. It is, however, still of great importance to understand their position and the intertwined nature of their style with surrounding sub-genres in order to grasp the function and essence of their sound. In terms of classification and the attribution of stylistic values to a sonic text to equate its content with words, one

might think of the popular (and perhaps and clichéd) aphorism – often attributed to either John Cage, Frank Zappa or Elvis Costello – that writing about music is like dancing about architecture. With regard to describing Autechre by the way they sound and how they work, Booth states the following:

> *Wilfred Jans: Do you aim to break certain conventions, and is that why you are a band that breaks boundaries?*
>
> *Sean Booth: It's not all that much of a conceptual thing. Look, we are very much interested in the concept of rhythm. However, we think that you can also move internally, not just externally. As far as genres are concerned, as long as the two of us know about which music we're talking then there's no problem. But as soon as you stick a certain name on it, like 'electronic music', you run into problems. I mean, all music in a sense is 'electronic'. Even a recording that consists completely out of natural sounds can be regarded as electronic. When somebody concentrates on the sound itself, instead of the melody or the song, then almost automatically he gets shoved in to the experimental or electronic niche.*
>
> *Wilfred Jans: You are still wary of any kind of definition?*
>
> *Sean Booth: Yes, we've even stopped explaining what we do to other people. It may sound like the oldest cliché in the world, but now I only ever give people the advice... "Listen to our music". Everything is in there. We've always been interested in things you cannot describe using words. Our music is the logical progression of that. That's why it sounds the way it sounds...* (Jans, 1995:np)

It is hard to capture a single notion of the Autechre aesthetic. The duo often discuss their methods in a fairly *macro* level way, commenting that "We are very much interested in the concept of rhythm" (ibid.) and "When we do generative stuff we work with real-time manipulation of MIDI faders that determines what the rhythms sound like". (cited in Tingen, 2004:np)[45] In later interviews, Autechre have gone to great lengths to discuss how attitudes and pre-conceptions as to how they work are not (or no longer) correct. A sensible approach to analysing *autechre* would be to address Autechre as meta-composers, constantly reassessing their creative practices and re-inventing their approach on one level, whilst maintaining a cohesive underlying connection between works on another.

[45] http://www.soundonsound.com/sos/apr04/articles/autechre.htm

Chapter 3: Historical Analysis of Autechre's Sound

A Survey Of Key Characteristics In Autechre

This chapter will provide an in-depth deconstruction of Autechre's works and they changing methods, structures and evolution over time. This will be prefaced by an examination of Autechre's works prior to 1998. At the core of this analytical approach is a focus on key characteristics[46] that recur throughout Autechre's works. Whilst not all-encompassing in approach, this breakdown provides a basis for analysing a large portion of Autechre's corpus.

The key characteristics under analysis include: Autechre's element structure; synthesis approaches; manipulation of sounds; dynamic tempo features; instrumental timbre; and compositional approaches. Each of these characteristics will be explored in detail. An analysis of the progression of each of these key characteristics with regard to the development of Autechre's work will also be discussed throughout this study. Additionally, many of these characteristics overlap and intersect with other characteristics or are dependent on others; as an example, percussive timbre may involve a granular manipulation/looping of a sampled sound combined with a sample-rate-limiting effect. Subsequent chapters will place a larger focus on combining and recreating key characteristics. This chapter serves to highlight the evolution of Autechre's style through a textual description of their works, demonstrating changes in their approach to composition and sound design.

Historical Analysis of Autechre Prior to 1998

Although it is not the primary focus of this thesis, a discussion of Autechre's works prior to 1998[47] is included as it demonstrates a turning point in Autechre's recorded output. The year is significant in my opinion as it marks a change in Autechre's style that can be traced to a technological origin. At this time, computational speeds of home audio systems increased (and began to allow processing of audio signals in realtime) and home audio software became more accessible.

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[46] These characteristics are subjectively considered to be key features and recurring themes.

[47] A number of EPs will not be discussed due to the releases being either rarities, or the fact that the tracks are comprised of other artists' remixes of Autechre works, or Autechre remixing other artists' works. These EPs include *Cavity Job* (1991), *Basscadet EP* (1994), *we r are why / are y are we?* (1996), *radio* (1997) and *splitrmx12* (1999)

Preceding 1998, we see a focus on compositional structure and sequenced sample-playback. Audio processing prior to 1998 seems to be mainly constrained to hardware effects such as delays and reverbs, in contrast with the more evident *digital* influence of effects and playback methods, such as high-resolution audio editing and spectral manipulation present in their later works. The transition of Autechre's sound is often described as a progression from sequenced structures to heavily processed audio.

> *The development of Autechre's music since 1993 is fairly easy to qualify. Earlier work is more harmonious, ambient and tonal — conventional, for lack of a better word. More recent works have become much more adventurous, with out-of-time playing rhythm boxes promoted to the role of lead instruments.* Confield, *especially, is full of digital distortion, generative sequences, and irregular rhythms set in ambient contexts.* (Tingen, 2004:np[48])

Autechre's progression in compositional style and structural complexity has tended to reflect technological hardware and software developments of the past two decades, whereas the evolution of their stylistic complexity and conceptual approach is refined with each release. Their earliest release on Warp Records, *Incunabula* (1993), features a selection of tracks with comparatively straightforward percussive elements and simple melodic lines. Many of the tracks contain prominent and recurring features such as simple layered TR-606-sounding analog drum patterns (reminiscent of other releases around that time, such as Aphex Twin's *Selected Ambient Works 85-92* [1992]) with light spatial texturing through delay and echo effects. Tracks develop mainly through repetition and variation based on instrument and layer combination changes, rather than through melodic or part variation. The tracks are simple and succinct, and tracks such as *Autriche* feature almost jazzy lead melodies and simple synth-woodwind melodies. The duo consider this work to be more of a compilation of material spanning a number of years than a cohesive Autechre album, as the content was selected by Warp Records to promote an 'armchair listener' aesthetic (an extension of the established theme set by the *Artificial Intelligence II* [1992] compilation) – hence the lack of a coherent approach that is present on most of their other work. Booth describes the compilation-style nature of the album:

> *[W]hen we first signed to Warp, they were picking all the softer tracks.* Incunabula *was a compilation, really, of a lot of the older material that we'd had,*

[48] http://www.soundonsound.com/sos/apr04/articles/autechre.htm

> *most of which is either surface layer or which was around. At the time... Warp were putting out a lot more of the "home listening" stuff that we were doing ... Incunabula would have probably been half dance music, if we'd have been doing the compiling, but it was Warp, which is why it sounded the way it did.* (O'Leary, 2005:np[49])

Amber (1994), a spacious and intricate work compared to *Incunabula*, is considered by the duo to be the first 'real' Autechre album, and even though it shares similarities with their first album release, it demonstrates an evolving approach to composition in Autechre's body of works. *Amber* itself is an evolving album, with individual instrumental parts constantly changing (eg. filter cutoff of melodic lines), while still maintaining a repeating underlying structure combining layered combination changes and varying timbral change of individual instrumental layers. Through percussive structuring and time-based spatial effects, such as spring-reverb effects and choruses, timbral experimentation begins to move to the fore with this release. Tracks are given a rhythmic complexity through the use of bouncing delays that fill the percussive spaces with repeating patterns. Tracks such as *Glitch* feature percussive and instrumental manipulation, overlaying elements such as the snare sounds with ring modulated effects and rich broad-spectrum noise. Melodically, many tracks feature sparse lead lines and broad washes of supporting ambient tones, and in other percussive based tracks such as *Piezo*, melodies are inferred through the pitch changes and effect variance of percussive elements.

Released in the same year, Autechre's *Anti* EP (1994) shares similar characteristics to *Amber* as it similarly features heavy use of reverb and delay. *Anti* features three tracks (*Lost*, *Djarum* and *Flutter*) that sound structurally similar. *Lost* is simultaneously lo-fi in its percussive timbre, yet crisp and clean in its melodic lines with fade-ins of white noise that texture and emphasise phrases. In addition, the track incorporates human elements consisting of female non-lexical vocables. *Djarum* is harder-edged with tight, rapid recurring kick and rolling hat patterns, interspersed with spaciously effected drum and percussive elements and almost house-like chordal progressions. The most conceptually interesting track for the purposes of this analysis on the EP is *Flutter*, whose motivation extends beyond the purely sonic. Whilst it does not sound dramatically different from any of the other tracks on the release, its strategic compositional intent is specified in the liner notes.

> *Warning:* Lost *and* Djarum *contain repetitive beats. We advise you not to play*

[49] Interview in Kultureflash #119. Printed online at http://www.kultureflash.net/archive/119/priview.html

these tracks if the Criminal Justice Bill becomes law. Flutter *has been programmed in such a way that no bars contain identical beats and can therefore be played under the proposed new law. However, we advise DJs to have a lawyer and a musicologist present at all times to confirm the non-repetitive nature of the music in the event of police harassment.*

The significance of highlighting the lack of repetitive beats is a response to an ill-thought-out section of the UK Criminal Justice and Public Order Act of 1994, prohibiting the diffusion of music with repetitive beats[50] in an attempt to outlaw rave/ dance parties by isolating the key feature that the UK Government considered to be present in electronic/dance music. Whilst Autechre cited the reasons for their approach as artistic and personal freedom, the conceptual nature of constant structural variation of percussive elements as an indirect response to the Bill or not, recurs in their later works.

Garbage (1995) is a 4 track EP, marking a transition from the synth-like sounds of their previous works to an increasingly sample-based approach. The track *Garbagemx36* builds from a single recurring loop, and timbrally evolves into a complex layered piece with a single, pitched synth sound that features for the first four minutes, before evolving into a melodic progression. Melodic content also starts to move to the fore with this release as opposed to the simple single lines in their earlier releases, with ambient washes of pitches contrasting thin, bright percussive structures and arpeggiated melodies. *Bronchusevenmx24* contains low-level elements of echoing vocal-like sounds layered over splashy, filtered drum patterns and ambient melodies. The orchestral *Vletrmx* brings ambient melodic progressions to the fore, and is an eight-minute evolution of the ebb and flow of dynamic swells of sustained synth sounds, featuring no percussion.

Anvil Vapre (1995) demonstrates an increased focus on percussive structure and timbral representation. Almost industrial in sound due to its distorted elements, *Anvil Vapre* contains fast-tempo highly structured sampled sounds, leaving melodic content to be supplied by the timbral colours of the percussive sounds. *Second Bad Vilbel* shares a similar characteristic of breakdown and reinvention to the track *Teartear* on *Amber* through dynamic tempo changes. *Second Scepe* employs female non-lexical vocables as percussive elements, similar to tracks such as *Lost*; and

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[50] See Appendix II for Section 63 of the UK Criminal Justice and Public Order Act of 1994. The entire bill is available at http://www.opsi.gov.uk/acts/acts1994/Ukpga_19940033_en_6.htm

Second Peng combines lo-fi kicks and crunchy snare sounds with the heavy reverb and delays of their earlier albums.

Tri Repetae (1995) continues the progression of their works towards a refined mix of sonically simple but structurally complex material on some tracks, that contrast with structurally simple but sonically complex counterparts on others. The album shares a similarity between tracks with regard to the evolution of the layering of parts. With the exception of *Eutow* and *Overand* (where the melodic part begins the song, and is often stripped back as the track progresses, opening up for the percussion to move to the fore), a percussive line usually begins the track, and an alternatively structured percussive line is layered over the top after a number of measures. Simple pitched sounds act as percussive events, as opposed to being used in a melodic sense, where melodic lines begin to develop over the top. Although released in the same year as *Garbage* and *Anvil Vapre, Tri Repetae* shows a marked difference from these EPs, as the tracks are more accessible conventional pieces than the tracks on the short and more texturally intense minor releases.

Envane (1997) introduces a theme into Autechre's works that develops over subsequent releases, of *conceptually* structured tracks. Whilst still emphasising that the tracks should not be imbued with any meaning other than being purely creatively or sonically interesting, Booth states:

> [Envane *is] sort of hard to explain: four tracks that came from the same basis but not in the traditional sense of it (of them being sounds). They were more like mathematical bases... We started off with the same part and developed it in four different ways but they ended up being completely different tracks. It's almost like they were just different tracks but because they started from the same basis we thought, well, fuck it, we'll call them remixes, 'cause they're all related.* (http://www.disquiet.com/autechre.html)

Envane's four tracks feature less conventionally structured rhythms than previous releases. Inter-track variation through digitally signal-processed effects and abstract melodic progressions become increasing features. Released only a month later, *Chiastic Slide* continues the transition into more processed works, with aggressive sampled-sounds replacing standard percussive elements. The tracks do not seem to share a single focus, as *Tri Repetae*'s tracks do; while *Cipater* features intricate loops of samples assembled to form a drum pattern, *Rettic AC* features heavy compression, moving the noise between events to the foreground to create an ambient noise-scape overlaid with rich melodic swells. With regard to percussive

content and note structure, tracks such as *Tewe* exhibit inter-note rolls and fade-ins, where brief percussive events become sustained, mosaic-like noise swells laid over a steady beat. Fixed time-delay effects suggest a melody through repetitive percussion. In contrast to these percussively rich tracks, *Pule* is structurally simple with a single, syncopated melodic line sounding similar to a pitched drum.

Stepping back from the coarse, distorted sounds present on much of the releases of the previous few years, *Cichli Suite* (1997) demonstrates a clean and crisp sound with a greater focus placed on synthesised, rather than sampled, sound. This synthesised sound leads to a timbral clarity and crispness. Percussively, the elements are sonically simple and intricately arranged, demonstrating inter-note rolls previously included in tracks such as *Tewe* on *Chiastic Slide*. *Krib* extends this concept, including *micro-temporal* variation between successive percussion events, generating effects of an accelerating force being applied to an object[51]. Through its synthesis-based creation, *Cichli Suite* has more of a bright, high fidelity timbre than distorted sample-based previous albums. This crispness and timbral brightness is apparent on subsequent releases such as *LP5* (1998).

The releases that follow *Cichli Suite* mark the point at which the methodological analysis outlined at the beginning of this chapter becomes an apt categorisation method for deconstructing features of Autechre's sonic texts.

Historical Analysis of Autechre Post-1998[52]

The major focus of this analysis begins with *LP5* (1998). Sharing a similar fidelity and structural complexity to *Cichli Suite*, many tracks on *LP5* feature multi-layered percussive recurrence (such as *777* and *Fold 4,Wrap 5* discussed in detail later) and ambient melodic progressions/swells (featured in tracks such as *Acroyear2*, *Rae*, *Vose In*, *Fold 4,Wrap 5* and *Under Boac*). Many tracks feature a recurring beat with broad spatial placement of percussive elements, and varying effects on melodic and percussive parts.

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[51] A way to convey this concept is to imagine picking up two glass bottles on two adjacent fingers, separating them slightly and letting go so that they bounce elastically against one another but lose distance between them after each hit, hence a speed up in successive hits. This has the effect of a slight bend upwards in pitch, but still maintains the effect of a singular percussive element.

[52] Although released in 1999, *Peel Session* will not be discussed in this section as it was created prior to this period.

In the introductory sections of tracks such as *Under Boac* and *Drane2*, Autechre temporally dissect sonic motifs with phase-vocoded manipulation. This has the effect of producing sonically mutated and stretched samples, yielding frozen pitch spectra and noise. *Drane2* again features *micro-temporal* variation in recurring percussive and melodic events, producing accelerating and decelerating sequences. This simulates the bouncing of a ball, and is used in a pitched, melodic sense to create temporal and rhythmic complexity. Elements of *777* and *Fold 4,Wrap 5* are discussed in detail in Chapter 4.

EP7 (1999) diverges from the clean, crisp synthesised sound of *LP5*, incorporating harsh, compressed tones and introducing some approaches that will be discussed in detail later in this thesis. A particularly interesting conceptual approach that is introduced with this album (or at least brought to the fore) is the notion of generative melodic and percussive structures, creating non-recurring or structurally similar but elementally different patterns. This approach is apparent on tracks such as *Left Blank* and *Liccflii*. While the notion of non-recurring structural similarity with Autechre's work with *Flutter* on *Anti* (1994), interviews with Booth circa 1999[53] suggest that tracks on *EP7* are computationally generative (as opposed to humanly-programmed[54]). *EP7* also introduces software-based synthesised sound (both melodic and percussive), as well as an increased use of signal processing effects. These encompass ring modulated sounds on *Rpeg*; the heavily compressed nature of *Dropp*; sample-rate based degradation of *Liccflii*; and a continuation of phase-vocoded frequency-domain manipulation on *Pir*. Tracks such as *Netlon Sentinel* exhibit an increasing tendency of Autechre to explore non-standard rhythmic phrasing. This track is in a 4-beat structure, but shifts the swing of events in the middle of a measure, giving the effect of a time signature change. Elements of *Rpeg*, *Dropp* and *Liccflii* are discussed further in Chapter 4.

Autechre's next complete album continues along the trajectory cast from *LP5* to *EP7*. *Confield* (2001) is a relatively abstract release that sees further experimentation with nonstandard rhythmic phrasing, as apparent on tracks such as *Cfern*. A dramatic use of compression effects is shown on tracks such as *Pen Expers*, where drum

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[53] http://www.cocksocket.org/articles/seanbooth.html

[54] It is difficult to ascertain whether *Flutter* was generatively created, but it is assumed that the liner notes on *Anti* EP (1994) allude to *Flutter* being 'programmed' in terms of being step sequenced.

elements overpower the underlying melody, and maximise the noise between the percussive elements. Other experimental extremes are demonstrated on this release, such as the frenetic percussive variation on *Bine*, and the dynamic tempo variation of *Lentic Catachresis*. Interviews with Booth also suggest the continuation of generative and algorithmic approaches in tracks such as *VI Scose Poise*, and possibly on *Bine*:

> *The generative stuff... some of it's process-based; a track like* VI Scose Poise, *for example, is completely process-based. That was a process made in Max as a kind of sequencer, spitting out MIDI data. It was built just to run. It had various counters that would instigate various changes in the way the patch [evolved]. We'd hit Start and listen to it, and if it did something wrong we'd change whatever variable it was that was making it go wrong, then run the process again.*
>
> *Then a track like* Uviol *was made using a sequencer we'd built that changed what it was generating according to parameters we set with faders, so we'd spend a lot of time building it very soberly, and then we'd spend a lot of time very un-soberly playing it. A lot of the tracks on* Confield *are like that... they're basically made in real-time using sequencers where we'd spent a lot of time making this thing that would generate music according to a few set parameters, and then we'd mess around with the parameters in order to make the music later, when we were in a different frame of mind.* (Hollo, 2005:np)

Aspects of *Cfern*, *Lentic Catachresis* and *Bine* are discussed further in Chapter 4.

Gantz Graf (2002) is a 3-track EP which features a video clip of the eponymous track, presenting an apt visual parallel for the sonic text. *Gantz Graf* is a heavily compressed and processed granular-stuttering track, where percussive samples are processed and retriggered in such a way that they resemble a timbral freezing rather than individual sounds exhibiting traditional traits of percussive envelopes. Samples of drums and other percussive sounds are apparent, but are used in a recurring granular repetitious pattern, resulting in pitched noise. The phrasing and timing of the track is centred through a recurring hat sound. The two remaining tracks *Dial.* and *Cap.IV* differ in timbral construction from *Gantz Graf*, but share a similar timbral/tonal quality with each other. *Dial.* is a tight, piercing track interspersed with unintelligible peripheral vocal samples that move around the recurring central theme of a spiralling melody and short percussive excerpts that form a beat. *Cap.IV* shares a similar synthesised percussive sound to *Dial.*, including ambient melodies and deep melodic progressions that unfold beneath the central drum line. Across the entire length of the track, *Cap.IV* revisits the theme of dynamic tempo variation, present in Autechre's earlier works, with the track evolving into a rapid high-tempo piece. Elements that

occur in *Gantz Graf* are discussed in further detail in Chapter 4.

Autechre's full-length 2003 release, *Draft 7.30* marries slurring and stuttering granular audio processing with the precision and clarity of synthesised drums. As a subjective interpretation, the abstract 3D imagery of the sleeve design mirrors the combination of fluid 'curves' and synthetic 'precision' present in their music. Autechre's percussive elements are brought to the fore, featuring synthesised percussive wooden-knock sounds in place of kick-drum elements (in tracks such as *Xylin Room*), and *micro-temporal* sound grains as hi-hats (in tracks such as *Surripere* and *Reniform Puls*) – a feature seen in some of the synthetic percussion elements present in earlier releases like *EP7*. *IV VV IV VV VIII* features an almost free-rhythm (or convoluted quantisation) feel that is also apparent in the final sections of tracks like *Surripere* and *6IE.CR*. *VL AL 5* features swells of ambient string sounds above a tight synthetic beat. The track progresses from washes of granulated percussive and non-melodic timbral elements into a stuttering complex mix of granular sounds, reminiscent of the intros and outros of tracks on *Chiastic Slide* (1997) and *LP5* (1998). Successive recurring percussive elements are again featured on tracks such as *P.:Ntil*, which contains looping granular *micro* elements adding melody to the percussive track. On a larger scale of granular manipulation, the spatially mixed *V-Proc* opens with looped elements of constricting widths overlaid with a syncopated break-style beat. The final track, *Reniform Puls*, reintroduces Autechre's stylistic non-recurring generative elements atop a simple varying beat, structurally reminiscent of *Liccflii*'s phrasing on *EP7*, that gradually evolves into rapidly retriggered drum elements. Elements of *V-Proc* and *Reniform Puls* are discussed in Chapter 4.

As their most recent release at the time of this writing, *Untilted* (2005) takes a slight step back from their granular manipulation of audio samples and DSP processing and is more focussed on complex transient percussive programming and structural looping combined with ambient tonal elements. With percussion still at the fore, the complexity of phrase structuring on this release is heightened. Many tracks exhibit this complex phrase structuring, such as *Iera*'s oddly timed kick and snare combinations, and the inter-phrase quantisation-shift towards the end of the track. Although not granular in terms of synthesising new sound from audio samples, *Augmatic Disport* features a complex retriggering of synthetic drum sounds that generates a similar effect to the granular processing effects of tracks such as *Gantz Graf (Gantz Graf)*. Similar approaches are used in *Ipacial Section* on the melodic

backing of the final section of the track, as well as various elements in *Pro Radii*. Although many tracks are loop-based, they often contain a form of track re-invention part-way through. As an example, *Pro Radii*'s intro, consisting of lo-fi spectral blurring and imperfection artifacts of spectrally processed elements and 'crowd' sounds, transforms into a fast, sequenced, 'stumbling' structure. The difference in compositional approach between *Untilted*, *Draft 7.30* and their earlier work is indicated by Booth as being the exploration from a direct compositional perspective, as opposed to an 'abstracted' generative means:

> Draft 7.30 *is very different [to earlier works such as* Confield*], because it's almost 100 per cent composed, with very little playing or real-time input or anything.* Untilted *is different again, it's basically loads of different sequences all running together. We've used so many hardware devices this year compared to* Draft 7.30 *– on* Confield *there are a few hardware bits and pieces, a few analogue sequences being used there as well. On* Untilted, *it's basically everything – bits of drum machines, old MIDI sequencers, old analogue sequencers, MPCs, basically the whole gamut of equipment we've had around us for ages, but used in slightly different combinations – in some ways more traditionally, in some ways less so.* (Hollo, 2005:np)[55]

Elements of *Augmatic Disport* and *Pro Radii* are discussed in Chapter 4.

Analysis of the Sound Product / Conceptual Deconstruction in Detail

The classification of key concepts in Autechre's works is broken down into various analytical areas, each pertinent to features in particular tracks. The aim is to investigate Autechre's phrase structure, methods of sound construction, and track creation through the discussion of the recurring key features outlined earlier in this chapter (discussed here in further detail), namely:

1. Phrase and element structure: temporal ordering and placement of note and percussive events, and rhythmic phrasing.
2. Synthesis approaches: electronic sound generation, both melodic and percussive.
3. Granular manipulation of sounds: manipulation of elements of sounds on fine temporal scales and creating/synthesising new sounds from parts of larger sampled-sounds.
4. Dynamic tempo features and non-standard rhythms.
5. Percussive and instrumental timbre: an analysis of sound, including mastering processes, sound manipulation and effects.
6. Algorithmic, generative and other compositional approaches.

