A STUDY, EXPLORATION AND DEVELOPMENT OF THE INTERACTION OF MUSIC PRODUCTION TECHNIQUES IN A CONTEMPORARY DESKTOP SETTING

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Abstract

As with all computer-based technologies, music production is advancing at a rate comparable to 'Moore's law'. Developments within the discipline are gathering momentum exponentially; stretching the boundaries of the field, deepening the levels to which mediation can be applied, concatenating previously discrete hardware technologies into the desktop domain, demanding greater insight from practitioners to master these technologies and even defining new genres of music through the increasing potential for sonic creativity to evolve.

This DMus project will draw from the implications of the above developments and study the application of technologies currently available in the desktop environment, from emulations of that which was traditionally hardware to the latest spectrally based audio-manipulation tools. It will investigate the interaction of these technologies, and explore creative possibilities that were unattainable only a few years ago – all as exemplified through the production of two contrasting albums of music. In addition, new software will be developed to actively contribute to the evolution of music production as we know it. The focus will be on extended production technique and innovation, through both development and context.

This commentary will frame the practical work. It will offer a research context with a number of foci in preference to literal questions, it will qualify the methodology and then form a literature & practice review. It will then present a series of frameworks that analyse music production contexts and technologies in a historical perspective. By setting such a trajectory, the current state-of-the-art can be best placed, and a number of the progressive production techniques associated with the submitted artefacts can then be contextualized. It will terminate with a discussion of the work that moves from the specific to the general.

Acknowledgements

Any undertaking on the scale of a doctorate demands an inordinate amount of personal time, time that I would ordinarily share with Jo. She has sacrificed a great deal to allow me to pursue this and I offer her my profound thanks.

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1 Introduction

A record is a world. It is the world scratched by man in a form that may survive him.

(Eisenberg, 2005, p.210)

In 1983[1] Brian Eno (2004) succinctly traced the evolution and trajectory of recording technology from inception to 48-track and beyond. Since then, the digital era has led to this trajectory steepening exponentially, and the contemporary desktop recording system is easily capable of what were then, seemingly incomprehensible feats of sonic manipulation.

This ongoing journey is portrayed in a number of consumer and professional periodicals, but the emphasis is typically on the reporting of both emergent technologies and the retrospective analysis of commercial music productions. Whilst some relevant textbooks exist, they typically dwell upon the 'operational', or are seated in established fields such as musicology or composition. In music production (henceforth 'production'), the progression along the above trajectory can be too rapid for conventional authoring and publication lead times, often rendering attempts at documentation anachronistic.

The opportunity therefore exists to utilize the practice-led framework of the DMus in Music Production to explore the desktop production process from within, not just reflecting on the creative issues or analyzing the finished stereo artefact, but accompanying finished productions with a contextualizing exegesis to provide a more unique insight into the formative creation of the art form

[1] When his lecture of four years earlier was first published.

placed in time. This will offer an insight that augments the practice and qualifies it as research via the ‘performative research’ paradigm presented by Haseman (2007).

1.1 Background – Current Literature, Practice and Tools

The art of producing ‘professional quality’ audio mixes is firmly rooted in professional practice. In this context, such professional practice might be interpreted as the skills, knowledge, understanding and creativity held by practitioners that enable them to function in the professional studio environment. Aspects of this practice are increasingly taught in universities, written about in textbooks and consumer periodicals, and discussed widely on the Internet. To cite merely examples of each:

- Owsinski’s (2013) book offers considerable insight into a generalized practical approach to mixing music, usefully underpinned with tips from established professionals.
- *Sound on Sound* magazine has featured the ‘Mix Rescue’ series of articles, the first of which was in 2002 under the name of ‘Studio SOS’ (White, 2002). These articles offered an operational recounting of efforts to improve readers’ mixes, although the work was conducted after the main body of music had been created. In addition, the magazine has featured (primary source) retrospective musings on the creation of ‘classic tracks’, launching the eponymous series in 2003 (Buskin, 2003).

- Many ‘how to’ articles exist on the Internet, alongside many equipment-specific help forums that offer solutions to users’ problems, e.g. ‘Logic Pro Help’ (n.d.).

What does not seem to happen often in academic writing[2] is an exposé of the professional practice with insight derived throughout the *creation* of a contemporary production. Such practice is hugely diverse, and features both well-established and emergent techniques and approaches that utilize a vast range of tools, not to mention a multi-polarized plethora of opinion and taste. As such, it could not be encapsulated in a single thesis. This thesis will therefore endeavour to illustrate only a subset of the tools and techniques in the form of a case study that involves the creation of two contrasting albums. As in the title of this work, the illustration will be based around a contemporary desktop setting, although some work (e.g. recording and mixing) utilizes the hardware studio too.

Further, although software development is a whole field in itself, modern software tools almost always seem to be designed for generic application, subsequently adopted for specific (usually intended) situations. The identification of production problems and aspirations that require tools not currently available offers the opportunity to design bespoke solutions. This approach in itself is common in DSP design arenas, but again is based in conceptual areas – not track-specific ones. Such an approach is simply not practical within the normal time constraints of professional practice; however,

[2] There are a small number of academic papers, such as Draper and Emmerson (2011) that do this.

again, the academic framework of the DMus can facilitate this. Such an approach offers a perspicacious insight into the praxis of software inception.

Whilst simultaneously a heterodox to the professional practitioner and a schism to the orthodox research establishment, such an exegesis is entirely appropriate in a research context. It fulfils the function of studio inquiry in a quite unique mode, providing an explanatory snapshot of contemporary practice, chronologized, contextualized, conceptualized and formed from the generation of bespoke tools and techniques employed in its creation; it is a nexus.

1.2 The Inquiry as Nexus of Praxis

Even to a trained ear, retrospective analysis of music production can only reveal those aspects that might be considered discoverable, i.e. via appraisal of the end product. An objective of this text is to penetrate beyond any such boundary, revealing aspects of the producer's journey towards said 'end-product', and also contextualized by consideration of the chronology of this journey and what has come before. To further elucidate on this, a perspective of the ontology of production must be offered – this is the praxis of production. Virgil Moorefield opens his argument for the 'producer as composer' with:

> …I make the case for three central developments in production and claim that they are all driven by an underlying mechanism. One: recording has gone from being primarily a technical to an artistic matter. Two: recording's metaphor has shifted from one of the "illusion