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[55] http://www.cyclicdefrost.com/review.php?review=879

Phrase and Element Structure

A defining factor of Autechre's sound is their percussive and melodic arrangement of sound events. Phrase structure is quite variable, ranging from tightly structured and rigid rhythms, to ebbing and flowing beats that blur a regular, linear time, a feature not often seen in other forms of popular electronic music. Additionally, the concept of non-recurring patterns (or generative permutations around a particular structural basis – discussed further in the *Algorithmic, Generative and Compositional Approaches* section of this chapter) is a fundamental characteristic of Autechre's style. Events that occur on time scales beneath the traditional concept of the musical atom (ie. the individual note) are present on many Autechre tracks. Therefore, as opposed to a traditional discussion of phrasing alone, an attempt will be made to provide analytical and descriptive structures that emulate certain concepts, such as ways to create 'swung' time or algorithmic processes that render a certain percussive structure.

As an example of events occurring on one temporal scale defining a sound on another temporal scale, the sound (or structural pattern) of a bouncing ball can be expressed as a constricting time between successive contact instances with the ground. For instance, if it takes 500ms between the first and second instances, we can recursively multiply that time with a fraction (such as 9/10) which would generate the following values (rounded to the nearest integer for convenience):

```
500 ms × 0.9 =
450 ms × 0.9 =
405 ms × 0.9 =
364 ms × 0.9 =
328 ms × 0.9 =
295 ms × 0.9 =
265 ms × 0.9 =
239 ms × 0.9 =
215 ms × 0.9 =
193 ms × 0.9 =
174 ms × 0.9 =
156 ms × 0.9 =
141 ms × 0.9 =
127 ms × 0.9 =
114 ms × 0.9 =
102 ms × 0.9 =
092 ms × 0.9 =
```

```
083 ms × 0.9 =
075 ms × 0.9 =
067 ms × 0.9 =
060 ms × 0.9 =
054 ms × 0.9 =
049 ms × 0.9 =
044 ms × 0.9 =
039 ms × 0.9 =
035 etc.
```

Hence, a decreasing time between successive hits would simulate a decrease in height each time the ball bounces (depicted in Figure 4.01 below).

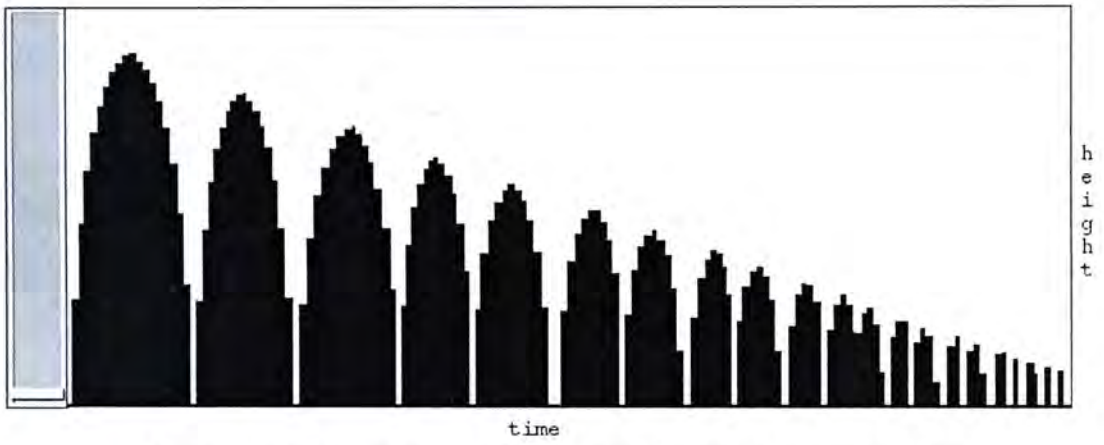

Figure 3.01. Modelling a bouncing ball as a function of height over time

Due to the nature of a 'top-down' deconstruction inherent in classical musicological analysis, in the sense that notes are discussed as $1/2^n$ lengths of (or begin at placements within) a bar or divisions of a larger set, expressing the above concept would be impossible in such a language, as note events as functions of previous events cannot be adequately described in the language of traditional musicology.

Whilst the above discusses sub-note-level processes that define a larger sound, Autechre's approach to the arrangement of content across *meso* level measures will be explored in further detail in Chapter 4. The nature of Autechre's complex timing patterns will be discussed through quantisation values, and bar/beat division structures. Particular tracks exhibiting complex phrasing within standard time signatures include *Cfern* and *Netlon Sentinel (EP7)*, *IV VV IV VV VIII (Draft 7.30)* and the final half of *Iera (Untilted)*.

Synthesis Approaches

Autechre's releases between the years 1998-2005 contain elements of additive, subtractive, FM and AM synthesis, as well as examples of timbral experimentation through wavetable and granular synthesis.

An intriguing feature of Autechre's work is their generation of pitched and varied-spectra noise elements that are shaped into percussive sounds through the use of differing envelopes. In many Autechre tracks, the more overtones present in a synthesised sound, the more likely it is to be used with a temporally shorter envelope to simulate percussive elements such as 'hats', and the simpler less timbrally-rich sounds are used as percussive elements such as the main beat or 'kick'. As an example, when analysing tracks from *LP5* (1998) and *EP7* (1999), it seems that Autechre take a fairly low-level approach to shaping sounds when producing synthesised tones and timbres. Rather than imitating acoustic phenomena, Autechre create sounds through forms of synthesis such as FM to represent percussive and melodic content. The nature of their sounds can be broken into a number of areas: the sound's fundamental carrier frequency; its harmonic and inharmonically related partials; and the relative strength of the partials compared to the carrier. The final step in the analysis and recreation of their synthesised sound lies in the shape of the sound's envelope.

Granular manipulation of sounds

Extending the idea of synthesising sound, Autechre have employed granular or wavetable-driven synthesis to construct sounds. In simple terms, small fragments of larger sampled sounds are looped at differing frequencies, which result in a wide variety of timbres. The use of differing grain sizes contributes to the overall sound of the final product, with greater grain widths allowing a more perceivable essence of the original sound to emerge. The larger the grain, the slower the sound is retriggered, hence sonic elements from the original sample come through. Conversely, the shorter the grain, the faster the sound is retriggered, and pitch becomes increasingly apparent as the sound is retriggered at frequencies considered to be humanly audible, ie. 50ms and less or 20Hz and above. In addition to grain width, playback speed is also a determinant in the synthesised pitch.

Examples of this notion of pitched and non-pitched sound through the retriggering of larger sampled sounds are audible in *Gantz Graf (Gantz Graf)*, *V-Proc (Draft 7.30)*, *Augmatic Disport (Untilted)*, analysed in detail in Chapter 4.

Dynamic tempo features and non-standard rhythms

Linked to the Phrase and Element Structure section discussed above, Autechre use dynamic tempo features such as temporal slowdowns to reveal or re-invent a track. This has the effect of exposing a track's structural underpinnings, whereas temporal accelerandi compress *meso* length measures into finer time scales. Although not the primary focus of this thesis, the early works of Autechre demonstrate this concept with tracks such as *Second Bad Vilbel (Anvil Vapre)*, which features a track slowdown and reinvention. A similar temporal dissection occurs at 2:42 on *Teartear (Amber)*. Conversely, a track like *Cap. IV (Gantz Graf)* features a linear speed increase over its nine minutes, while *Iera*'s *(Untilted)* increased pulse speed over its second half acts as an inter-track temporal re-invention.

The concept of non-standard rhythms here is differentiated from the Phrase Structure section outlined earlier and infers dynamic change of recurring events or inter-bar tempo changes. This is seen on *Fold 4,Wrap 5 (LP5)*, which features inter-layer tempo changes, whereby the spiralling outward (or constant ritardando) of the track's tempo each bar is overlaid with a contrasting 'hat' sound that spirals outward from a different starting point to the rest of the melody and percussion. *Drane2 (LP5)* similarly contain elements that increase in speed over repeated events. This sonic phenomenon mirrors the effect of a linear motion (ie. velocity of an object) with an accelerating force applied to it (such as the sound of a ball bouncing on the ground, modeled above). *Drane (Peel Session)* takes this element further with re-triggering of note-level events being accelerated into the audio-rate domain, generating granular synthetic sounds. *Gaekwad (Peel Session 2)* shares a similar inter-track-element accelerating recursion. This transitional shift of time-scales between events is again linked to the idea of granular manipulation of sounds.

Percussive and Instrumental Timbre

Whilst the concept of percussive and instrumental timbre incorporates some of the above features such as forms of synthesis or granular manipulation as note

construction, additional characteristics are added to these sounds through various forms of DSP manipulation such as EQ, compression, sample-rate limiting, spectral manipulation and ring modulation. Audio effects such as compression/expansion are heard to a great extent on releases like *EP7* (on tracks such as *Squeller* and *Dropp*) and *Confield* (on tracks such as *Pen Expers*). Spectral manipulation is apparent on a range of releases, such as the use of spectral stasis on tracks like *Gantz Graf (Gantz Graf)* and *Liccflii (EP7)*. Another recurring feature is the use of short feedback-delay lines on percussive events, producing extended static, amplitude modulated sounds. Percussive and instrumental timbre focuses on the nature of Autechre's synthesised and sample-based sound construction methods and signal processing, and features examples of harmonically and inharmonically produced synthesised sounds, phase vocoding and methods of spectral stasis, and methods of granular sound construction.

Algorithmic, Generative and Other Compositional Approaches

Whether created generatively or not, the compositional approach behind the *Anti* EP track *Flutter* highlights an important notion creatively for Autechre: non-recurring composition. Perhaps beginning with the conceptual notion behind *Flutter (Anti)* of constant variation, many of Autechre's works can be characterised by their use of non-repetitive structural permutations around a given framework. Seen on tracks like *Liccflii (EP7)*, *VI Scose Poise (Confield)* and *Reniform Puls (Draft 7.30)*, structural variation between bars, as well as melodic movement, can be created through algorithmic or generative means. These algorithmic, generative, and rule-based deterministic compositions are structurally complex and non-recurring. The overall essence of the tracks, however, remains constant. Booth describes his generative approach to composition as "a few bits of number crunching objects that don't really do a great deal until you feed them numbers and tell what to come out with" (Reynolds, 2001:np)[56], that is, where the input of one event causes a chain reaction and continuously generates new events.

Non-repetitive algorithmic and generative progressions involve constantly varying data whereby one object, when set in motion, can produce a sequence of events, which in turn can trigger another sequence of events, and so on. Autechre's algorithmic approach can be broken into two areas: chaotic/stochastic and rule-

[56] http://www.cocksocket.org/articles/seanbooth.html

based. Both techniques appear to be used within particular tracks in both structural (such as percussive element pattern placement) and progressional forms (such as track transition or key modulation). In articles and interviews near the release of *Draft 7.30* (2003), a combination of stochastic and rule-based approaches seems evident:

> *Booth describes the duo's current working method as a process of building "a set of variables that make the track progress in a certain way." Utilizing these techniques, Autechre... can define the* outline *of a composition, while letting the algorithm(s) define certain aspects of its final form. In this way, "the programs are always going to spit out different versions of the track" whose boundaries and protocols its composer delineate [sic].* (Sterling, 2003:np)[57]

Conceptually, many features of Autechre's works can be represented algorithmically (such as the bouncing ball example cited earlier), regardless of whether or not they were created in such as manner. Indeed, much of Autechre's recent work is not algorithmically generated (Daniel, 2005)[58], but still exhibit characteristics that are reproducible through algorithmic structures. For the purposes of this study, and its creative component, algorithmic and generative forms will be discussed and employed wherever possible as a mode of dissecting *process* and as a model of a conceptual notion.

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[57] http://www.junkmedia.org/issues/electronic/autechre.html

[58] http://www.pitchforkmedia.com/article/feature/14673-interview-autechre

Chapter 4: Detailed Analysis of Selected Autechre Tracks

Track Analyses

This chapter is broken down into various analytical models, each pertinent to particular Autechre tracks. The purpose of this chapter is to break down phrase structure, sound construction, and method of creation through the discussion of the six key features outlined in the previous chapter.

In many of Autechre's tracks, a number of elements are obscured through their sonic manipulation and placement alongside other track elements; hence a complete sonic deconstruction is not the aim of the following analyses. Since the analyses in this research thesis are purely from the sonic text, key elements that recur in these (and other) tracks are to be the basis for discussion, as opposed to a complete sonic deconstruction[59]. The proposition that certain parts of their arrangement and structural and compositional approach can be estimated/emulated stresses the main goal – the reproduction of patterns and characteristics in their work.

The purpose of this chapter is to provide an interactive analysis, through the discussion and replication of concepts present in selected Autechre tracks. On the attached disc, audio tracks that have been composed with custom written Max/MSP patches that emulate[60] particular compositional processes or routines are available, so that the reader can auralise a written concept.

Particular tracks and track elements are to be discussed with reference to four perceptible time scales: namely the *macro*, *meso* (and *sub-meso* – referring to groups of *sound objects* within a *meso* length measure), *sound object* and *micro* time scales. On the *macro* scale, overall track progression and structure will be discussed. On the *meso* level, phrases and groupings of *sound objects* (notes) will

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[59] Any attempt to discuss Autechre's compositional approach with certainty would be erroneous. Sections of Autechre tracks that cannot be addressed comprehensively demonstrate the limitations of a purely sonic-based analytic approach, and highlight possible areas needed for improvement in analysis of these and other similar musics, and areas for further discussion and future research.

[60] As mentioned previously, it is hard to determine exactly how Autechre work, so these patches aim to illustrate concepts and replicate elements present in their tracks. The choice of the Max/MSP software to recreate these elements is due to its flexible nature, and not necessarily because Autechre have used the program. Many of the concepts that are recreated here may not have been created through Max/MSP, but 'hard-sequenced' in another audio program, for example. As such, this is an attempt to *emulate* musical constructs, as opposed to definitively recreate.

be analysed. On the *sub-meso* level, groupings of elements within phrases will be analysed. On the *sound object* level, individual notes, percussive and melodic elements will be analysed; and on the *micro* level, parts of individual notes will be discussed (such as the how the *sound object* is created through granular means).

Analysis of *777 (LP5)* – Model 1

The second track on Autechre's *LP5* release, *777*, is a particularly pertinent example of Autechre's approaches to compositional structure, synthesis, and percussive and instrumental timbre. Focussing on the *meso* scale, the track is composed according to a multilayered recurring 7-count time signature – a looping of 3.5 whole beats (or 7 half beats) repeats each bar. This has the effect of shifting the percussive emphasis within the bar. The main percussive structure (based around the kick and snare patterns) is outlined below:

```
o.ooi.o...o...o.ooi.o...o...
1xxx2xxx3xxx4xxx5xxx6xxx7xxx
1...2...3...&.1...2...3...&.
o = kick
i = snare
```

Main recurring percussive structure in 777 (LP5)

The top line of the above percussive tablature represents the kick and snare pattern. The second line represents the main beat count (listed numerically) and the quarter beats between successive pulses (represented by x). An interesting recursive feature of this phrase is that the kick stresses of the former half of the phrase lie mostly on the upbeats (shown in beats 2, 3 and 4), whereas they lie on the downbeats in the latter half (shown in beats 5, 6, and 7 – where the kick coincides with the pulse). The third line shows why this is the case. On a *sub-meso* scale, the phrase of seven beats is a cycle of two identical three-and-a-half-beat segments that recur inter-bar. Whilst this percussive framework remains present throughout the track, complexity and variation around this simple fixed- and recurring structure is created through the inclusion of percussive elements present in the wide stereo field, representing bright percussive features analogous to hats. Short feedback delay lines and time-based effects are added to these elements to create a constantly changing pitched-percussive overtone, resulting in a broad wash of rich synthetic sound. This creation of complexity through variation of simple structures is a

fundamental feature that recurs throughout Autechre's work.

Central in the mix is a fast modulating arpeggiated-synth line that is brought to the fore at 4:00 when the wide stereo elements are reduced. The track ends with a temporal ritard that spans a few measures of the loop, revealing the recurring structure.

Analysis of *Fold 4,Wrap 5 (LP5)* – Model 2

Much like the previous example of *777*, *Fold 4,Wrap 5* is a structurally simple track, featuring a recurring percussive theme overlaid with a shifting melodic progression each measure. The track exhibits a distinctive feature, whereby its tempo slows down each bar to half its original tempo, providing a clear example of Autechre's use of dynamic tempo features.

While there are many transient synth elements present in the track, the main percussive structure is outlined below:

```
o...i...o...i.........i.o.i.o.i.
+.+.+.+.++++++++++++++++++++++++
1xxx2xxx3xxx4xxx5xxx6xxx7xxx8xxx
o = kick
i = snare
+ = hat
```

Main recurring percussive structure in Fold 4,Wrap 5 (LP5)

This main percussive structure remains constant throughout the track, except for segments of the track where portions of the measure are removed to allow for synthesis based elements and broad chorus effects to vary the loop. The arrangement is conceptually simple, as the main emphasis is placed on the main beats of the measure. However, complexity arises when a linear tempo shift from regular to half-speed occurs over this measure of 8 beats, resulting in a more complex and ambiguous sense of layered tempos. The temporal slowdown is shown graphically below:

```
o...i...o...i.........i.o.i.o.i.
+.+.+.+.+++++++++++++++++++++++++
1xxx2xxx3xxx4xxx5xxx6xxx7xxx8xxx
```

Main recurring percussive structure with temporal slowdown in Fold 4,Wrap 5 (LP5)

While the notion of a temporal ritard is fairly simple to comprehend, the actual result of this effect is more profound than it appears. On the 3rd beat of the measure, the hat line doubles its periodicity, which results in a smooth transition from the 8th beat back to the 1st beat of the following cycle (as the doubling in periodicity is counteracted by the ritard of the loop to half speed). This also occurs on the kick and snare combination from the latter-half of beat 6 where a double in periodicity begins, resulting in a similar smooth transition effect from the end of the measure to the beginning of the next. This continual decelerando operates by exploiting similarities on metrical levels; slowing one element until it matches the pulse of the next cycle, conveying a sense of continual operation.

Above the percussive layer lies a fundamental chordal progression, setting the melodic space and starting point for each measure. The main melody consists of arpeggiated overtones of the fundamental chordal progressions. The resultant effect of the combination of these elements is a continuous spiralling outward of recursive tempos and layered elements.

Analysis of *Rpeg* and *Dropp (EP7)* – Model 3

With reference to percussive and instrumental timbre and effects, Autechre's *Rpeg* and *Dropp (EP7)* are heavily processed, featuring characteristics such as (or suggestive of) heavy compression, ring modulation, short feedback delay and spectral convolution. The characteristics of the compression on *Rpeg* demonstrate an inverse volume relationship between the elements present in the track and the headroom and high-frequency space above them. As the elements decay, high-frequency noise begins to emerge, as the elements are maximised through their compression; this is quickly suppressed when percussive and melodic elements re-occur. This effect, present on many elements in the track, is particularly noticeable on the final notes of the melodic phrases in segments such as 0:46 to 1:00. The high-register percussive elements in *Rpeg* are textured with ring modulated effects, resulting in a high-frequency splash that acts as a hi-hat element.

These heavily compressed characteristics are repeated on *Dropp*, where the compression and expansion effects on the percussive line are such that the presence of percussive elements are suppressed whilst the vacant space surrounding the *sound objects* are expanded and raised to the fore resulting in a subtractive or inverse sense of the track. A blurring of elements is also achieved through the use of what appears to be a fixed time delay, producing a deep tone when excited by percussive *sound objects*.

Like *777*, *Dropp* is in a 7-count, and is built out of a series of three recurring measures, that are slight variations on a single theme:

```
o.-.....-.-..-.o..o...-..-..
.i..i.......i.......i..i...i
+...+...+...+...+...+...+...
1xxx2xxx3xxx4xxx5xxx6xxx7xxx
o..-....-.-..-.o..o...-..-..
..i.i.......i.......i..i..i.
+...+...+...+...+...+...+...
1xxx2xxx3xxx4xxx5xxx6xxx7xxx
o.-.....-..-...o..o..-...-..
.i..i....i..i.......i..i...i
+...+...+...+...+...+...+...
1xxx2xxx3xxx4xxx5xxx6xxx7xxx
o = kick
- = kick 2
i = snare
+ = hat
```

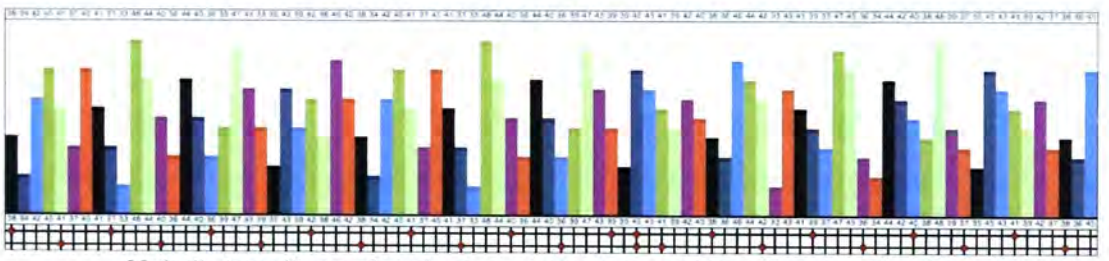
Main recurring percussive structure in Dropp (EP7)

A more inexpressible notion of musical content in the track is the presence of rhythmic variance of noise elements situated above the structural elements. As the least tangible content to express textually, it is the part of the track that varies the most, and gives the track its unique sound. The outcome of this effect suggests the use of complex forms of control over filters, as rapid, non-recurring changes occur on the *micro* time scale. The defining feature of the track emerges in the absent spaces between the noise where the filter of one sound is controlled by the envelope of

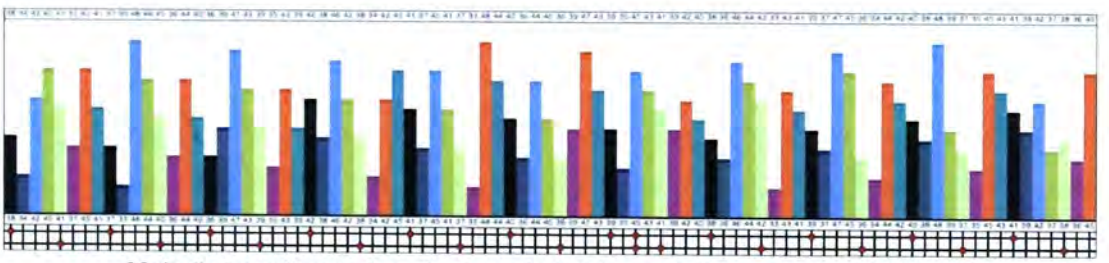
another signal. This form of using signals as control input seems to have a strong presence on *EP7* (1999), with notable examples on tracks such as *Squeller*, *Outpt* and *Pir*. This use of complex control mechanisms, and mapping of one system's data to another system is a characteristic of Autechre's work and manifests in various ways. (Tingen, 2004:np)[61]

Analysis of *Liccflii (EP7)* – Model 4 (EP7)

As the track that continues sequentially from *Dropp (EP7)*, *Liccflii* is a stark contrast both sonically and timbrally, omitting the lower-frequency blurring and heavy compression artifacts present on many of the preceding tracks. The timbral characteristics of the percussive structure in *Liccflii* are high-contrast, ranging from deep, simple kick elements, to sharp, bright and overtone-rich hat elements.



Melodic transitions of each phrase's fundamental key (7 colour bar chart)



Melodic transitions of each phrase's fundamental key (8 colour bar chart)

Liccflii's pitch progression (reduced to MIDI note numbers) is

38	34	42	45	41	37	45	41	37	33	48	44	40	36
44	40	36	39	47	43	39	35	43	39	42	38	46	42
38	34	42	45	41	37	45	41	37	33	48	44	40	36
44	40	36	39	47	43	39	35	**45**	43	41	39	42	40
38	36	46	44	42	33	43	41	39	37	47	45	36	34
44	42	40	38	48	39	37	35	45	43	41	39	42	37
38	36	45											

Fundamental pitch progressions in Liccflii

[61] *Talking 'Bout Our Generation* section - http://www.soundonsound.com/sos/apr04/articles/autechre.htm

```
...  -4  +8  +3  -4  -4  +8  -4  -4  -4 +15  -4  -4  -4
 +8  -4  -4  +3  +8  -4  -4  -4  +8  -4  +3  -4  +8  -4
 -4  -4  +8  +3  -4  -4  +8  -4  -4  -4 +15  -4  -4  -4
 +8  -4  -4  +3  +8  -4  -4  -4 +10  -2  -2  -2  +3  -2
 -2  -2 +10  -2  -2  -9 +10  -2  -2  -2 +10  -2 -11  -2
+10  -2  -2  -2 +10  -9  -2  -2 +10  -2  -2  -2  +3  -5
 +1  -2  +9
```

Pitch shifts between successive notes above

Notice the pattern recurring on lines 1 and 3 (and 2 and 4 – ie. every 28 measures), and also the palindromic nature of the progressions around the pitch 48 and 42 (11th element on lines 1, 2, and 3, and in other places marked by odd-numbered pitch changes in the second model of pitch shifts between successive notes). This pattern of pitch transitions suggests that the progression is rule-based. Marked in bold is the point in the track where the pattern shifts to an alternate melodic transitional model. The percussive structure of the track is also suggestive of a rule-based variation around a static theme. Whilst the pulse of each measure is on the first and third beats, other beats and percussive elements within the bar are constantly shifting placement, and are intertwined with rapid recurrences of certain elements. This use of *micro-temporal* recurrence of percussive elements, such as fast snare and hat rolls is another recurring theme of Autechre's work.

Analysis of *Cfern (Confield)* – Model 5

Cfern exemplifies Autechre's approach to oddly quantised material. There is very little repetition across the first 12 bars of the track, but instead a highly syncopated variation around a basic pulse on the 1st and 3rd beat (kick and snare respectively), of each bar. The majority of the elements are aligned to a 1/8th triplet quantize setting, with a 1/16th triplet quantization in the final few bars. Quick drum rolls occur, similar to the retriggered events mentioned above. In addition to triplet based quantisation, the final bar shows examples of dynamically quantised events with a drum roll and slowdown. The following images of Cubase's Drum Editor[62] show the kick and snare pattern (the top two elements on each image) and other percussive material constituting the drum part (the remaining elements in each image, such as wood

[62] The following images show *Cfern*'s percussive structure mapped against a General MIDI drum map. These images are intended to show the overall percussive complexity, so it is not necessary to know the instruments being played, other than the top two rows of elements representing the kick (top row) and snare elements (second row). The remaining elements represent various short percussive hats, clicks and knocks.

block, claves etc.).

A model of the percussive content of the first 12 bars of Cfern (Confield)

Other examples of this dynamic quantisation include *Bine (Confield)* and *Netlon Sentinel (EP7)*. *Netlon Sentinel*'s non-standard rhythmic phrasing is a 4-beat measure with structural emphasis shifting in the middle of a measure, giving the effect of a time signature change. Booth discusses Autechre's approach to timing and patterns on *Confield* as a series of abstracted levels of control over data generating devices as follows:

> *...And then you get another analogue sequencer to drive [another] analogue sequencer with a different timing. Immediately you have something that some people would call random, but I would say is quantifiable. It seems that for a lot of people, if they hear something that doesn't sound regular, they assume it's random. If live musicians were playing it, they'd probably call it jazz or something. But the fact that it's coming out of a computer, as they perceive it, somehow seems to make it different. For me it's just messing around with a lot of analogue sequencers and drum machines. It's like saying, 'I want this to go from this beat to that beat over this amount of time, with this curve, which is shaped according to this equation.' Or you want all the sounds and the way the rhythm works to change, and you don't quite know how long the transform will take. You can then build a patch to do the transform, and you do it by ear with a fader. We may have one fader that determines how often a snare does a little roll or skip, and another thing that listens and says 'If that snare plays that roll three times, then I'll do this.'* (Tingen, 2004:np)

Combining elements mentioned previously, *Lentic Catachresis (Confield)* features a simple alternating kick and snare/hat motif, not scored graphically here, combined with varying generative percussive structures. The track begins with a straightforward kick- and snare-based percussive structure. At around 2:00, the track begins to slide in and out of tempo; by 4:00 the track descends into a frenetic mix of stuttering kick and hat events over a steady hi-hat pattern. By track end, the kick and snare elements are frozen into granular repetitions that sustain these percussive attack transients.

Methods for Capturing Generative Structures

A number of the tracks mentioned in this chapter contain elements of algorithmically generated content. In order to discuss the musical content that is being generated, methods for analysis and recreation of the generative structure, perhaps going beyond the scope of this thesis, could include the creation of an automated listening program that scored percussive events within a bar.

A poll of percussive onset-detection and feature-matching[63] is undertaken and tabulated at chosen divisions (such as 8ths or 16ths etc. of a measure) within a repeating *meso* scale measure (ie. every bar or multiple thereof). By measuring the ratio of actual events divided by the number of possible events, a probabilistic model of the music content can be determined. As an example, if the first beat always contains a kick, then over the course of 10 bars, 10 kicks will be present on the first beat, giving the kick a probability of 1 of its occurrence at this point in the bar. Furthermore, if a snare occurs 4 times out of 10 on the 4th beat division of the bar and 7 times out of 10 on the 12th division of the bar, then the probabilities of their occurrence are 0.4 and 0.7 respectively.

The above concept of building a probabilistic model based on automated listening or musical style modelling is moderately easy to describe (and was, in part, used to help score the *Cfern* model above), although the actualisation of such an analysis with reference to much of Autechre's work is much more complex.

With reference to *Netlon Sentinel* however, it is problematic to undertake such analysis. As timbral recognition is the main identification mechanism in the Max/MSP `bonk~` object[64], identifying percussive events as instances of a certain type (eg. kicks, snares, hats etc.) is much more convoluted in Autechre's work. While a percussive structure may recur or evolve, in many cases filters and effects alter the percussive 'colour' or frequency distribution of these events. These changes obscure timbral recognisability in the onset detection and matching mechanism.

The author of this thesis has created a generative structure-builder[65] that satisfies the original objective of building probabilistic models based on automated listening. Although the analysis undertaken was fairly low level, it should be noted that the processes used in onset detection and feature matching would need improvement to be used in analysis of a complete sonic text. The prohibitive aspect of undertaking this analysis is that `bonk~` needs to be trained to identify percussive elements as

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[63] Using Miller Puckette and Ted Apel's `bonk~` object for Max/MSP from http://crca.ucsd.edu/~tapel/software.html

[64] The `bonk~` object is a Max/MSP external that can used to extract percussive information through percussive onset detection and feature matching.

[65] A Max/MSP program generates a probabilistically driven beat; the resultant audio signal is then analysed, and percussive information is extracted. The extracted information is then used to build a probabilistic model of event occurrence.

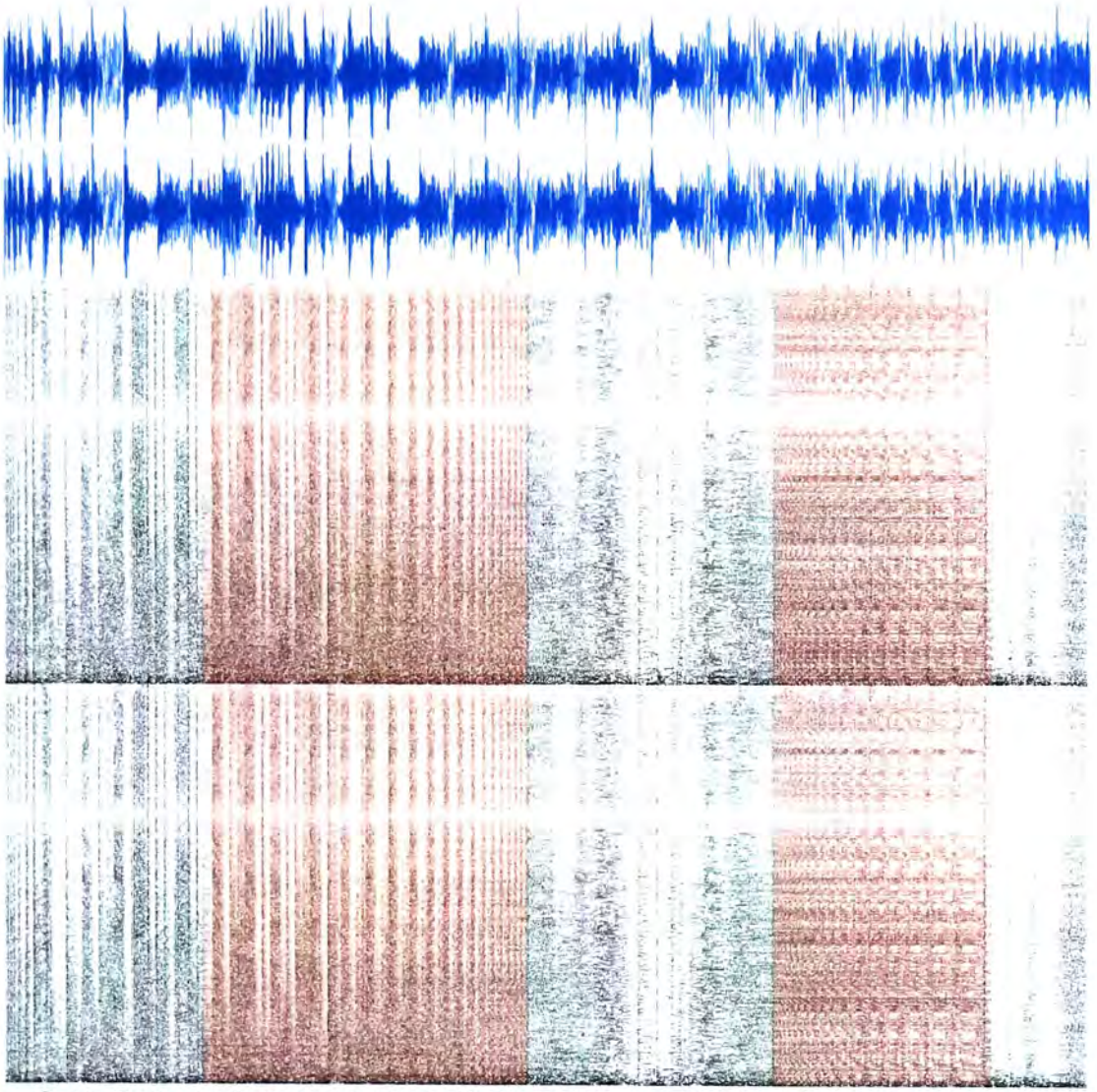
one type or another. Exposure to recurrences of the same percussive element is necessary, such that a bank of identifiable possible sounds can be constructed. Autechre's filter effects change the sound of elements enough to inhibit effective categorisation by the `bonk~` object.

Analysis of *Gantz Graf (Gantz Graf)* – Model 6

Discussing *Gantz Graf* in its entirety, is a lengthy task. The track is a multilayered and sonically forbiddingly complex piece consisting of a generatively varying drum pattern behind shifting granular tones in the foreground. Synthetic tones and granular reconstructions of pitches timbrally similar to bowed strings are layered above this foundation in certain parts of the track.

Although the track seems fairly straightforward in its structure, the forbidding complexity arrives from the nature of the timbral changes and *micro-temporal* fluctuations on and beneath the *sound object* level. A scoring of musical material on the *meso* level (as strings of *sound objects*) alone would disregard the essence of what makes this track unique. Furthermore, textual discussion of the track is a complex task, as its main feature is process-driven timbral modification with inhibited elements of percussion and melody in the background. In addition, providing a score of these sub-elements in the *Gantz Graf* arrangement is yet again another complex task. The optimal solution would be a mix of event and process mapping. This would involve mapping *sound object* onsets alongside the process they subject to, such as retriggers or effect changes; in this case, processes encompass granular looping and concatenation of grains with constricting and expanding widths. This too, however, would be prohibitively laborious. Hence, I will employ instead a theoretical discussion of the nature of the track and discuss practical examples that employ the concepts outlined.

To achieve this, the aspect of *Grantz Graf* that will be isolated and discussed is the use of granular concatenation to build both percussive and melodic tones, as opposed to a discussion of the track as a whole. These concatenated granular elements are most notable in sections such as from 1:00 to 1:09 (the highlighted segments in the below image) and from 2:00 onwards with reference to melodic and pitch-based granular elements.



Gantz Graf *waveform and spectrum (0:54–1:10) displaying dynamic granular retriggering*

The track commences with a pattern of identifiable synthesised percussive objects, such as kick, hat and snare elements, arranged in interlocking intra-note repetition. Early in the track (from 0:20 to 1:00) are pitched elements that punctuate the beginning of a cycle. As these pitched elements are introduced, the cycle becomes more obviously defined and regular, with a slight variance of rolls and repetitions and *sound object* placement across each measure. A growing reverb effect is present on the pitched element opening each cycle, expanding in both decay time and stereo spectrum. In addition to the moderately clear sense of rhythmic texture and beat, the track is populated with rich FM noise tones, with sidebands at equal intervals apart, as seen in individual notes on the spectrogram above. Futhermore, individual percussive elements are constantly being altered both within and across measures.

From 1:00 to 1:09 (highlighted in the above graphic), the notion of this granular

manipulation is easily identifiable and noticeable. In the first highlighted section, an event is retriggered with constricting time intervals between each recurrence, as shown by the spectrogram. The reverse is seen in the second highlighted section, where the pitch peaks, followed by expanding grains of sounds retriggered at slower intervals. These retriggered events span a range from about 3 times per second to about 500 times. In this example, the retriggering begins at *sound object* level (ie. roughly 3 times per second) and is linearly constricted to recurrences at a *micro-temporal* level. This notion is graphed below, occurring over 10 seconds.

Graph of times between grain retriggerings in Gantz Graf *(1:00–1:09)*

The constricting and expanding grain widths simulate pitch sweeps as they cross the *sound object* and *micro* levels. A simple example of granular-based melodic content is exhibited later in the track, from 2:45–3:15. In contrast to the nature of the sounds earlier in the track, the sound of the pitched tones displays elements of pitched source material, as opposed to the percussive source material used before. The granular repetition of this pitched content generates tones that contain timbral similarities to strings or piano; however, the recognisable essence of the source material (ie. the attack and decay) is removed, due to the nature of the repeated sound grains. This repetition of the sounds' body suggests infinite decay or spectral stasis.

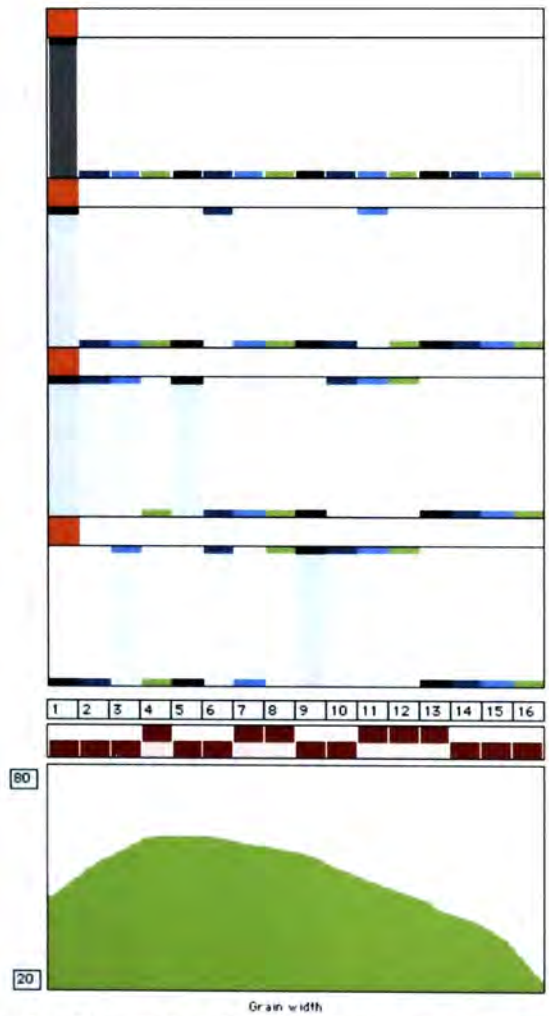
Further examples of granular manipulation are discussed below.

Analysis of *V-Proc (Draft 7.30)* – Model 7

The complexity and detail in this track precludes listening-based analysis. *V-Proc* demonstrates a comparable level of granular modification to *Gantz Graf* on certain percussive elements; however, it extends the notion of complex sound construction

to areas such as *micro-temporal* filter control and amplitude modulation on stuttered sounds. The opening section of *V-Proc* features heavy structural and timbral manipulation of sounds. The arrangement may be transcribed, as shown below; however elements of the opening sequence, such as filter levels and equalisation modifications, resist this method of annotation due to their constant modulation and subtle application.

From 1:24 onward, acoustic-sounding percussive elements are introduced, forming a kick, hat and snare pattern that carries both the granular stuttering audio modification process in the foreground, and the tonal swells in the background. The most important feature of this track is the combination of events and the processes to which they are subjected. The following image shows an example of a scoreable model of events and processes.



An example of how a bar of V-Proc*'s intro could be represented*

Layers 1, 2, 3 and 4 represent the occurrences of individual percussive events across four layers. These layers represent kick, snare, hat and an additional percussive texture element. Layers 5 and 6, however, present a graphical notion of what was described in the previous model as a process mapping[66]. In this case, these images represent an evolving set of control switches. Currently, beats 4, 7, 8, 11, 12 and 13 are to be subjected to a process. This process is a quantifiable set of retrigger times, displayed and controlled by a hand-drawn curve shown as time values ranging from 20ms to 80ms. These process maps are set to drive the event mapping of Layer 4.

The not-easily-quantifiable data present in this track, such as filter control, introduces the concept of control data as data abstracted from another set of control parameters. This concept constitutes a recurring feature in Autechre's work, and is outlined in further detail in the following model.

Analysis of *Reniform Puls (Draft 7.30)* – Model 8

Reniform Puls, the final track on *Draft 7.30* is a lengthy piece featuring a simple chordal progression as backing to an evolving arrangement of melodic patterns and generative drum patterns. The most notable feature of the drum track is its non-repeating nature, which evolves over the course of the track from a straightforward kick and snare pattern into a rapid succession of note rolls and frenetic patterns. Scoring or inducing a *meso* length generative framework around musical elements such as these is a complex task, as the essence of a generative process is not always visible in its structural output. Recreating this essence of generatively varying output is, however, quite an easy task to undertake. The following image, although not as complex as the types of methods used by Autechre, shows a probabilistically-driven generative structure that can drive three individual percussive elements.

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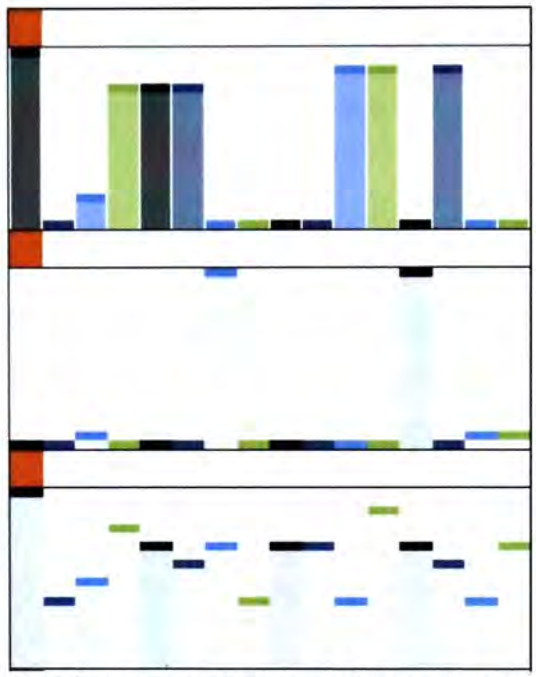
[66] This notion of event and process mapping will be highlighted and demonstrated in Chapter 5, with reference to process-altered sequences and granular manipulation of elements used in original works.



A probability driven kick/hat/snare pattern used for creating a varying drum pattern

Represented as values on a slider, each note's occurrence is determined by a probability value ranging from 0 to 10, where 0 implies that the event shall never occur and 10 implies that it should always occur. Values in between determine the frequency of the event occurring.

Whilst the above diagram represents a controlled, probabilistically-driven sequence, it seems that much of Autechre's work is generated through conditional means, where the current state of the system defines how the next stages of events change. Booth illustrates his view on and approach to generative composition:

> *Paul Tingen: Perhaps the most challenging and potentially controversial aspect of Autechre's music is their use of generative sequences.* Confield *contains more of these than their other works, though they also feature on their latest release,* Draft 7:30. *Insofar as these sequences involve drum machine sounds they are sometimes referred to as 'random beats'. The adjective clearly sits uneasily with Booth, who is at pains to point out that the beats are far from random.*
>
> *Sean Booth: "There's a lot of maths and generated beats on* Confield, *but we never considered that album very difficult," asserts Booth. "It's like pop music compared to some of the stuff we had considered putting out! And even when the beats sound like they are moving around in time and space, they're not random. They're based on sets of rules and we have a good handle on them.* Draft [7.30] *is really straight, using straight-up normal sequencers and samplers. It's written note by note, where we know exactly what we put on. Only* Reniform Puls' *has some generative stuff, done by Max, which also controls a vocal filter in that track. When we do generative stuff we work with*

> *real-time manipulation of MIDI faders that determines what the rhythms sound like. A sequencer is spitting out stuff and we're using our ears and the faders to make the music. There's no event generation taking place other than within the system we've designed."* (Tingen, 2004:np)

Although it is unclear whether this *conditional* mode of generative processing is operative on *Reniform Puls*, Booth here indicates the level of control and data mapping characteristic of Autechre's work as opposed to chaotic or random sequences. The use of abstracted control data, such as the use of envelope-following to control playback position within a sample, or another form of data controlling a vocal filter, helps to identify the types and level of detail used within certain tracks. Whilst it cannot be accurately measured from purely a listening standpoint, it does help in focussing on and reproducing the Autechre aesthetic of attention to detail and evolution.

Analysis of *Augmatic Disport (Untilted)* – Model 9

Sharing similarities to other works such as *V-Proc* and *Gantz Graf*, *Augmatic Disport* exhibits granular repetition within *sound objects*. The difference with this example, on a granular processing level, is what seems to be the combination of sequenced events on a *micro* level with shifting audio manipulation, such as moving loop points within looped segments of sounds or individual percussive samples. This is opposed to the static granular forms of audio cutting and repetition present in other tracks.

The first half of *Augmatic Disport* comprises a layered composition of percussive metronomic repetition, combined with elements of synthesised tones and washes of excited spectral data demarcating phrases. The frontal mix of percussive manipulation (distinct from the use of pitched sound in the background) exhibits a moving melodic essence, achieved through minute alterations in loop retrigger time and subtle pitch variations of the percussive source. The track features an evolving percussive structure, typifying Autechre's focussed approach on rhythm and metamorphosis on *Untilted* as a whole. Although the track is multilayered, with regard to percussive content, melodic washes and tonal stains, the lead element of the track is the singular, processed drum line. This is of particular note as the drum line in *Augmatic Disport* is essentially (though, not strictly) monophonic, as each element (or group of elements) is singled out and manipulated. The shift of this role from accompaniment to lead instrument fulfills both a time-keeping, rhythmic essence, and a frontal lead feature role.

The latter half of the track, demonstrates a slow moving metamorphosis of rhythm and texture, as the granular manipulation moves from the fore to a regular motif. This accompanies a simple sequenced beat, lightly distorted tuned sub-bass elements, and a spatially dynamic synth-based progression.

Analysis of *Pro Radii (Untilted)* – Model 10

Although *Pro Radii* does not typify Autechre's 'sound', as a whole, it encapsulates their compositional and structural approaches well. In contrast to their bright and spectrally rich tracks, *Pro Radii* begins with a low-end dominated track intro.

The first two minutes are built primarily from reverb-smothered percussive elements, low-end tonal sweeps, and ambient crowd noises that are cut up and arranged into a stuttering mix of sound and space. From 2:00 onwards, the track builds a rigidly structured sequence that sits atop slow-moving synthetic swept pitches. An interesting feature of this section is that there seems to be an abstracted layer of *process* from *event* on certain elements[67]. Although there is a sense of rhythmic structure on the *sound object* level, there are per-note processes that create intra-events in and amongst the rhythmic meta-structure. Particular elements which can be isolated are the delayed half-beat (and half-velocity) notes echoing each snare hit, as well as the comb filter effect that emerges at 2:19, adding a series of new delayed events on the kick at a *micro-temporal* level.

This track takes notable steps in structural pattern and timbral change as it evolves (such as at 3:32 and 4:06); however, the intra-events between *sound objects* continue to manifest in sections such as that from 5:48 onward, where pitched events seem to trail certain percussive events. The pitch insinuated here is the result of the time between each event retriggering, where clusters of closely packed events generate higher pitched trails compared to sparsely packed events. From 6:58 onwards, as the track draws to a close, intra-note events become moderately sparse (notable sections are at 7:25, 7:31, 7:38).

Whether these effects are created through some kind of delay-based audio process

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[67] This concept of process as event is discussed later with regard to sequencing complex works by sequencing *processes* or *event-types*, in place of sequencing singular events.

or through the generation of further events is unknown; nonetheless, the following chapter will introduce practical examples that use this system of per-note abstracted event processes.

The main elements highlighted in the following chapter will be the basis for creating musical material in the style of Autechre. Although the analyses of selected tracks do not encompass all of Autechre's style or the complete range of compositional approaches within each track, the key features and induced compositional methods are now examined and extrapolated.

Chapter 5: Applying Key Concepts to New Works

Extrapolating Autechre's Compositional Approaches

Practical examples illustrating chosen recurring concepts and compositional approaches in Autechre's work have been created as Part 2 of this thesis to serve two purposes. Firstly, to provide a sonic illustration to a verbal and metaphoric description; and secondly, to highlight particular uses of expanded, computer-aided creative practices that bridge the gap between composer, performer and director. To illustrate the myriad recurring concepts in Autechre's works discussed in previous chapters, the author has created custom-made performance and compositional patches using Max/MSP to realise these creative works. This chapter discusses computer-aided compositional approaches and sound design methods with reference to the supplementary recorded works.

A list of the concepts explored in my use of Max/MSP for this thesis includes:

1. Using generative and pattern-based routines to produce content based on previous occurrences.
2. The creation of a multi-layered routine-based sequencer matrix, allowing creation of live sequencing of patterns/routines, as opposed to *sound objects* alone.
3. Inter-pattern beat changers, or pattern restarters.
4. Oscillator-based percussive events using simple and more complex forms of additive, noise- and AM/FM-based sound generation.
5. Probabilistically-weighted events to generate non-recurring data, as well as probabilistically-weighted routines to modify the resulting events.
6. Use of an external master clock in Cubase, via the Rewire protocol to drive Max/MSP generated events according to complex time signatures and dynamic tempi.
7. 2D lookup/breakpoint functions to 'swing' the master clock's metronome.
8. Loop based audio cutting for re-sequencing on a *sound object* level, as well as granular synthesis on a *micro* level.
9. Pattern-based control for manipulating control change data or effects parameters, based on 'particle' movement in 2D space.
10. Scoreable methods for sequencing granular elements of sounds.
11. The use of percussive and pitch based listening tools to extract 'essences of shape' from Autechre tracks.
12. Phase vocoder and spectral modification tools.
13. The use of interpolated presets and evolving structures of percussive patterns.

Prior to the composition of these works, the author posed the following questions:

1. Will the recreation of elements (illustrating *sound object* and *meso* scale similarities) suggest similarity on a higher level (overall track direction and form/shape)?
2. If there are noticeable differences between the original compositions for this thesis and the selected Autechre tracks for analysis, how can they be reconciled?
3. If the recreation of key elements in selected Autechre tracks does not satisfy the above questions, then do any differences suggest that the methodology for analysis is incomplete? If so, how could it be improved?

These questions will be reflected upon in the Conclusion.

A Discussion of the Compositional Techniques Used

The following discussion of compositional concepts is a closer look at some of the patches created for this thesis. A discussion of these approaches and processes will provide a framework from which to consider and reflect upon the audio component of this thesis, as well as an illustration of the compositional intent that informs the creation of a musical work of this style.[68]

Although my original intention was to include the Max/MSP patches used in the composition of the creative component as a data portion on the attached disc, allowing the reader to explore the compositional approaches, it was later discarded for two main reasons. Firstly, this is the first 'written work' by the author in Max/MSP, and portions of the patches are not as clearly written as they could be. Secondly, the patches themselves rely on many external factors to run optimally, such as requiring external clock and time signature information from Cubase (or another external sequencer). Other required components include sound generating content, such as

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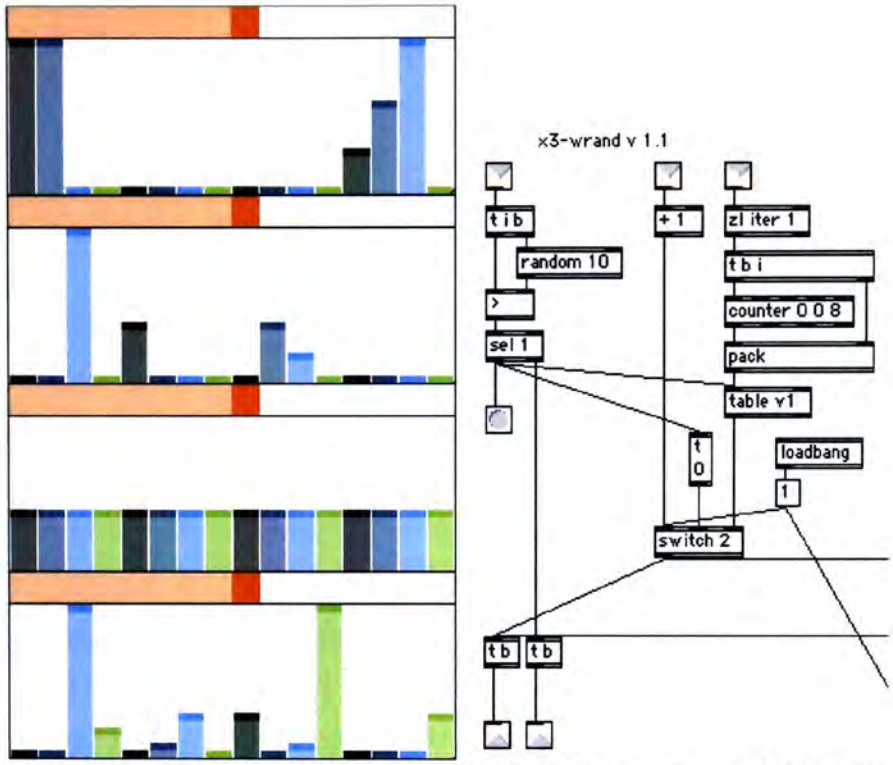
[68] During the process of writing this thesis, a number of presentations were made to groups of various people associated with music creation, music theory and popular music analysis ranging from undergraduate to postgraduate to academic areas. One critique that was constantly brought up from people was that Autechre's musical approach was 'not new' and neither was my research approach. Despite the fact that these two points were never insinuated by the author during presentations (nor hopefully anywhere else!), in the author's opinion these comments seemed to come from people that were not from this area of musical interest (ie. electronic music or software-based musical composition), but rather people who latched onto keywords that I attempted to keep to a minimum, such as 'random' (when talking about probabilistically driven concepts). The likening of this work to John Cage's approaches is, in the author's opinion, tenuous. The same opinion seems to be shared by Booth in defense of his own work: "For start, the word 'random' - it takes the shit right out of me. There's absolutely nothing random about what we do. There might be a lot of number crunching going on but there's nothing random in there." (Reynolds, 2001:np)

audio samples, external hardware and software such as synthesisers and virtual instruments, and external Max/MSP objects that are only commercially available, that can therefore not be distributed by the end user.

In place of the patches not being included for the reader, portions of the main graphical interface of the patches are shown. The mechanics of the patch, however, are not shown, as they are described verbally so that the processes are understandable by readers who are not familiar with Max/MSP. All abstractions and compositional tools built by the author with Max/MSP are prepended with the '`x3-`' prefix, denoting that they are portions of a custom-built collection of compositional tools.

Probabilistic (and Generative) Drum Patterns

The *x3-perc-gen* patch, portions of which are shown below, is a four-part percussion-generating patch that generates percussive events based on the probability of a positive result occurring. On the horizontal axis, the coloured bars represent an element's position within a 4-beat (or 16th note quantised) framework, with the orange bars representing current position within the bar. On the vertical axis of each of the four `multisliders`, the likelihood of an occurrence is represented as a value *n/10*, where a value of *10* generates the probability of *1* (a percussive event *always* occurs at that instant) and a value of *0* generates a probability of *0* (an event *never* occurs at that instant). Variable values in between dictate the likelihood of occurrence at that point. As an example, if we regard the four parts as kick, snare, hat1 and hat2 (in descending order), beat 1 will always contain a kick, and hat1 four times out of ten. Beat 3, or the ninth 16th note (where the current playhead is positioned) will not have a kick or a snare, but *will* generate hat1 and hat2 sounds 40% and 30% of the time respectively.



x3-perc-gen four-part percussion interface and the x3-wrand-v1.1 subpatch

The patch itself works by polling the values of all four `multislider` objects at regular intervals. Four separate random numbers (ranging from 0 to 9) are generated at each interval and then tested against the four `multislider` bars at that point. If the generated random number is *less than* the value of the slider at that point, then a positive event is triggered, causing the weighted randomness subpatch (*x3-wrand-v1.1*) to generate signal output.

The significance of this approach is that while there will be subtle changes between bars, there will still be a strong recurring theme throughout the composition. Four separate examples of MIDI output generated by the *x3-perc-gen* patch are shown below.

Four bars of probabilistically generated content using a single probability structure

All four bars of the above content super-imposed on one another to highlight the different content between bars, as well as to demonstrate the prominence of occurrence as opacity of events over a sample of four measures

Procedural/Subroutine-based Event Types

As a means of scoring complex sequences of events, as well as creating intricate sequenced material in a performance environment, the use of subroutine-based event types (such as note-rolls, half-beat delays and other events that occur beneath the resolution of the *x3-perc-gen* user interface) allows the user to specify types of event *behaviours* as an abstracted layer from the *sound object* level user interface.

The types of events that can be generated are based on a range of event patterns present in Autechre's tracks. These include note divisions and retriggers ranging from two retriggers per note, to five retriggers per note, as well as half-beat delays and time-varying retrigger times to simulate subtle 'bounce' effects, or constricting repetitions in the time domain.

This subroutine-based event generator (*x3-geneventtype*) is realised in two separate ways. One, like *x3-perc-gen*, is based on probabilistic occurrences; the other uses a scoreable method. The latter will be discussed with reference to the matrix-sequencer later.

Differentiated from the generation of *event* occurrences in *x3-perc-gen*, event-*types* are determined through a probability distribution table, where the values of all sliders are summed then divided into frequency distribution quantiles.

Event-type probability distribution table

The above image shows a lookup table that determines *event-types*. As opposed to the horizontal axis denoting placement within a measure, it represents nine different event-types, with the following values:

1. Column 1: Single note
2. Column 2: Double note roll
3. Column 3: Triple note roll
4. Column 4: Quadruple note roll
5. Column 5: Quintuple note roll
6. Column 6: Variable speed re-trigger delay
7. Column 7: 1/32nd measure delay
8. Column 8: Linear time-grain constriction
9. Column 9: Recursive division delay

There is a lookup table for each percussive voice, allowing the user to control the event-types for each voice type. As an example, the amount of note rolls can be controlled, allowing the kick and the hat1 part to play more note rolls than the snare and hat2 parts).

Original output (not textured by x3-geneventtype*)*

Event-type generated output

More complex event population

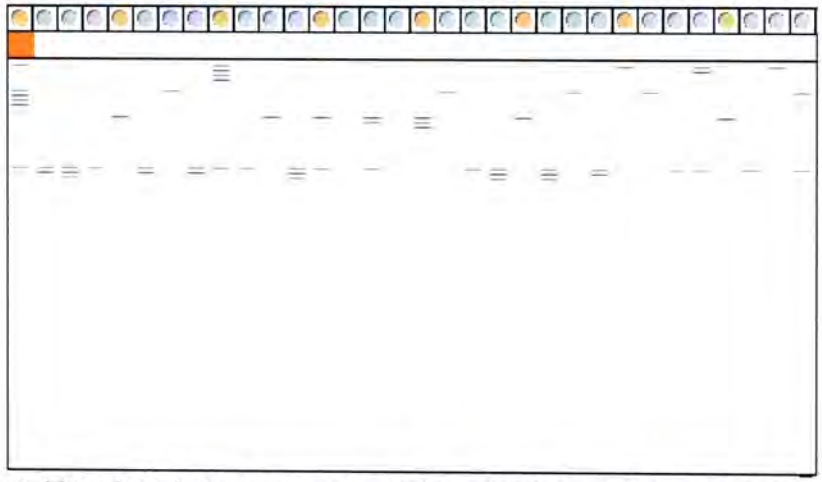
The above images show the difference between *x3-perc-gen*'s simple output (image 1) and the output generated by *x3-perc-gen*'s event-type-generator module (images 2 and 3). More events occur in the second and third images, where different settings were used to populate the measure. *Sub-sound-object* level events can be seen

where events are densely packed, and note-level accelerandi can be seen where notes condense into clusters.

The routines that populate the *x3-geneventtype* module have been tailored to mirror certain elements in many Autechre tracks, including tempo synchronous division and dynamic note division/retriggering.

Multi-layered Sequencer Matrix

A custom sequencer was created in Max/MSP to graphically arrange percussive events across a measure, similar to a *key editor* or *step sequencer* in many hardware and software sequencers where the horizontal axis represents temporal placement and the vertical axis represents voice. This sequencer, however, offers an additional level of control over and above note level processes. Building on *x3-geneventtype*, the sequencer matrix offers not only control/placement of events within the bar, but also allows the user to specify the *type* of event at a point. Hence the sequencer is multi-layered, and can be regarded as a three dimensional grid from a top down view, allowing *processes* to be sequenced instead of *events* alone.

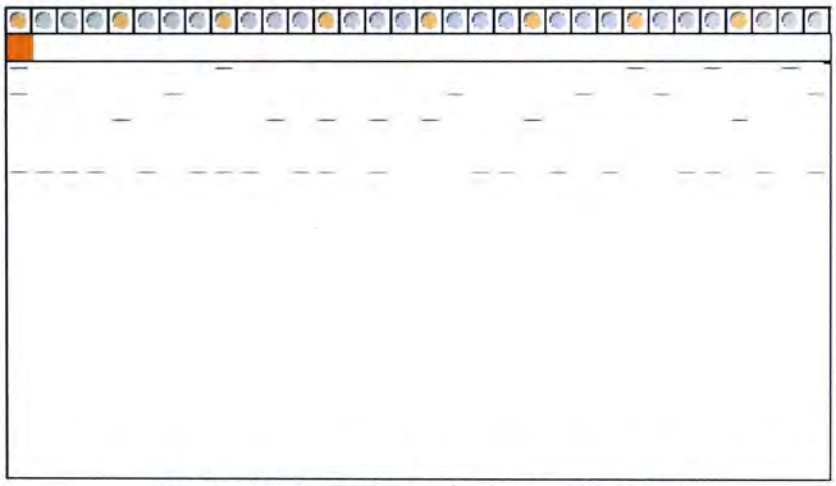


Procedure driven loop-based sequencer matrix, showing event-types being sequenced

The above image demonstrates the use of *event-types* in the sequencer's matrix, representing a series of complex events as single events. As an example, the snare part on beat 1 triggers a quadruple roll, and the hat2 part shows a double and triple note roll on quarter-notes 2 and 3 respectively. This output is rendered below in Cubase's Drum Editor.

An example of two measures of the sequencer matrix's output

The power of sequencing event-types is highlighted when the above matrix is contrasted with the below image, which shows single events being sequenced using the same structural pattern.



The matrix sequencer with single note output

An example of ordinary sequencer output (using the same score as above)

The sequencer is built using a matrix object with cells capable of representing 10 values, thus allowing a range of options, instead of simply event on/off. The sequencer operates by polling each vertical column at regular intervals for *event-types*, then routing those messages through an *event-type* generator.

The ten possible values available (ranging from off, to single event, to various complex events)

These ten values correspond to the nine event-types listed previously, and include a 0 or note off value.

Pattern Restarting

The matrix sequencer offers yet another level of control over playback; independent start point control. This allows sequences to restart or change start position within a measure. As the playback point increments at a fixed tempo, a lookup table that can operate at an independent tempo, controls the location from which the playhead begins. This allows the use of microstructures and exploration of sub-patterns within a measure.

The effect produced by this is constant variance, or convoluted rhythm. Stressed beats within a bar can thus be altered. Booth describes this technique as follows:

> *On* Confield *we also used analogue sequencers and drum machines, because you can do a lot with restarting patterns. You can hack things and maybe use a control volume to determine what step the drum machine is playing from. Perhaps you send that control volume from an analogue sequencer, so the drum machine is skipping around. And then you get another analogue sequencer to drive that analogue sequencer with a different timing. Immediately you have something that some people would call random, but I would say is quantifiable.* (Tingen, 2004:np)

Similar to Booth's description of abstracted control over sequences (or meta-control of patterns), independent step speed control can also be exercised over the incrementing sequencer at various timing settings.

Simple Synth-based Percussion

In addition to using hardware devices as sound generators, a series of simple synth-based percussion and melody generators were created for real-time sequencing. For percussion and drum based sounds, various forms of synthesis were used to create a variety of timbres. Each sound was shaped with a short-timed envelope to match a similar trend in Autechre's work for brief transient sounds.

The drum based percussion elements consisted of:

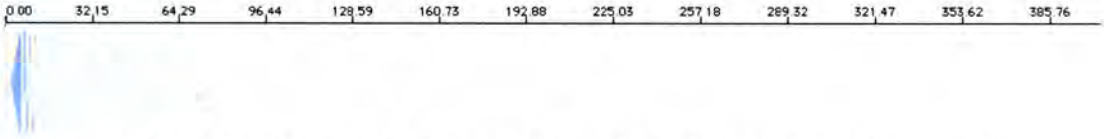
1. Wavetable-based kicks and snares, for the purpose of resonant and low-frequency dynamic pitched sounds.
2. FM-based snares and hats, to create spectrally rich and dynamic harmonic and inharmonic tones.
3. Noise based hats to create wide-spectrum inharmonic sound.
4. Impulse-based clicks to create instantaneous timbrally rich events.

In addition, FM, AM, and additive tones were used for simple melodies and pitched percussion for non-spectrally rich tones.

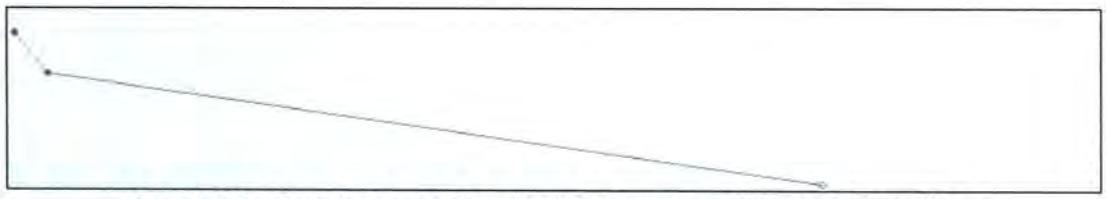
In contrast to the more sophisticated FM-based synthetic tones that are produced with 4 or 6 operators, simple tones and noises can be generated with 2 operators. Methods discussed in the Max/MSP manual[69] (Dobrian et al., 2006:114), based on concepts discussed in Chowning's article *Synthesis of Complex Audio Spectra by Means of Frequency Modulation* (1973) and in Roads' *Computer Music Tutorial* (1996) concerning relationships of carrier frequencies and modulator frequencies [Fc/Fm]; and modulator amplitudes and modulator frequencies [Am/Fm], illustrate the power of simple FM synthesis by manipulating these two ratios to alter brightness and harmonic/inharmonic character. These simple approaches work well for transient percussive effects, such as deadening the wide-spectrum resonance of a sound by decaying the modulator amplitude envelope.

Synthesising Sounds With Wavetable-based Lookup

Percussive tones were generated by modulating the frequency of a `phasor~` (a ramping sawtooth) wave to drive a lookup table for simple, sine tones to produce a frequency modulated tone.



A sine-based tone, with frequency driven by a changing `phasor~` wave

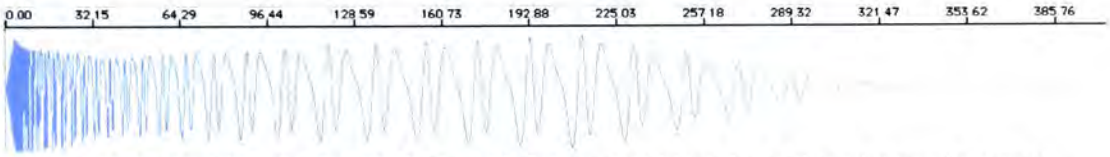


A modulator envelope, used to alter the frequency of the lookup oscillator

This generates a fairly straightforward tonal structure, suggestive of a simple resonant percussive tone. In the following example, other methods of lookup were used, such as driving the lookup function with a `cycle~` cosine wave to produce a

[69] MSP46TutorialsAndTopics.pdf documentation included with the Max/MSP software

more complex spectrum, creating a rough, noisier synth-kick sound. This synthesis technique is known as phase modulation, and produces a result similar to frequency modulation.



A more complex sine-based tone, with frequency driven by a changing cosine wave

As the modulator envelope alters the tonal decay of the sound, an amplitude envelope shapes the attack and temporal decay of the sound shown below.

Amplitude envelope performing overall loudness scaling function for a percussive event

Frequency Modulated Percussive Events

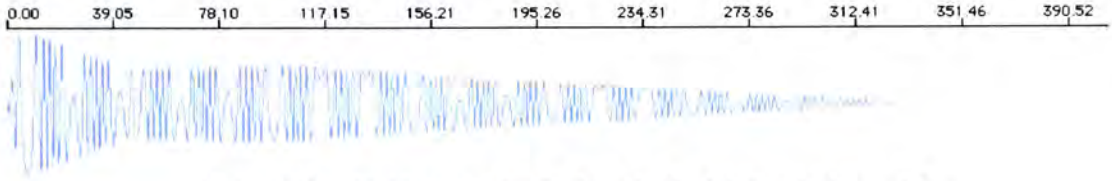
Below are some examples of synthesised percussive sounds created using a simple implementation of frequency modulation using two oscillators. Some fundamentals of synthesis using two oscillators are described in Roads' *Computer Music Tutorial* (1996) and in the Max/MSP manuals, cited below:

> *One important value is the harmonicity ratio, defined as Fm/Fc (modulator frequency/carrier frequency); this will determine what frequencies are present in the output tone, and whether the frequencies have a harmonic or inharmonic tone. The second important value is modulation index, defined as Am/Fm (modulator amplitude/modulator frequency); this value affects the "brightness" of the timbre by affecting the relative strength of the partials. The number and strength of sidebands present is determined by the modulation index; the greater the index, the greater the number of sidebands of significant energy.* (Dobrian et al., 2006:114)

In essence, there are two important factors in determining the nature of the sound, over and above the fundamental frequency. Firstly, the Harmonicity Ratio, which adds frequency sidebands to the fundamental pitch, creating a richer sound with more partials, and harmonic and inharmonic overtones depending on whether the ratio is integer or non-integer. Secondly, the Modulation Index, which determines brightness by controlling the loudness/strength of the sidebands.

Below are some examples of percussive sounds generated with different FM

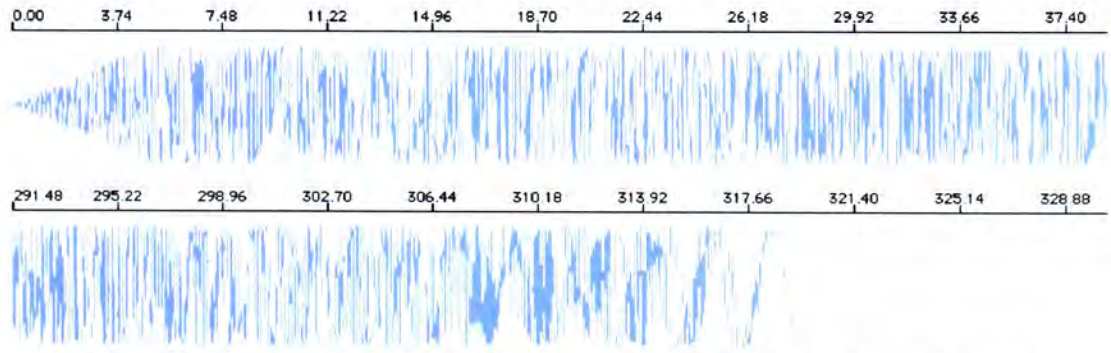
settings.



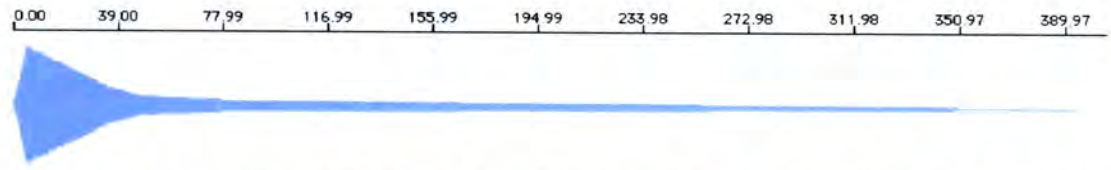
Kick – 9Hz with Harmonicity Ratio = 3, Modulation Index = 17

Snare – 500Hz with Harmonicity Ratio = 197, Modulation Index ramping from 10 to 0 over the course of the sound

Although the above image of the snare displays more of the amplitude envelope than the actual activity of the waveform, the images below display the waveform activity early in the sound contrasted with the waveform late in the sound. As the Modulation Index value decreases, note the reduction in waveform jitter, ie. less microfluctations until the point of pure tone.



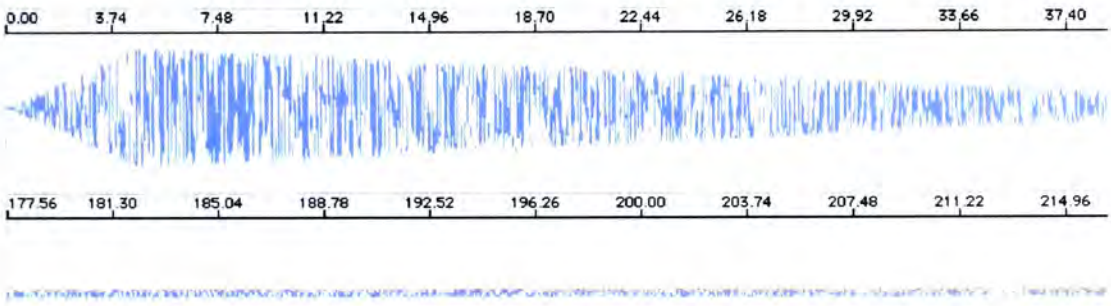
A more detailed view of the above snare sound, without amplitude envelope change



Hat – 2500Hz with Harmonicity Ratio = 396, Modulation Index ramping from 10 to 5 over the course of the sound

Like the snare, the synthesised hat sound shows much activity early on in the sample; however, instead of the noisiness decaying into a simpler resonating tone (as with the snare hit, simulating a percussive attack that decays to a simpler tonal

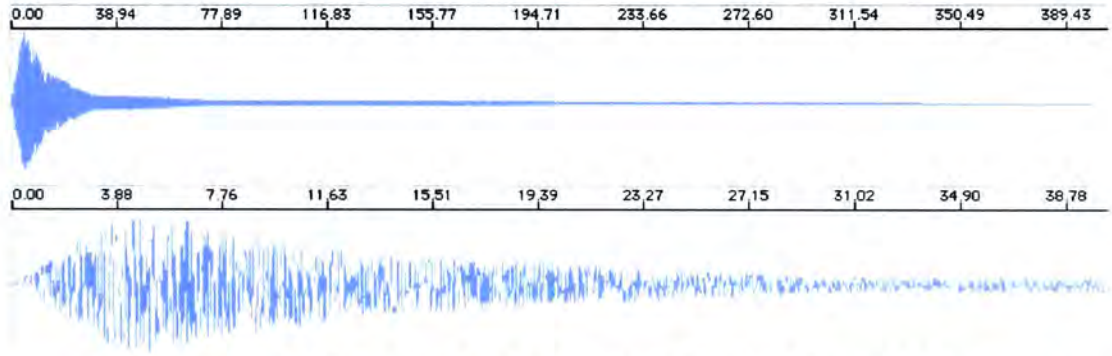
resonance), the hat sound retains a high Modulation Index value, effectively sustaining the brightness of the hit. This simulates the spectral roll-off of a hat, but ceases before the point of the emergence of a singular tone.



A more detailed view of the above hat sound

The high value of the Harmonicity Ratio creates a spectrally rich sound with a large number of partials.

Shaping a stream of white noise with an amplitude envelope creates a simple example of a hat element. The result is much like the hat FM example above, that is, a brief excerpt of sound with a wide range of partials present.



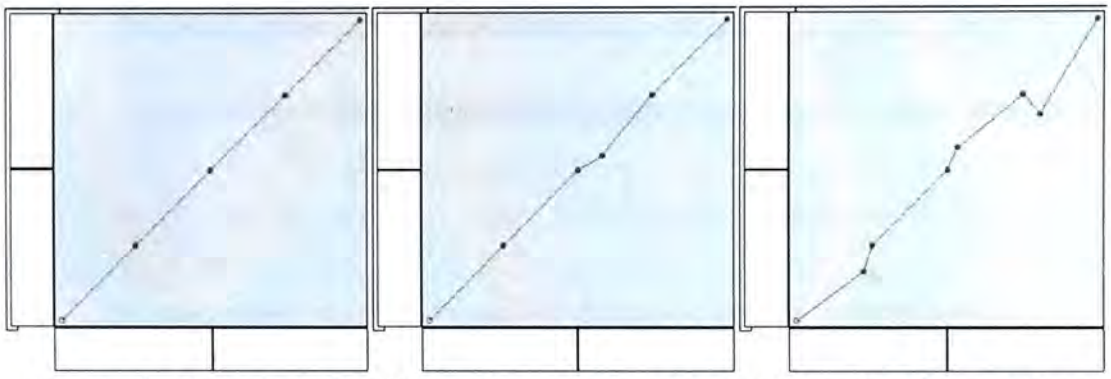
Shaping a stream of white noise with an amplitude envelope to create a hat sound

Using Cubase's Clock and Swung Time

In addition to using Cubase as a means to recapture and process MIDI events coming from Max/MSP, Cubase's clock is used by Max/MSP to control playback speed and time signature changes of patterns through the use of the ReWire protocol to send transport control and MIDI and audio events between applications. This is useful as a way to organise structural change, such as tempo change or

switching to a new beat count, if a track needs multiple passes to record MIDI events or audio events in the compositional phase.

While this has a practical purpose in maintaining synchronisation across multiple recording takes, the playhead information (tracking position within a bar) can be manipulated or sculpted using a lookup table in Max/MSP. This allows for control of otherwise straightforward incremental playback. A range of timing changes within a bar can be effected, from simple 'humanisation' effects such as reducing the regularity of the beat, to more dramatic swing functions. Extreme values can be used to make the playhead in Max/MSP behave erratically.



An example of 3 lookup tables to sway the rhythmic meter, from linear, to subtle quarter-bar or beat alteration, to dramatic swing and retrigger.

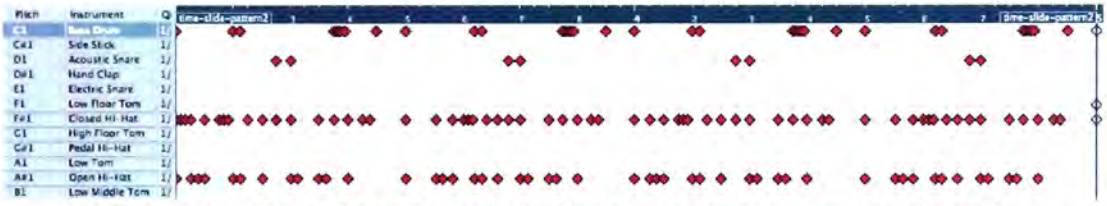
The left slider constantly increments and triggers 16th note events, as there are 4 separate notes triggered between points, based on the settings on the breakpoint slider. The range of the left slider is sent to the domain of the bottom slider based on the points and gradients in the lookup table, changing the rhythm from linear to function-based. A point *below* the gradient of the 4 points causes a lag followed by a speed-up over that beat (shown in the second lookup table), and a point *above* causes a speed-up followed by a lag over that beat (shown between beats 3 and 4 of the third lookup table).

The simple modification of the lookup table effectively allows alteration of tempo linearity. When slider values are pushed outside their respective ranges, they produce re-triggerings (or pre-triggerings) of previous or future events (shown in beat 4 of the third lookup table) by causing the playhead to scrub backward and forward, resulting in elements from beat 3 replaying in quick succession.

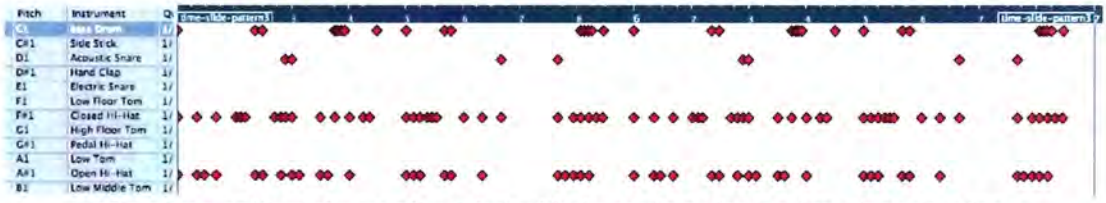
The following images show the effect of the time-swinging lookup table on two 8-beat

bars of the same sequenced material (using the 3 lookup tables shown above).

A pattern with a regular pulse, and no temporal alteration



The same pattern shown above but with a lag and speed up at bars 2 and 4



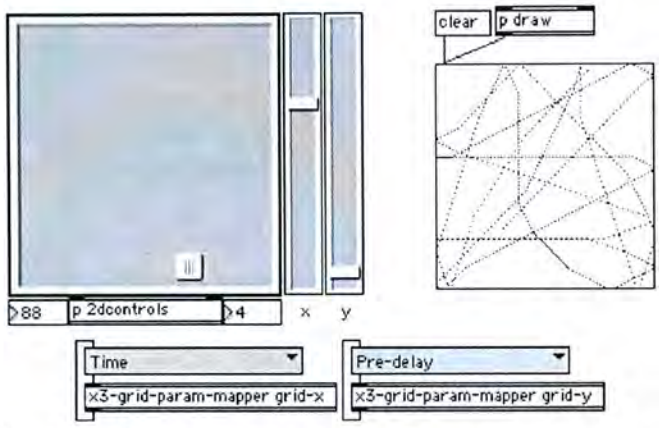
The same pattern shown above but with dramatic swing and re-trigger settings

Altough the effect may be unclear from a graphical perspective, the irregularity of the pattern in audio form as it is played with subtly modulating tempi is quite noticeable. Despite the subtle visual difference of the above sequences, the effect of sparse and dense clusters of events can be seen when individual percussive events are isolated and matched against the same section of another part. Examples of this are identifiable when looking at elements such as the shifting of the kick events in the first 4 beats in patterns 1 and 3, the placement of the snare in patterns 2 and 3, and the closed hi-hat pattern in patterns 1 and 2 etc.

Pattern-Based and Generative Control Change

In addition to altering timing, several modules have been created to produce constantly varying control changes, such as a 2D controller, shown below. As well as offering manual control over pairs of parameters such as VST plugin parameters, the 2D system can be put into motion, compelling the *control point* to bounce within the confines of the object, as different 'gravitational' effects act upon it. The effect produced is continuous control change at a user defined rate, based on pattern settings. The patch and speed at which the *control point* has moved can be mapped,

as shown on the right side of the image below to illustrate a history of parameter output settings.

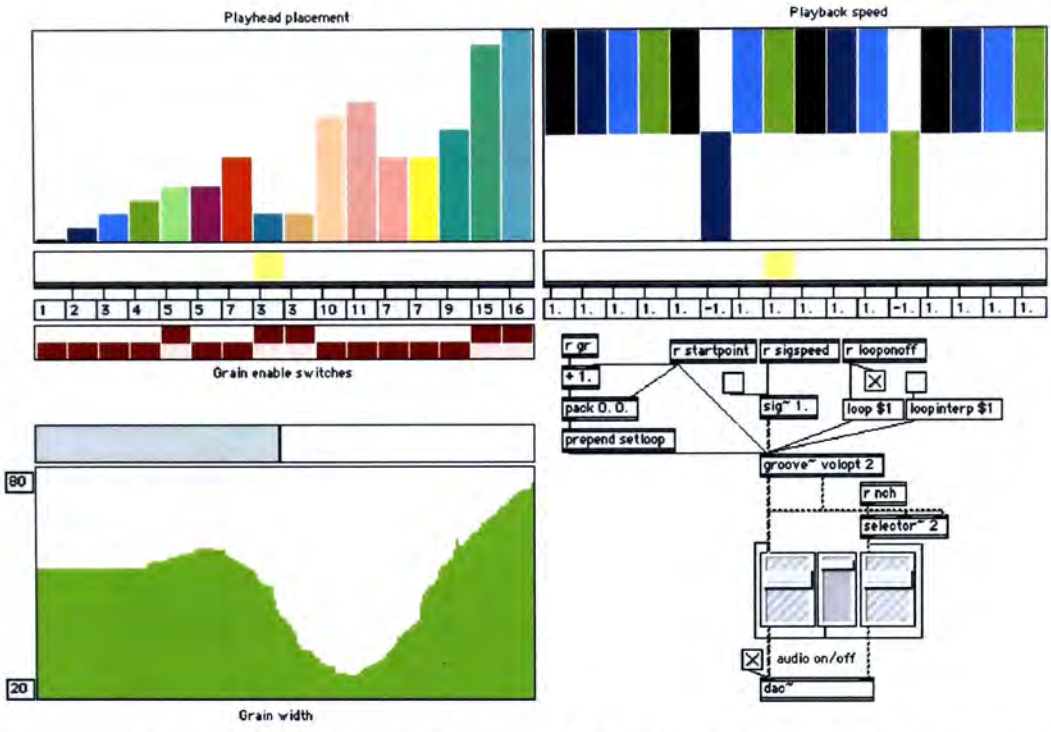


An example of the 2D parameter controller altering reverb time and pre-delay

The x and y parameters can be mapped to control two separate parameters such as reverb time and pre-delay, shown above.

Scoreable Granular Manipulation

As opposed to navigating through a *step sequencer* to alter the start point, the scoreable granular manipulator patch loops and splices audio segments at a *micro* level, extending the notion of dynamic playhead position to a more extreme role. This rapid control of playback on a *micro* level allows for musical results such as breakbeat effects and time-domain audio freezing. The granular manipulator patch has three main areas: playhead placement controls and grain repetition switches; grain width selector, triggered by the grain repetition switches; and playback speed controls.



A scoreable granular manipulator, re-arranging and re-triggering micro *level segments of an audio loop*

Shown above with a division of 16, the scoreable granular manipulator allows the user to isolate and repeat segments of sounds by adjusting the sliders to move the playhead to different steps within a sample. This patch has a number of applications involving pattern alteration (the ability to cut up, freeze, reverse and loop sound grains of a *meso* length sample) and sound design (the manipulation of elements of a *sound object* length sample). An example of the former is cutting up an audio loop to produce a breakbeat-style effect. An example of the latter is using a sample of a piano note, removing the attack by starting at a step other than the first grain, freezing/looping the sound, and creating a new sound that differs from a typical piano sound but exhibits a 'still picture' or 'snapshot' of the sustained sample. The grain width slider allows the frozen sounds to be retriggered at rates from around 20ms/ 50Hz (producing pitched granular sounds) to 80ms/12.5Hz (a sub-audio rate producing more of a percussive result from the manipulated sounds).

It is pertinent at this stage to remind the reader that the actual compositional processes employed by Autechre most probably differ from the approaches presented in this thesis. The concepts discussed here, such as the dynamic approach to rhythm and timbre, hopefully shed light on some of the reasons why computer-based listening is a complicated process when analysing Autechre's music

and why it has not been addressed in this thesis in much detail over and above simple event detection.

The Application of Key Concepts to New Creative Works

x3 Tracks[70]

The following is an outline of the application of key concepts, outlined previously in this chapter, to original creative works. Many of the tracks recorded for this thesis feature phase vocoded elements (ie. modifications to the frequency domain in both time-compression and expansion and pitch-shifting) to add textural intros, outros, and layers of sonic and musical material to the tracks. In addition to these non-structural aspects of the composition, other effects are applied, such as reverb, EQ filtering, and distortion (in the forms of bitrate and sample rate reduction). Furthermore, audio effects and processes that will purposely result in audio artifacts are applied after the completed compositional phase of the recording process. Although these features have not been discussed with regard to Autechre's compositional methods, they do feature throughout Autechre's work.

The six tracks display various approaches to composing with Autechre-like structure. They are approached as follows:

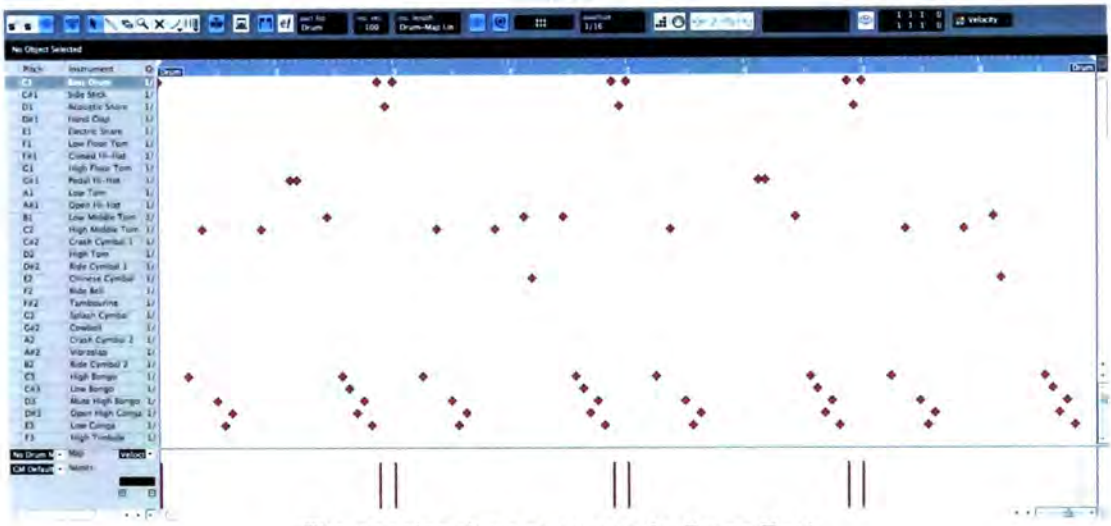
Track 1 – *Brace Rect*

Brace Rect is 'hard sequenced', and does not use any computer aided compositional techniques. The motivation behind this track is to show that Autechre-like material is not a product of computer intervention or compositional assistance, but rather due to compositional intent. The track combines a wide range of compositional approaches including sequenced sampled and synthesised drums, large amounts of hand-crafted automation (modulating synth parameters and control change messages), simple chord-based progression and arpeggiation, and manual manipulation and dissection of audio samples. While the track is *structurally* non-complex in sections, non base-two quantise settings are used at times to swing the rhythm and throw the arrangement out of a standard meter. The combination of these elements results in

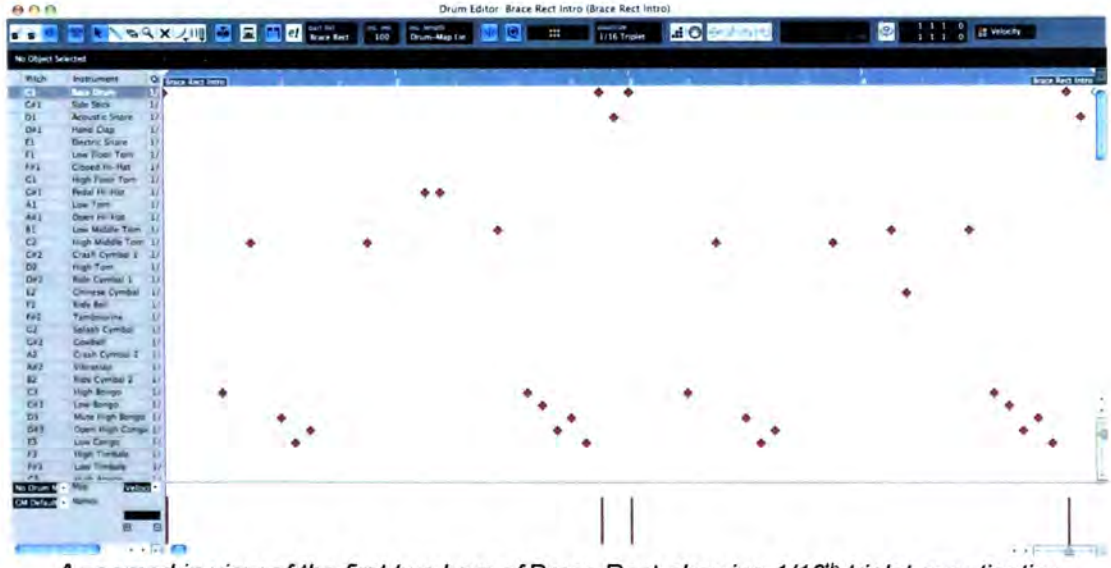
[70] 'x3 Tracks' denotes the various musical pieces made with the collection of 'x3-' prefixed Max/MSP programs and abstractions and VST effects created for this thesis.

a work that is sonically similar to Autechre tracks such as *Dial. (Gantz Graf)*, *The Trees (Untilted)*, *Netlon Sentinel (EP7)*, *Rae (LP5)*, *Blifil (Peel Session 2)* and the ring-modulated effects on the percussive parts of tracks like *V-Proc (Draft 7.30)* and *Zeiss Contarex (EP7)*.

Brace Rect opens with an syncopated drum pattern. The first four bars of the opening drum part are shown below:



The opening drum sequence for Brace Rect

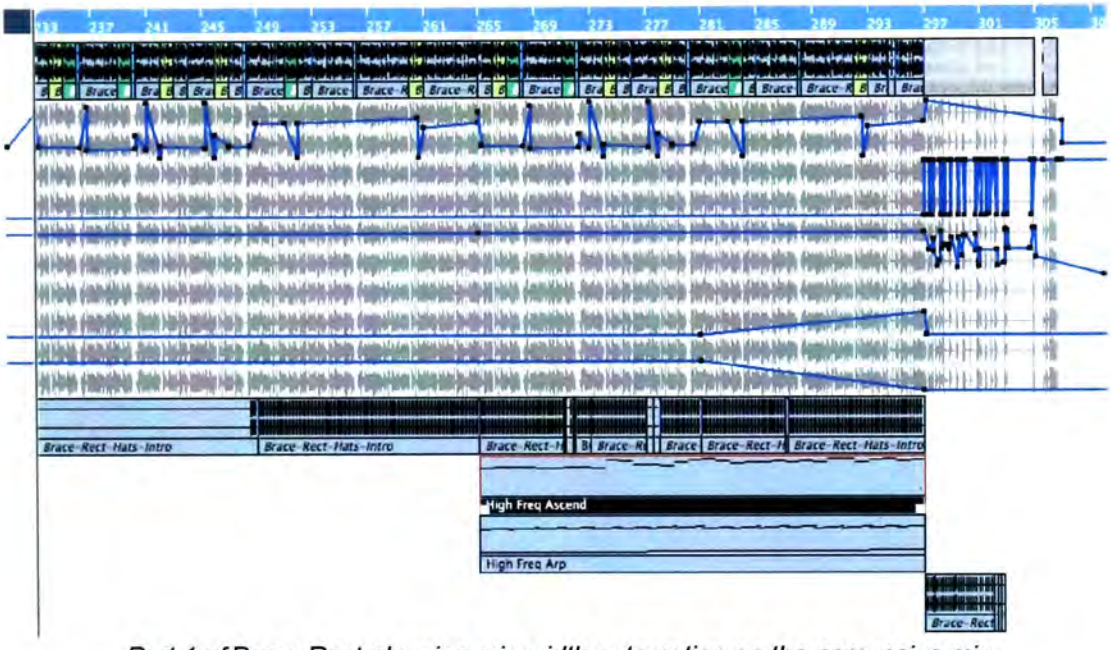


A zoomed in view of the first two bars of Brace Rect *showing 1/16th triplet quantisation*

The above images show the non-uniform phrasing of the opening drum sequence. The uppermost two rows of sequenced events are the kick and snare pattern, and the remaining events are hats, toms and clave-like sounds. The kick and snare

pattern is fairly sparse, but the centre of each bar is populated with complex-timed percussive motifs. Whilst it may be hard to discern from the above images, the drum intro for *Brace Rect* mixes two quantisation settings: 16th bar division and 16th-triplet bar division. The effect this has is of obscuring the predicability of the beat whilst maintaining a regular meter.

The layout of the *Brace Rect* track is in two major parts. The opening section is an up-tempo mix of percussion and effects modulation.



Part 1 of Brace Rect *showing mix-width automation on the percussive mix*

A simple, custom-made ring-modulation plugin effect has been applied to the drum parts. This effect oscillates at around 40Hz, beneath an audible tone level, but adds a textural element to the parts. In addition, compression based ADSR envelope-shaping is used to sharpen and shorten each percussive event. A large amount of effect automation is present throughout the opening sequence, shifting the drum parts in and around the stereo space.

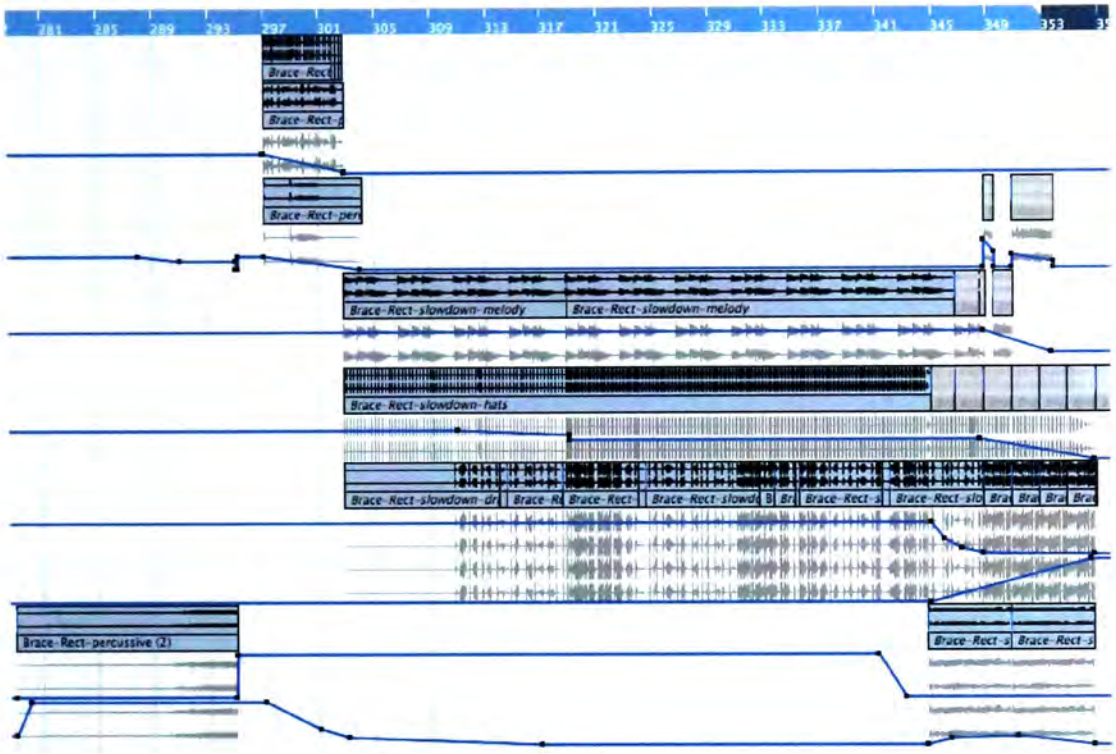
Throughout the first part of *Brace Rect*, various elements are introduced and layered over the percussive foundation:

1. At 0:27, a hat element is introduced to bring regularity to the percussive pattern.
2. At 0:58, an ultra-high frequency ascending melodic pattern enters the mix

to emulate Autechre's use of ultra-high frequency tones in tracks such as *Overand (Tri Repetae)*.

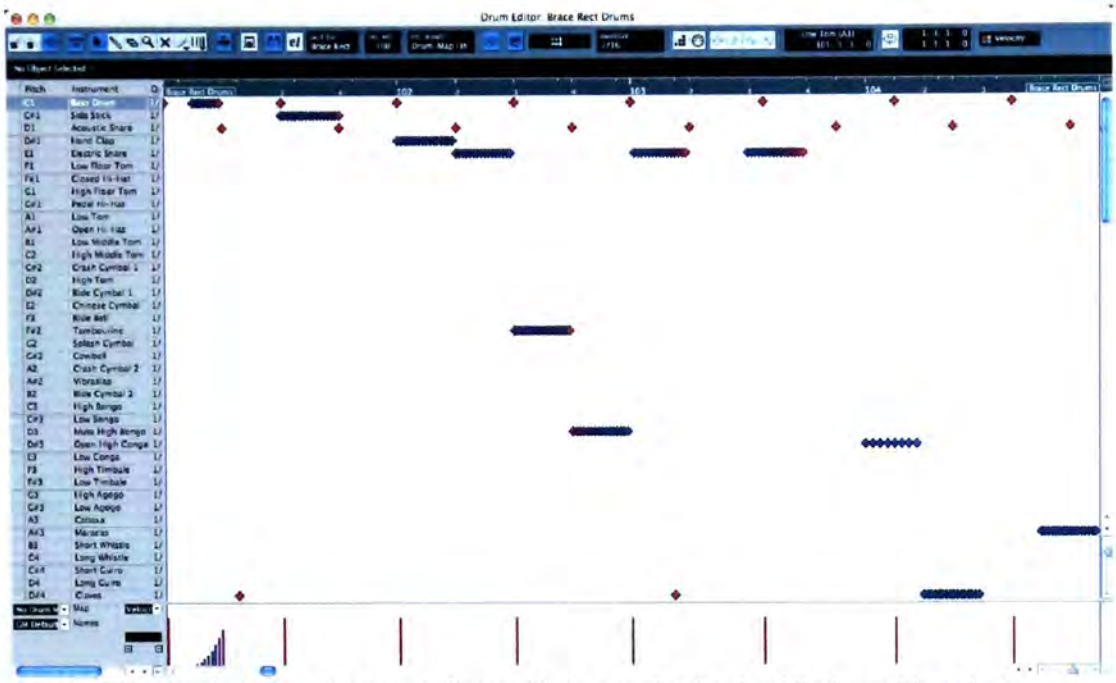
3. At 1:31, a sizeable reverb tail effect slowly enters the mix, transforming the pattern into a noise swell before a tempo ritardando at 1:54.

The track slows down to half speed and the second phase of the track begins at 2:04, comprising a solo synth line and compressed hat part.



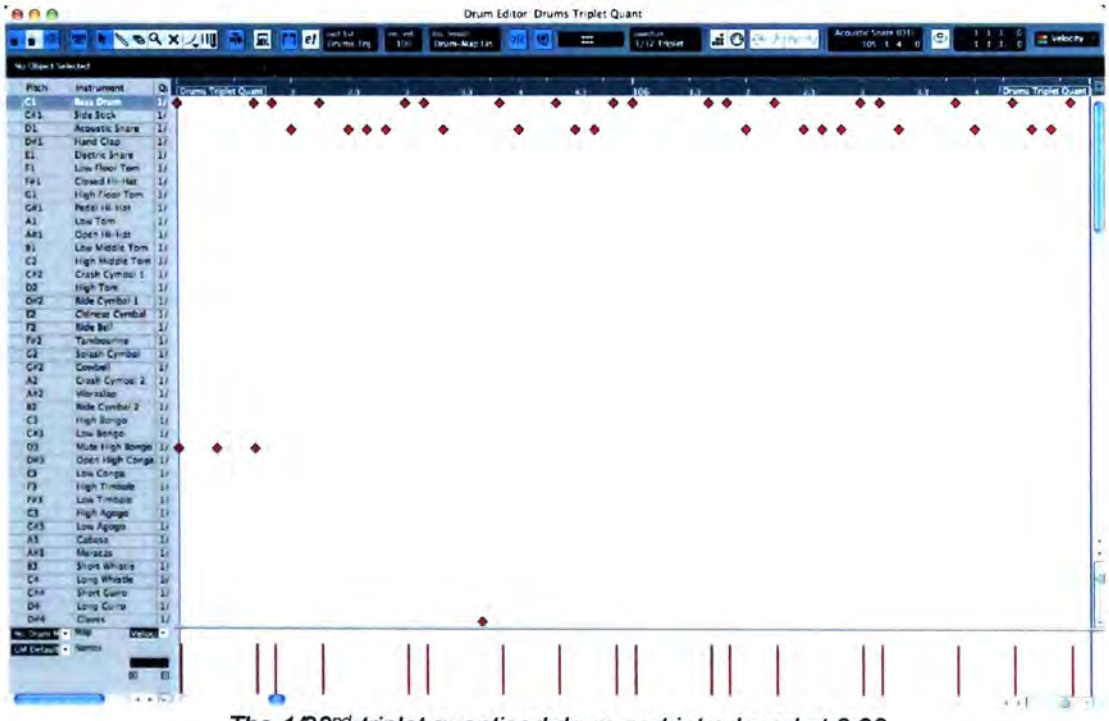
Overall mix and automation in the second phase of Brace Rect

The drum part entering the mix at 2:18 is a very straightforward alternating kick and snare pattern, but complexity is added to the mix through retriggered events or 'rushes' that swell in volume. The time between retriggered events changes for each note rush, but is most commonly retriggered at 1/32nd and 1/64th lengths of each bar.



The simple kick and snare pattern with percussive 'rushes' that swell in volume

At 2:32, the rhythmic complexity is changed from a simple pattern with retriggerings and pretriggerings to an intricate kick and snare pattern with 1/32nd-triplet quantisation. Used in conjunction with the melodic part and the regular hat pattern, the 1/32nd-triplet quantised drum part adds syncopation to the track.



The 1/32nd-triplet quantised drum part introduced at 2:32

Transition from 1/32nd quantisation to the simple kick and snare pattern

The track outro alternates between the oddly quantised drum parts and the straightforward kick and snare pattern, as the melodic synth part loops until fading out.

Track 2 – *IV Exact*

IV Exact takes its inspiration from Autechre's dynamic-tempo-based tracks such as *Fold4,Wrap5 (LP5)* in that it is built on the concept of an auditory illusion[71] of perpetual ritardando. The track is procedurally driven; individual events trigger sequences of notes, all of which are controlled by a master metronome. Similar to *Brace Rect*, but more prominently featured in the mix, chordal patterns of notes built around a master key or chord set populate the melodic space. As the track progresses, the starting points of the percussive layers in the tracks are rotated, so that the percussive line changes in emphasis, but still maintains a single structure.

The track is very similar to *Fold4,Wrap5 (LP5)* due to the nature of the tempo slowdown combined with the halving of the beat division, which is used to transition between the slow and fast segments. *IV Exact* also shares timbral similarities with the intro of *Zeiss Contarex (EP7)*, *Drane2 (Peel Session 2)* and *Characi (Cichlisuite)*.

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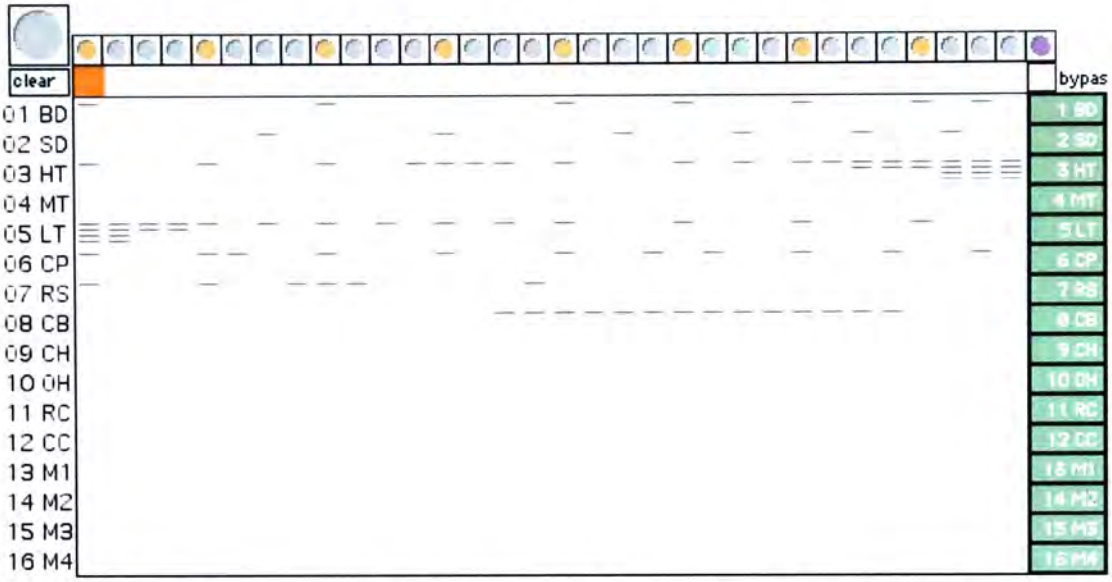
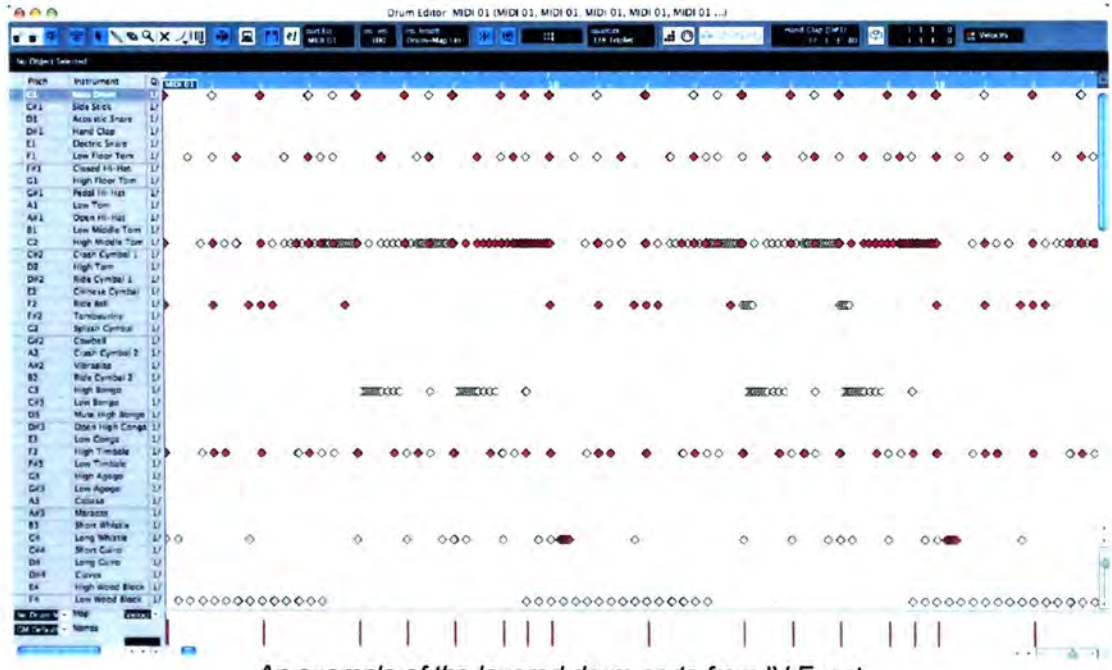
[71] As discussed during a paper presented by Freed at Macquarie University (2006:np)

The following image shows the event-types as sequenced in Max/MSP:



The pattern used in the multi-layered sequencer matrix in Max/MSP

The output of the *event-type* sequencer in Cubase is displayed below. Red events are the direct output from the Max patch shown above:



An example of the layered drum parts from IV Exact

Layered above the drum pattern is a simple chordal progression, providing a counterpart to the rhythmic complexity. Although the use of dynamic tempo variation

remains present throughout *IV Exact*, the startpoint of the step sequencer in the Max/MSP image above rotates at sections in the track. It is through this startpoint rotation that the track gradually changes, while maintaining a structural similarity or consistency. The change of the startpoint in a measure also alters the stressed sections in the pattern, as the sections that slow down do not necessarily coincide with the sections at which the percussive events double in frequency. As a means of adding continuous change to the track, *IV Exact* also features continuously modulated effects throughout, such as reverb swells, delays and sustained noise.

Track 3 – *Halt*

Halt incorporates non-repeating percussive patterns and heavy forms of compression as demonstrated in tracks like *Licflii (EP7)*, *Left Blank (EP7)*, *Yeesland (Cichlisuite)* and *Reniform Puls (Draft 7.30).* Other track features include the timbral qualities and melodic progressions of tracks like *Sim Gishel (Confield)* and *Under Boac (LP5).* The track is built primarily out of probabilistically weighted events used to determine the percussive structure of the track. The percussive part is built out of five probabilistically derived layers of events; one kick part, one snare part, one noise swell element, and two hat layers. The track beginning is fairly straightforward, however probabilistically weighted events are introduced to supply continuous variations of the structure of the piece. In addition, probabilistically derived event-types are introduced to add further complexity to the piece.

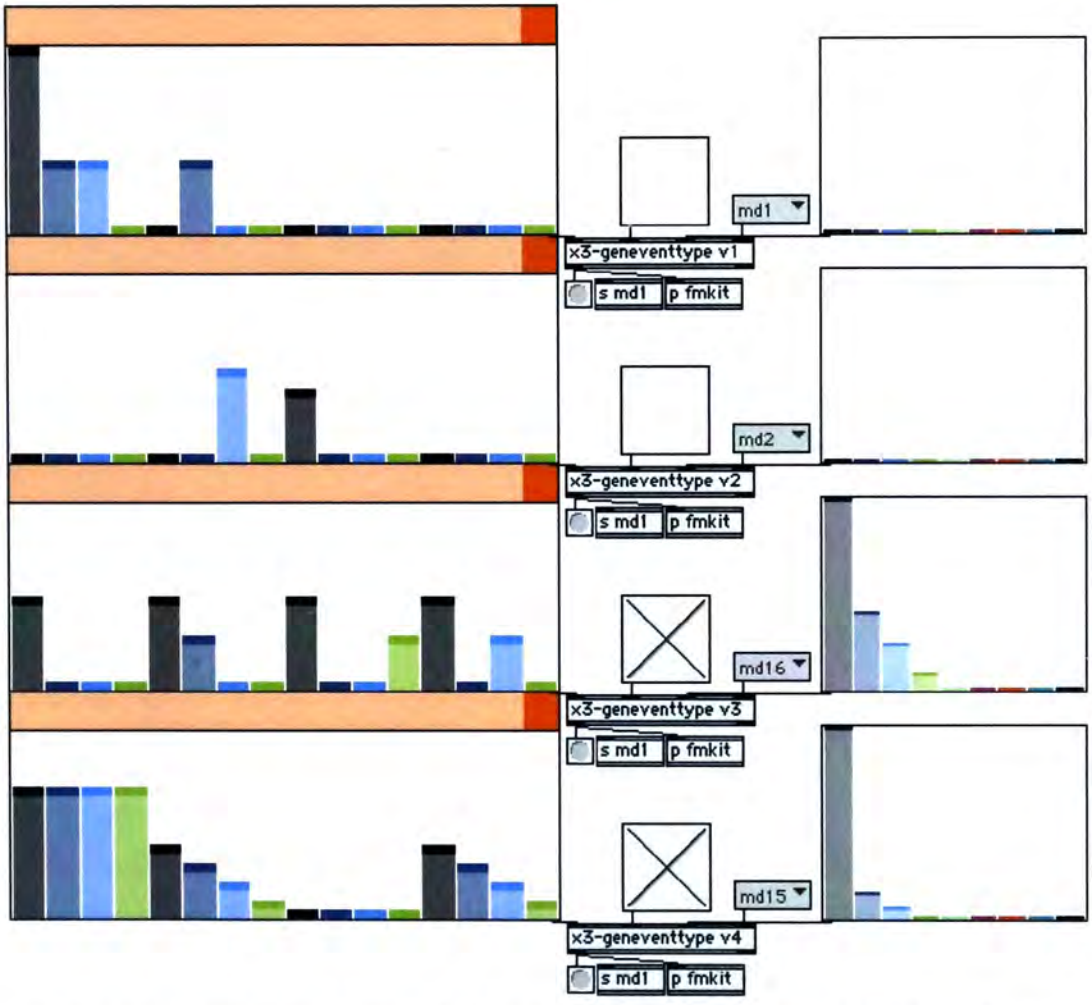
The track opens with a regular hat part:

Halt *begins with a regular hat pattern playing 8th notes*

The regular hat part plays from start to 1:02. From 1:02 onwards, the hat part becomes probabilistically weighted:

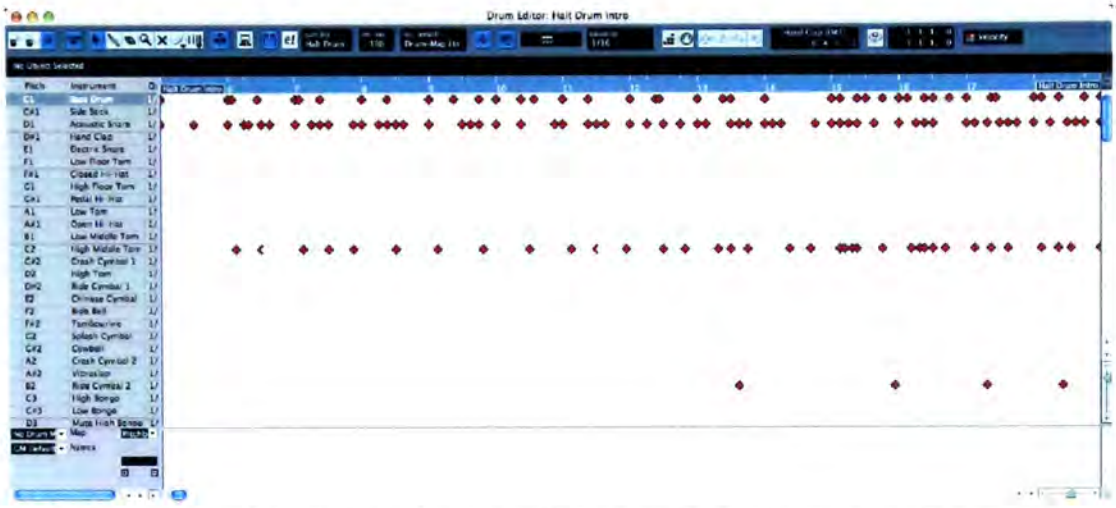
An intricate and dense pattern generated by probabilistically derived events and event-types

The following image shows the probabilistic pattern used to derive events in *Halt*.



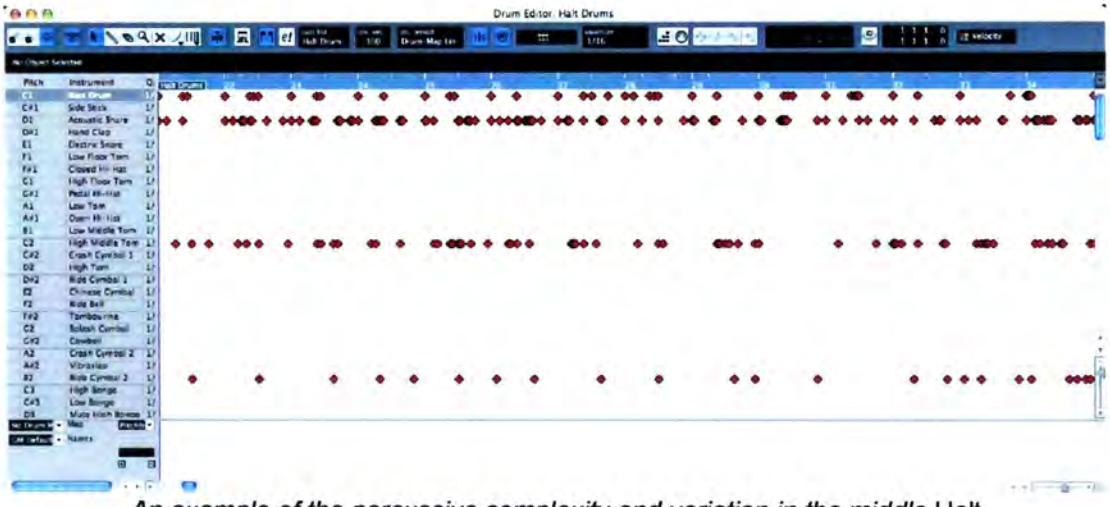
Probabilistically weighted events (left) and probabilistically weighted event-types (right)

The track starts fairly simple, and the non-recurring percussive patterns are noticeable early on in the track, as shown below:



The percussive intro to Halt, *showing variation and structural similarity between bars*

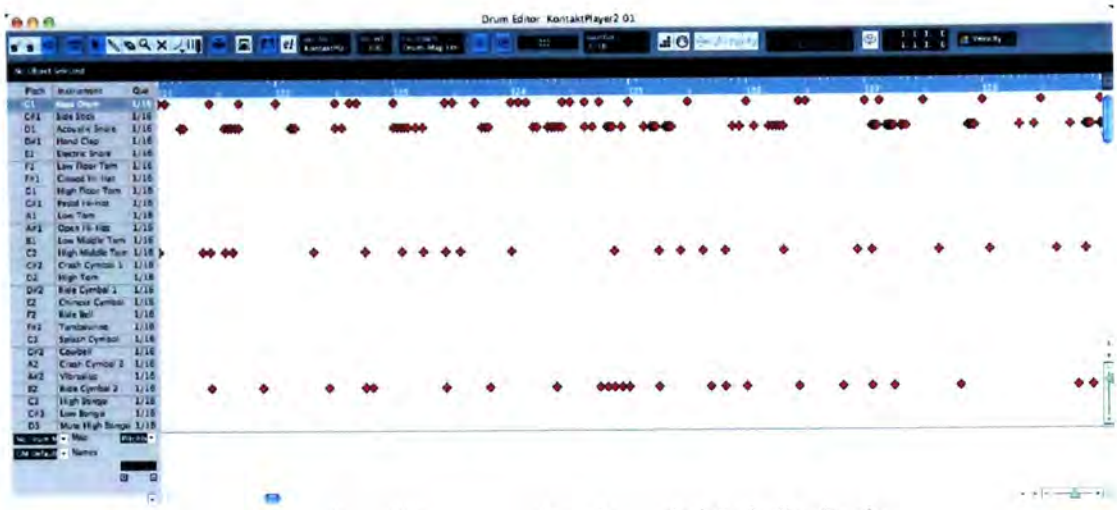
From 0:35, a more complex percussive pattern is slowly introduced, noticeable through the more densely packed clusters of percussive events:



An example of the percussive complexity and variation in the middle Halt

Tempo-synchronous effects manipulation is employed, determined by the use of the 2D controller to alter effects parameters in sections. Most notable is the use of a 'sample divide' effect to reduce the quality of the drum part, heard as distorted kick and snare elements at 0:55-0:59, 1:09-1:23, 1:44-1:46, 1:51-1:55, 2:01-2:07, 3:04-3:08 and on the overall mix from 3:58 onward.

Throughout the track, the probabilistic pattern is adjusted and interpolated into a new pattern, slowly transforming the underlying percussive structure. By the end of the track, percussive events are clustered into dense zones of kicks and snares.



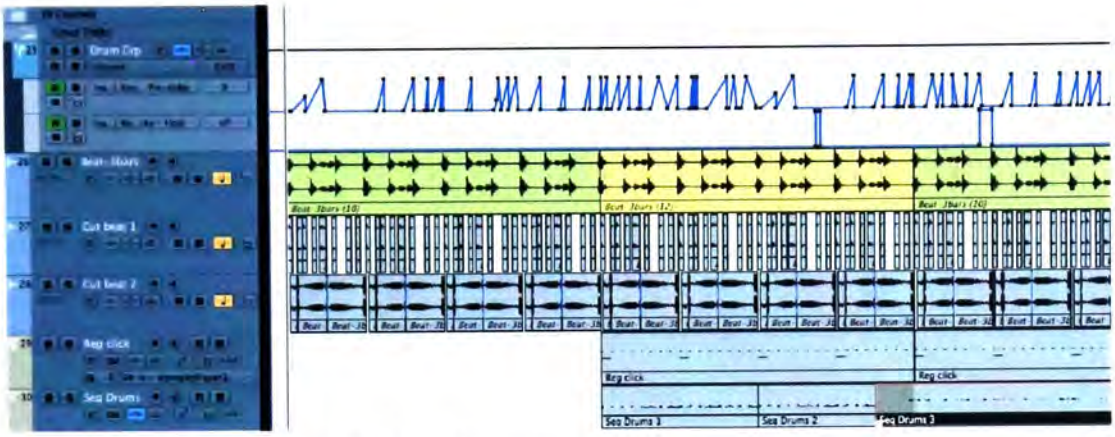
Examples of the percussive elements late in the track

In addition, a number of transformation features are introduced throughout the track, including chord-set based arpeggiation from 2:07, a slow transform of mix width at 2:27, and the addition of a long reverb tail and heavy compression ratio from 3:31. Late in the track, the combination of dense clusters of notes and a large reverb tail combined with heavy compression results in an inverse envelope effect; the attack of the sound is attenuated, and the sustaining level is boosted. The compression transformation is visible in the following image:

An overall view Halt, *showing heavy compression late in the track*

Track 4 – *Supine*

Supine incorporates features that are demonstrated in Autechre tracks such as *Cfern (Confield)*, *IV VV IV VV VIII (Draft 7.30)*, *6IE.CR (Draft 7.30)*, *Theme of Sudden Roundabout (Draft 7.30)*, *Xylin Room (Draft 7.30)*, and *Cap.IV (Gantz Graf)*. *Supine* combines parameter-modulated effects, cut-up audio samples, and complex, rhythmic sequencing.

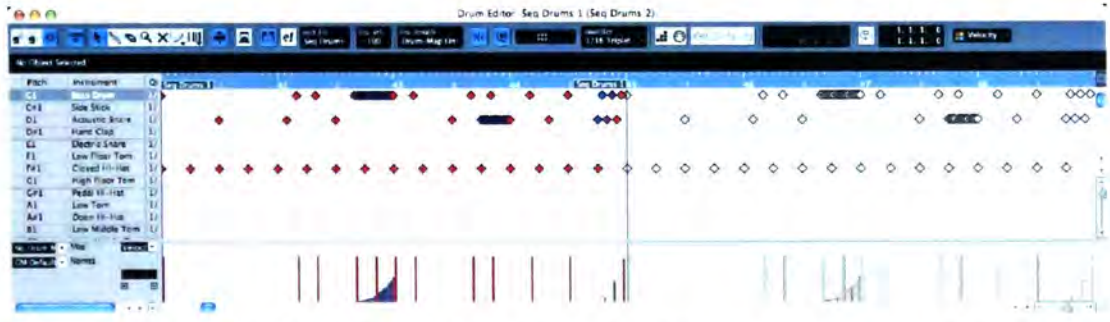


Overall mix of the intro to Supine *showing pre-delay automation*

In the opening sequence of the track, the meter is slurred by manipulating the time offset of a delay line, thereby stalling, stuttering and scrubbing through audio samples. The heavy automation on the *Drum Grp* channel above adjusts a pre-delay effect, which allows the drum audio signal to be temporarily held for longer than it would normally be. This has the effect of swinging and temporally distorting the drum signal.

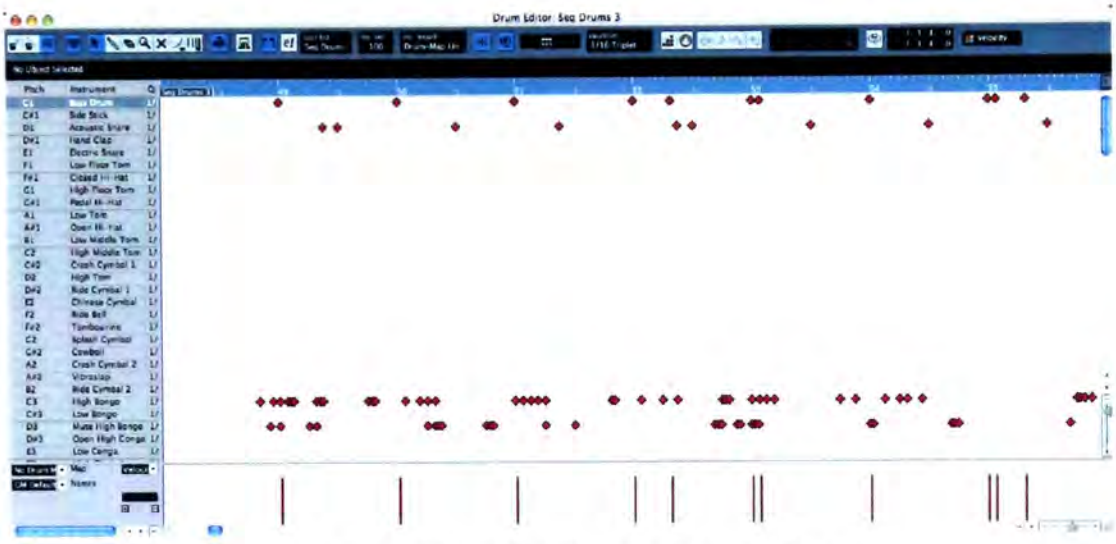
The rasterised output of the automated pre-delay effect showing clusters of sound

At 0:14, a sequenced percussive beat enters, mixing percussive rushes with a swung quantisation and a regular hat pattern. This adds a syncopated backing beat to the temporally distorting audio samples.



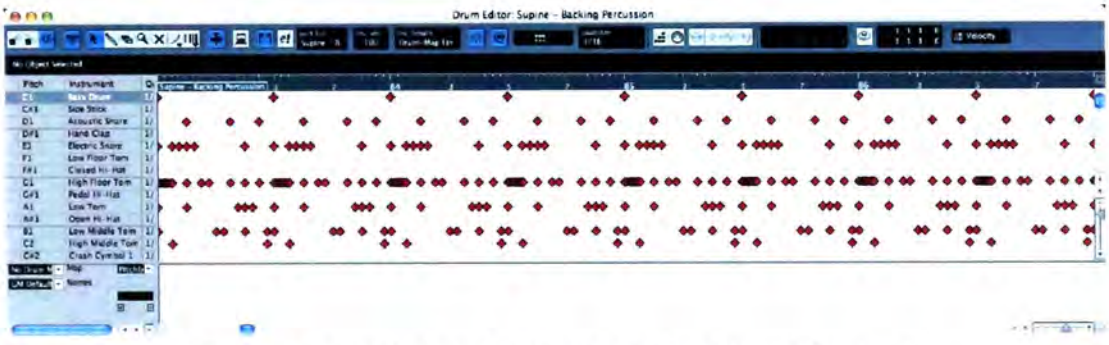
A triplet based quantisation from non-triplet based input quantises events into an awkward beat

At 0:29, an additional percussive layer is introduced to the mix, adding constant variation:



An additional percussive layer added at 0:29

At 1:46, a 'wooden knock' section is introduced that intermittently emerges from the mix. The pattern is derived from the matrix event-type sequencer, but is used intermittently. An example of the pattern is shown below:

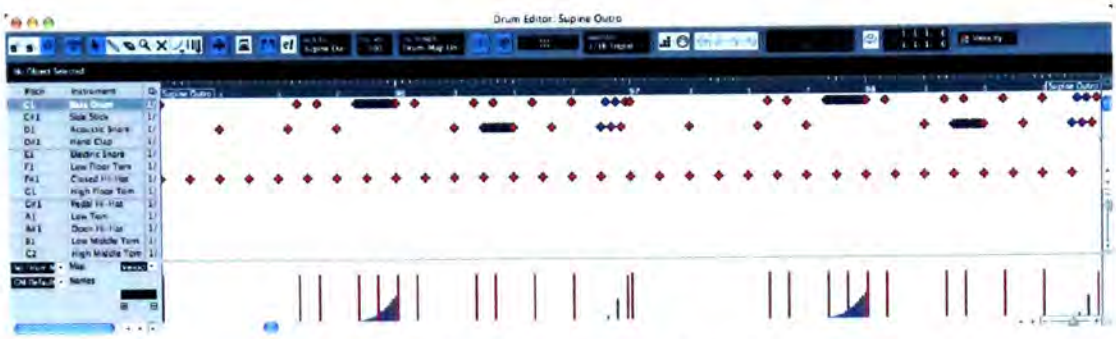


Percussive wooden knock pattern that plays from 1:46 onward

The bursts of the percussive knocks are programmed by allowing a muting function to silence some parts of the pattern while allowing some parts through. An example of the mute pattern is shown as automation below:

The events in the arrange window and the muting function that lets the complex percussive backing emerge

From 2:29, *Supine* begins its outro section by replacing the complex drum sequencing with a swung quantisation pattern and note rolls.



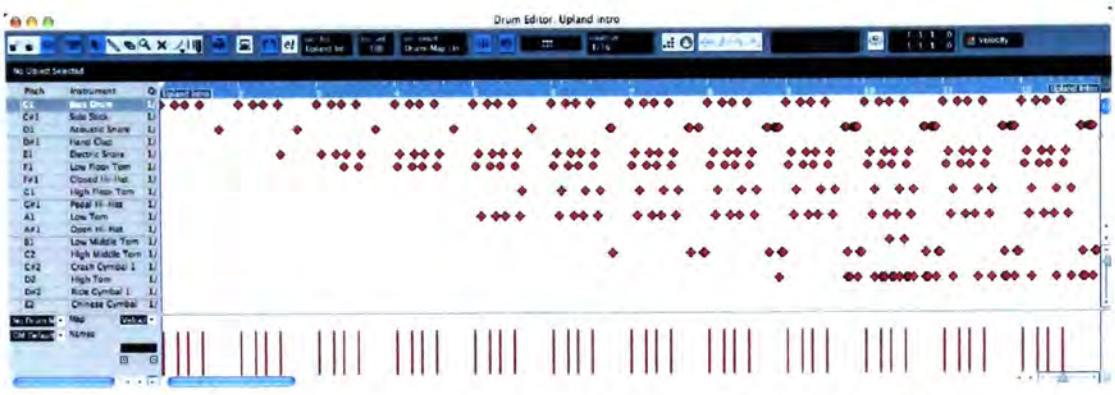
Supine's sequenced outro pattern

Track 5 – *Upland*

Upland shares similarities to Autechre tracks such as *Caliper Remote (LP5)* and *Cap.IV (Gantz Graf)* and incorporates elements similar to the backing drum pattern in *Arch Carrier (LP5)*, the 'wooden knock' of *Xylin Room (Draft 7.30)*, and the drum pattern clusters of *LCC (Untilted)*.

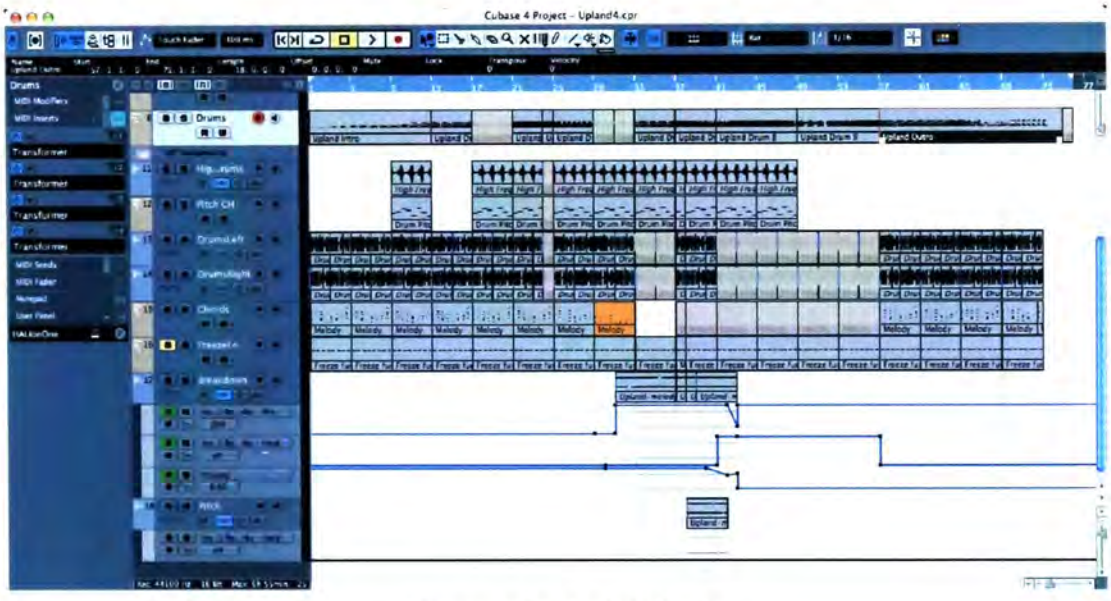
The most complex of all the tracks, *Upland* is built around the use of a simple pattern that is continuously altered by the use of moving-playhead-startpoint control. The source pattern itself remains fairly constant in the first segment of the track, however the pattern goes through a process of restarting within measures as well as starting at differing steps within the source measure. The result is a wide range of generated patterns that, while not generative *per se*, explore permutations within the set of a single compositional structure. The main varying part of *Upland* is an intricately sequenced pattern of 'wooden knock' sounds, sequenced live with the multi-layered sequencer matrix. In addition to the use of pattern restarting, additional percussive elements and layers are constantly added to texture the percussive foundation of the track.

The main recurring backing beat uses a drum pattern that is textured by adding a custom made audio-freeze effect to the left and right channels, determined by a generative pattern. Above this steady backing beat, the varying drum pattern eases its way into the mix by increasing the number of events triggered each bar. In the intro section of the track, this constantly varying pattern can be seen, with new percussive elements added each time the measure cycles:



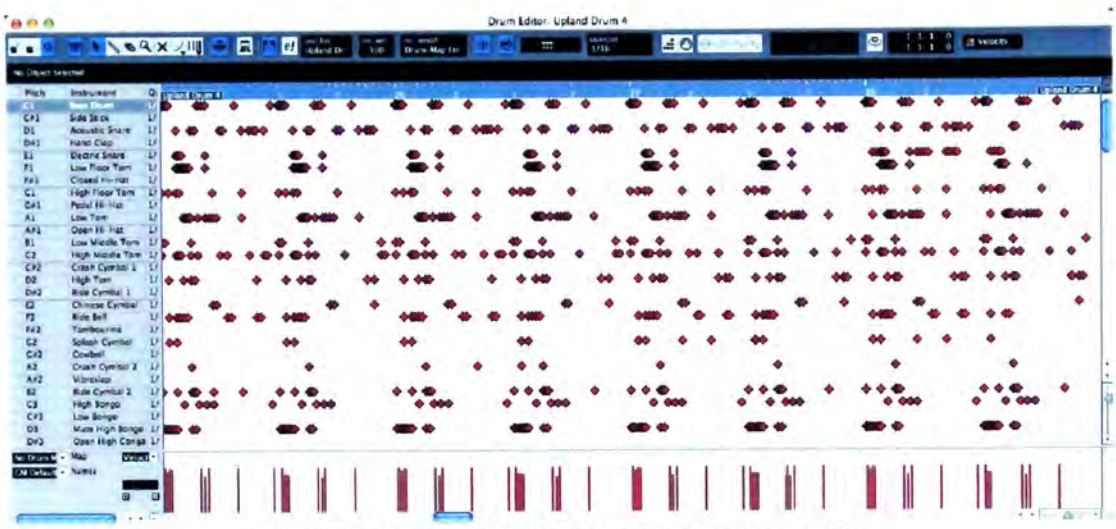
The percussive lead showing how the pattern builds and cycles

The following image shows the overall mix of the track, displaying the intro build (bars 1-21, 0:00-1:32), the mid-section (bars 21-33, 1:32-2:27), percussive solo (bars 33-57, 2:27-4:18), and the outro (bars 57-75, 4:18-5:46).



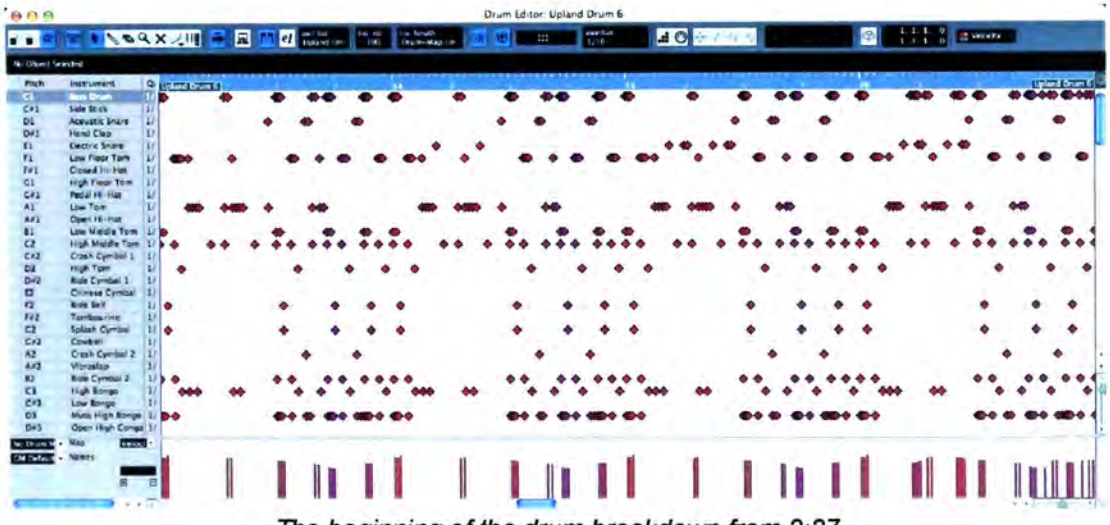
The overall mix of Upland

The mid-section of *Upland* builds to a rich mix of percussive events, combining single triggered events with note rolls. An example of the arrangement of note events being triggered is illustrated below:



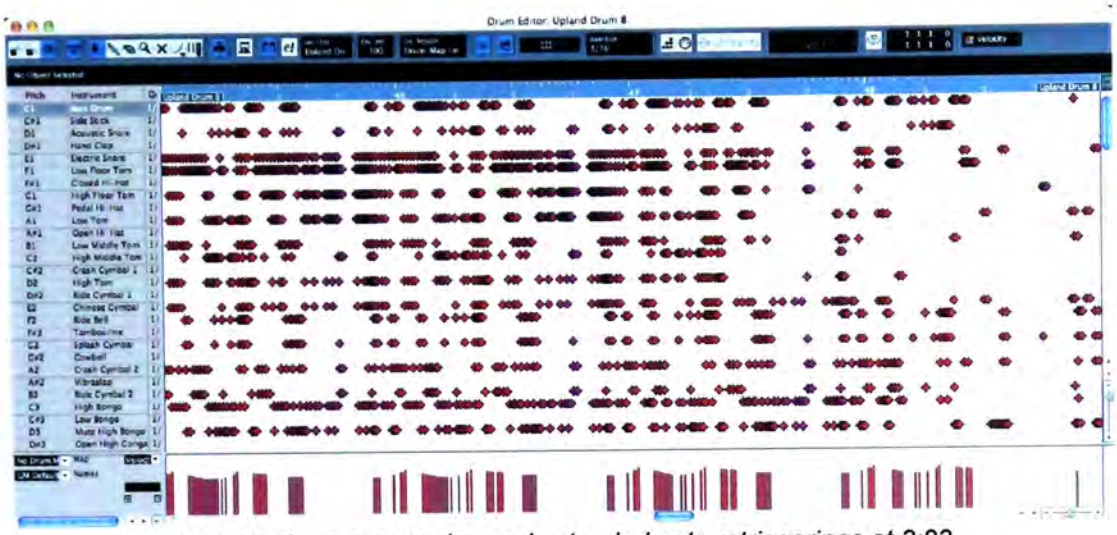
An example of the percussive complexity at 1:50

Whilst the track is 'hard-sequenced' and uses playback startpoint-restarting to build a complex evolving pattern, a 2D lookup function is used to swing the playback to add a further complexity. The percussive and rhythmic complexity is at its highest at the drum breakdown from 2:27 onwards:



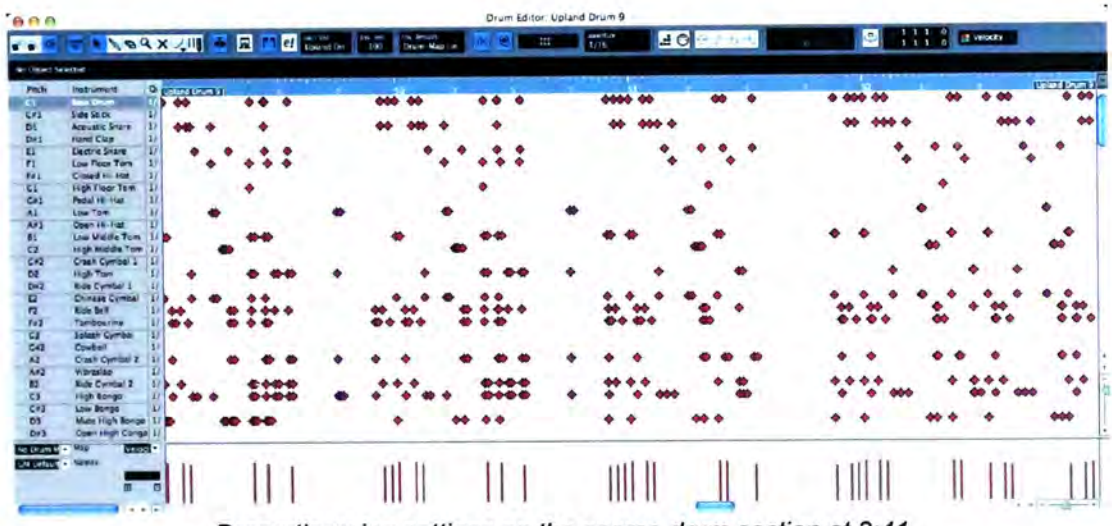
The beginning of the drum breakdown from 2:27

From 3:23, the meter is thrown out of standard timing by adjusting the 2D lookup function to use more of a dramatic swing setting. During this sequence, the drums are also retriggered at very close intervals, and the play-head is constantly shifting around, creating a granular retriggering of events. This can be seen below:



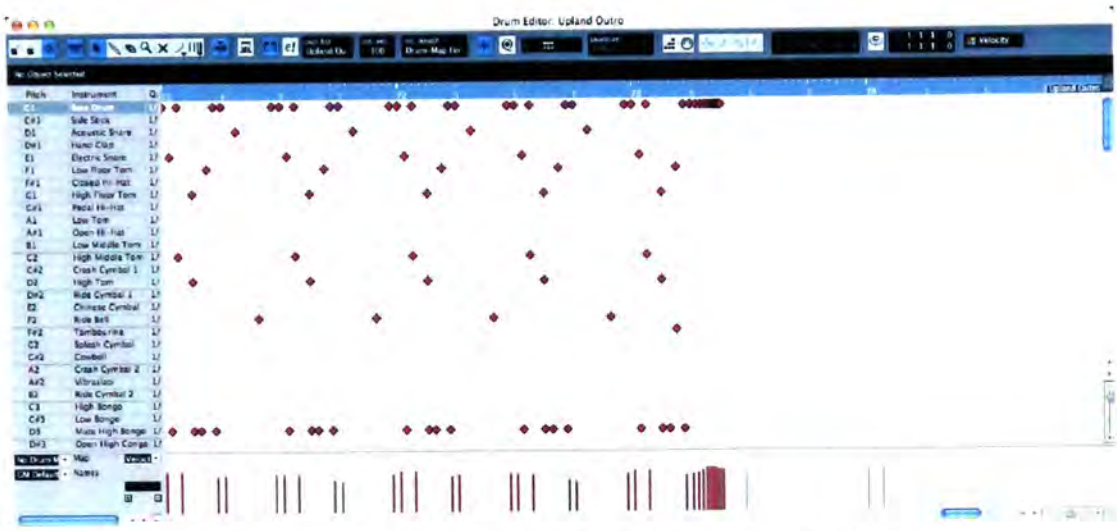
Intricate drum sequencing and extended note retriggerings at 3:23

The dramatic swing settings are continued from 3:41 onwards, and the amount of notes being triggered is reduced, allowing the oddly-phrased meter to emerge:



Dramatic swing settings on the sparse drum section at 3:41

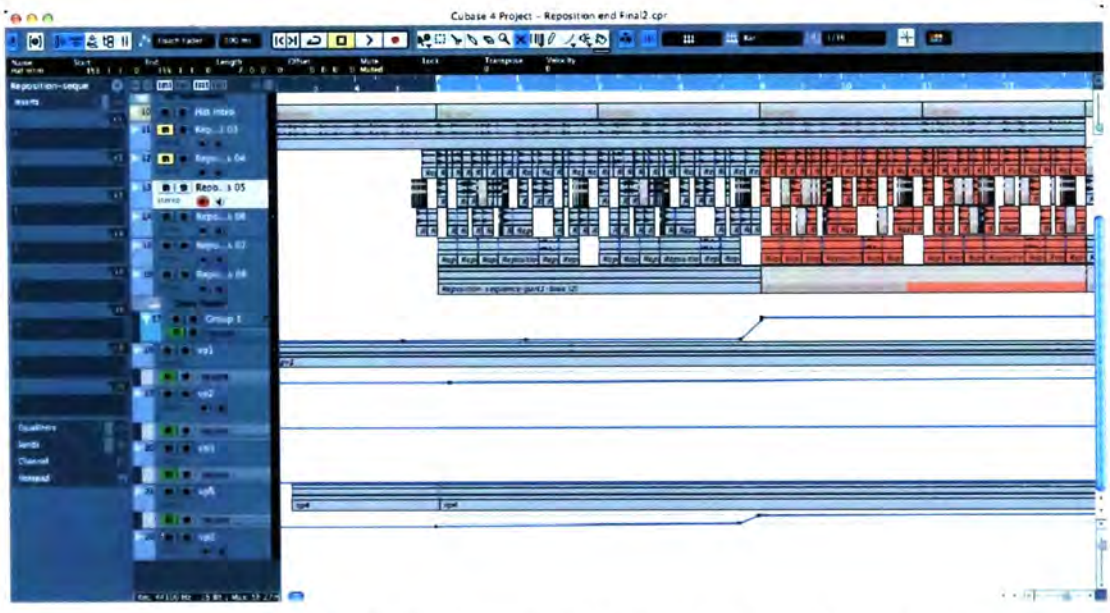
Throughout the drum solo section, a spectral freeze is performed on the backing chordal progression to provide a still and continuous element whilst the drums are frenetically triggering. The track concludes with a 'bouncing' pattern at 5:33, shown below as the last cluster of constricting events:



The outro bars of Upland *showing dynamically timed retriggering*

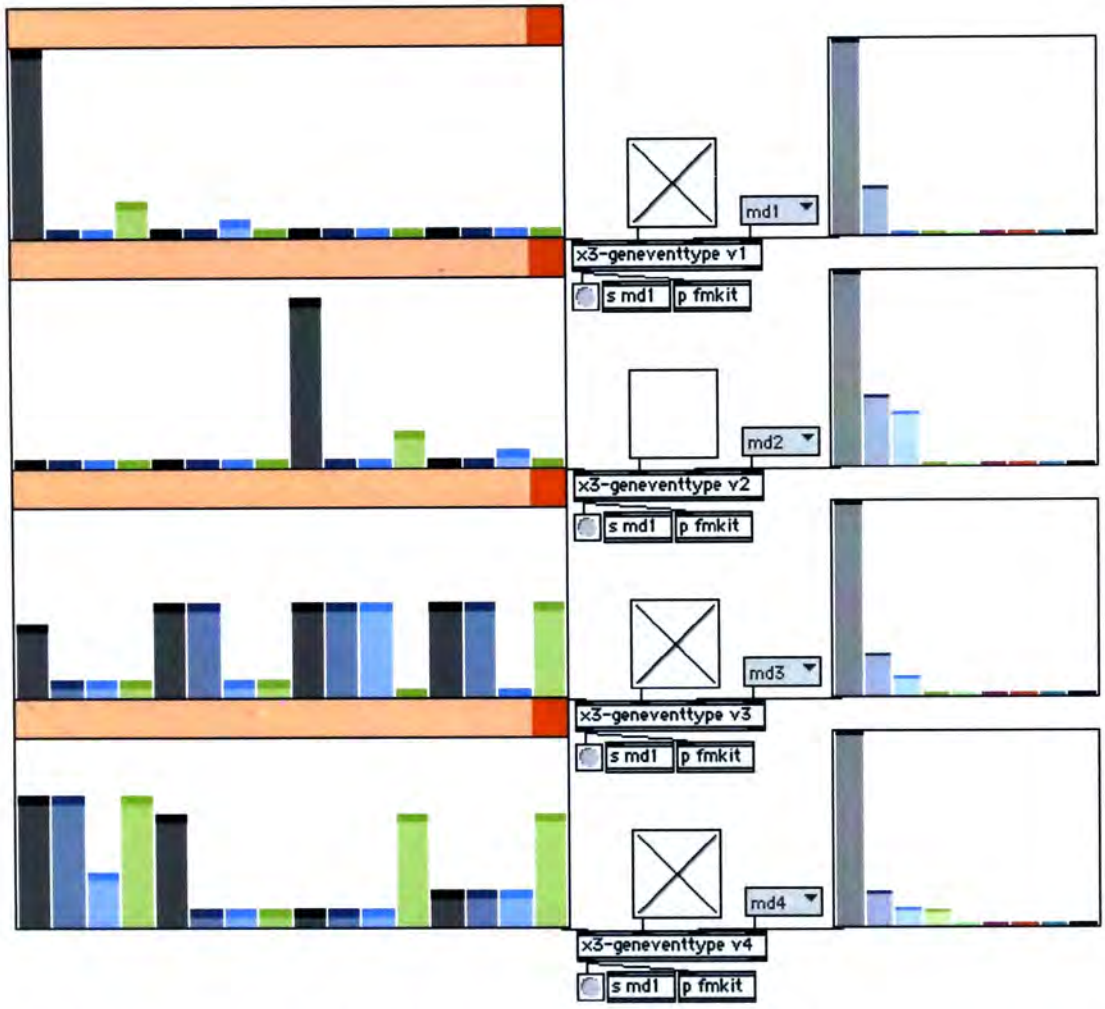
Track 6 – *Reposition end*

Reposition end combines many of the previously discussed features into a single track. The track is heavily processed, both in terms of audio cutting and in the use of modulating audio effects. The track mixes hand-cut and sequenced audio samples, manual automation, generative drum sequencing (in the second section of the track), phase-vocoded spectral manipulation, and FM-based percussive and melodic synthesis. *Reposition end* shares similarities to Autechre tracks such as *Bine (Confield)*, *Gantz Graf (Gantz Graf)*, *Lentic Catachresis (Confield)* and *Left Blank (EP7)*. The sample-based cut-up drum intro is shown below:



Hand sequenced and cut-up samples in the intro section of Reposition end

Reposition end uses similar techniques to *Halt* for sequencing non-recurring material throughout sections of the track. The second half of *Reposition end* (beginning at 0:49) features intricately sequenced synthesised FM-based percussion. Using noise as hats and (as discussed in Chapter 4) and rich and dull FM-tones to emulate snares and kicks, a probabilistic pattern is used to continuously vary the generated pattern, determining when notes are triggered, and what kinds of events are triggered.



A probabilistically driven event and event-type generator used to sequence percussive synthesis in Reposition end

The leftmost `multislider` objects shown above determine note placement of four percussive sounds, and the rightmost `multislider` objects determine the probability of event-types to be triggered. Alongside this sequenced section, a linear arpeggiation of descending tones is used as a melodic counterpart.

From 1:36 to 1:45, a minor breakdown is created through granular audio cutting of the sequenced beat. Examples of the granular stuttering, playback speed manipulation and repetition can be seen in the snapshot of the rendered waveform below:

The note- and micro-level granular stuttering shown in the highlighted section from 1:36-1:45

The track undergoes a major change from 2:23 onwards through the use of heavy phase-vocoder manipulation, adjusting and removing sinusoidal, noise-based elements and transients from the mix, as well as performing frequency-domain time stretching and pitch shifting on the sequenced percussive section. The use of a hat element to bring regularity to the mix is audible at 2:43, when the tempo moves to a free rhythm. The use of a regulating hat sound is seen in a number of tracks recorded for this thesis, and is reminiscient of the use of hat sounds in Autechre tracks such as *Gantz Graf (Gantz Graf)*.

From 3:26, the track begins its outro by re-introducing a steady beat to recover from the free rhythm section, and features note-level granular manipulation and *micro* level granular stuttering.

Chapter 6: Conclusion

This research study into the creative practices employed by Autechre is built on a consideration and reflection on recurring characteristics in their work. While the main area of this thesis covers an analysis of various forms of control over percussive structure and melodic content, Autechre's conceptual approaches to music making have not been discussed at any length. In April 2005, prior to the release of their most recent album to this writing, the BBC Collective website invited questions to be submitted to Rob Brown. The author managed to submit a question to Brown[72], and the answer intrigued me.

> *Alex Mesker: If you were non-musicians growing up, do you think that had a negative or positive effect on your role as musicians, or approach to composition/listening now?*
>
> *Rob Brown: It's got us where we are now. We know things about music now. You find recurring themes and you go, "Why does this seem familiar?" Then you'll do a bit of research and you'll find you've stumbled across what most people consider a musical rule. When you've got no idea about these rules or musical dictates you're pretty open to anything... I guess it's a good way of keeping things open, not knowing what keeps most people closed. But we do have taste. It's all 'quality' to us. We like to do things properly, but whether 'properly' is the way that people have decided is a rule or not is irrelevant. We've been at this so long that we don't want to skimp on quality, or taste or style. All these things come from a hip-hop, graffiti, BMX background where you're showing off what you can do. Practising loads. I can appreciate that mentality. You know, when you see young kids skating, falling and getting up again and again in the most extreme environments – speed, concrete, sharp edges – I've always appreciated that they're just trying to get it right. It might mean a few bumps into a few walls here and there, and musically we probably do that all the time. Some classical musician probably thinks, god what a racket – and then other people say, "Oh that's totally Wagnerian." It's got us where we are now and we're comfortable with the fact that sometimes we don't know anything, and sometimes we're exploring areas where other people won't go because it doesn't fit black and white textbook stuff.* (BBC Collective, 2005, http://www.bbc.co.uk/dna/collective/A3895806)

As Brown states, specific musical intentions and conceptual forethought do not necessarily translate clearly to the finished musical work or to the listener, hence I would hope that it is evident that the task of discussing Autechre's work with regard to established musical practices is a complex one. During the process of

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[72] Whilst it was my original intention to not contact the duo (mentioned ealier), the reason was not due to the avoidance of possibly contradictory viewpoints in my analysis of their works, but rather to concentrate on the analysis by synthesis deconstructive approach. Although the question submitted to Brown could be considered personal correspondence, it is used to frame Autechre's approach to composition, as opposed to reveal creative process.

undertaking this analytic study, a number of limitations and areas for further exploration became apparent. With regard to the music of Autechre, there is no established vocabulary or method for analysis for a number of reasons. Firstly, due to the nature of the music being not yet well-established. Secondly due to its complexity; and lastly, due to the fact that listening to a recorded work is subjective. Furthermore, it seems necessary that the technologies used in music's creation must also be used in discussion and analysis of it. This is evident in Brown's quote above, in that it is erroneous to try to apply 'textbook' style analyses to Autechre's music. It is through their experimentation and exploration outside conventional musical rules that makes their music often widely-known and well-received in contemporary art music circles. Although Autechre's compositional processes are not strictly software driven, this could be due to the nature of many software environments today that offer and embody all the tools of contemporary, electronic and computer musics. Their ingenuity is shared by many that use modern software in this sense. The computer and associated audio electronics allow them to compose instruments and processes. By building, exploring and playing these instruments, they can engage with sounds in a new way that is both exciting and motivating because they can learn and grow by experimentation without the chore of mimicry and drills employed with conventional instruments. Autechre are from this new generation that doesn't need to learn music through traditional instrument practices or conventional music training – they can learn it by exploring the affordances of the technology tools. This is mirrored in Brown's reference to hip-hop, graffiti and BMX practice.

A concluding thought is to reconsider and reflect on where Autechre reside within the musical movements such as atonalism, chance-based approaches and serialism and to consider what can be reflectively said about their aesthetic approach. Although Autechre are not strictly aligned with any of these musical approaches, aspects of all appear in their works.

With regard to atonality, Autechre's lack of formal training suggests that there is no tendency to produce music with 'established' musical rules, such as centring around a tonal centre to which phrases always return. Many of Autechre's generative or algorithmic works tend to sound atonal; however, many other tracks offer conventional melodic content. Their chance-based approaches share a loose association with other existing chance-based approaches. Again, there is no single way in which Autechre compose a work, so any discussion of their work being

chance-based is very limited, as *chance* would not dictate musical direction, but rather, *rules* would, as any chance-based composition necessarily implies setting rules and constraints. Considering Autechre's music with regard to algorithmic composition techniques, such as working with rules/sets and to describe musical elements, is the most apt alignment of compositional approach.

Whilst loose associations can be drawn between these compositional strategies and Autechre's works, their overall approach continues from these areas and incorporates various other approaches. Much attention seems to be paid to *sonic construction* as well as *musical structure*. This description of Autechre's approach to music is captured in discussion with Booth:

> *Wilfred Jans: Do you aim to break with certain conventions, and is that why you are a band that breaks boundaries?*
>
> *Sean Booth: It's not all that much of a conceptual thing. Look, we are very much interested in the concept of rhythm. However, we think that you can also move internally, not just externally. As far as genres are concerned: as long as the two of us know about which music we're talking then there's no problem. But as soon as you stick a certain name on it, like 'electronic music', you run into problems. I mean: all music is in a sense 'electronic'. Even a recording that consists completely out of natural sounds can be regarded as electronic. When somebody concentrates on the sound itself, instead of the melody or the song, then almost automatically he gets shoved into the experimental or electronic niche.* (Jans, 1995:np)

Some comparison to serialism can, however, be drawn, as this thesis has adopted a exploratory viewpoint in the analysis of Autechre's work, discussing and analysing their compositional aesthetic through patterns, rules and the exploration of data sets. In many cases presented throughout this thesis, what appear to be rule-based musics are in actuality serialist snapshots of their aesthetic.

Autechre's dynamic compositional approach defies a compositional-style-based categorisation. As their albums become increasingly complex, Autechre's musical output grows more refined, demonstrating that they are not a product of their tools, but rather two individuals, exploring their individual concepts of music. Regarding the speculation of outside influences affecting their compositional approach, Booth discusses the mentality behind the complexity of *Untilted* (2005):

> *Drew Daniel: The timing on that* "Iera" *track is pretty disgusting – were you using fader controllers to manipulate MIDI data?*

> *Sean Booth: No, that was purely programmed, grid-programmed, all onscreen, just nudging MIDI events around. That track is totally just mousin' it – but there are other tracks, as on* "Sublimit", *that are just a drum machine up and running, 16-grid style, no swing or anything, everything just completely straight. On this record there's no generative work or fader based MIDI stuff.*
> (Daniel, 2005)

Although the recurring use of fluid timing is apparent on a range of Autechre releases, the above quote from Booth shows that, regardless of tools and approach, tendencies emerge. This thesis has aimed to capture and define a selection of Autechre's musical tendencies and recurring characteristics, which must be regarded in an analysis of their work.

Autechre's evolution over their releases since 1998 emphasises the *creative decision* over the *process.* The progression of their work in this time appears to shift from complex, algorithmically driven approaches to a composed and refined complexity. This demonstrates a diminishing reliance on algorithmic intervention, the technique which listeners attribute most to the complexity of their sound and structure. The complexity and exploration of rhythm within set boundaries is ingrained in Autechre's aesthetic, not the employment of algorithmic processes.

The purpose of this research was to not recreate *autechre*, but to research methods for analysing and discussing these forms of complex music. Whether the processes used to generate these forms of music are routine driven or humanly driven is irrelevant. The process must be distinct from the means, and this is demonstrated by Autechre's more recent tendency to work *without* compositional software such as Max/MSP.

> *Sean Booth: [A]ll it comes down to is taste, that's the only thing you can say is constantly there and is constantly feeding what you're doing, and it's the only thing you can possibly lay claim to.*
>
> *Alex Reynolds: So no meaning, just taste.*
>
> *Sean Booth: It's all about taste, completely about taste. Yeah, 100%. Totally.*
> (Reynolds, 2001:np)

The primary goal of musical composition as stated by Autechre is the sound or surface-level of the music. The technology and the compositional structures are incidental to the final product. However, it is necessary to understand the technologies used in the creation of such music to develop an analytical method that

is appropriate to the final product.

A number of important factors became apparent throughout the writing and recording of this thesis. Firstly, an analysis of Autechre's sonic text outlined the need for a deeper understanding of organising and manipulating 'sound'. The use of programs like Max/MSP highlight an expanded way to compose both structurally and timbrally, over and above the ordering of musical events alone, dictated by many modern forms of 'linear' multitrack recording software. Secondly, the exercise of creating these tracks contributed to an understanding of the compositional-style of Autechre-like tracks in the following ways. A self-awareness is necessary to compose with such programs as Max/MSP: in the mode of composer, as opposed to ordering notes alone, one must consider why one does things in a particular way, and how that *way* can be represented. With regard to the use of algorithmic composition as an extension to the creative process, Jacob (1996) indicates that this meta-level of composition (not only on the level of composition, but rather on the level of how one composes) involves an "understand[ing of] one's own creative process well enough to reproduce [them] as an algorithm". (Jacob, 1996:157). Thirdly, while tendencies to compose music in a certain way emerge in Autechre's works, their approach to achieve their ends is not singular. As indicated earlier, interviews with the duo at different stages throughout their musical career suggest that their compositional methods change over time, although hallmarks of their sound recur.

The creative component of this thesis aims to illustrate that creative tendencies can be represented algorithmically. What still remains unknown is the *actual* creative approach undertaken by the duo. Whilst the tracks for this thesis contain varying amounts of subjective interpretation or artistic license, the employment of the outlined key characteristics allows the creation of works that share fundamental similarities to the works of Autechre.

The quote from Booth above illustrates that while creative methods change, the tendencies to produce works in a certain style are the actual 'essences' of musical works, not the approach or software used when composing the work. Although the processes apparent in Autechre's tracks and those used in this thesis are in ways mathematical or rule-based, the endeavour is not an exploration of mathematical or rule-based concepts. This is demonstrated by the use of different compositional methods ('hard sequenced' elements, or completely algorithmically composed tracks

etc.) and by Autechre's evolving sound. Ultimately, I have found that an analysis of this kind of music is most easily understood through technological recreation, despite the fact that an exploration of technology for its own sake is antithetical to Autechre's creative outlook.

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Appendix I

(From Roads, 2003: pp. 3-4)

Taking a comprehensive view, we distinguish nine time scales of music, starting from the longest:

1. *Infinite* - The ideal time span of mathematical durations such as the infinite sine waves of classical Fourier analysis.

2. *Supra* - A time scale beyond that of an individual composition and extending into months, years, decades, and centuries.

3. *Macro* - The time scale of overall musical architecture or form, measured in minutes or hours, or in extreme cases, days.

4. *Meso* - Divisions of form. Groupings of sound objects into hierarchies of phase structures of various sizes, measured in minutes or seconds.

5. *Sound object* - A basic unit or musical structure, generalizing the traditional concept of note to include complex and mutating sound events on a time scale ranging from a fraction of a second to several seconds.

6. *Micro* - Sound particles on a time scale that extends down to the threshold of auditory perception (measured in thousandths of a second or milliseconds).

7. *Sample* - The atomic level of digital audio systems: individual binary samples or numerical amplitude values, one following another at a fixed time interval. The period between samples is measured in millionths of a second (microseconds).

8. *Subsample* - Fluctuations on a time scale too brief to be properly recorded or perceived, measured in billionths of a second (nanoseconds) or less.

9. *Infinitesimal* - The ideal time span of mathematical durations such as the infinitely brief delta functions.

Appendix II

UK Criminal Justice and Public Order Act of 1994 Section 63 (cited in part at http://www.everything2.com/index.pl?node_id=513833)

Powers in relation to raves

63. Powers to remove persons attending or preparing for a rave.

(1) This section applies to a gathering on land in the open air (includes a place partly open to the air) of 100 or more persons (whether or not trespassers) at which amplified music is played during the night (with or without intermissions) and is such as, by reason of its loudness and duration and the time at which it is played, is likely to cause serious distress to the inhabitants of the locality; and for this purpose--

(a) such a gathering continues during intermissions in the music and, where the gathering extends over several days, throughout the period during which amplified music is played at night (with or without intermissions); and

(b) "music" includes sounds wholly or predominantly characterised by the emission of a succession of repetitive beats.

...

(9) This section does not apply--

(a) in England and Wales, to a gathering licensed by an entertainment licence; or

(b) in Scotland, to a gathering in premises which, by virtue of section 41 of the 1982 c. 45. Civic Government (Scotland) Act 1982, are licensed to be used as a place of public entertainment.

...

66. Power of court to forfeit sound equipment.

(1) Where a person is convicted of an offence under section 63 in relation to a gathering to which that section applies and the court is satisfied that any sound equipment which has been seized from him under section 64(4), or which was in his possession or under his control at the relevant time, has been used at the gathering the court may make an order for forfeiture under this subsection in respect of that property.

(2) The court may make an order under subsection (1) above whether or not it also deals with the offender in respect of the offence in any other way and without regard to any restrictions on forfeiture in any enactment.

(3) In considering whether to make an order under subsection (1) above in respect of any property a court shall have regard--

(a) to the value of the property; and

(b) to the likely financial and other effects on the offender of the making of the order (taken together with any other order that the court contemplates making).

(4) An order under subsection (1) above shall operate to deprive the offender of his rights, if any, in the property to which it relates, and the property shall (if not already in their possession) be taken into the possession of the police.

...

Supplementary Creative Works

x3 Tracks[73]

Track 1 – *Brace Rect*	3:43
Track 2 – *IV Exact*	4:28
Track 3 – *Halt*	5:08
Track 4 – *Supine*	3:09
Track 5 – *Upland*	5:42
Track 6 – *Reposition end*	4:12

[73] Available online at http://www.x37v.com/Masters

TAPE PEEL OFF THIS FILM TO EXPOSE ADHESIVE BONPACK® SEAL

Alex Mesker - MA (Research) Tracks
Macquarie University, 2007

Brace Rect 3:43
IV Exact 4:28
Halt 5:08
Supine 3:09
Upland 5:42
Reposition end 4:12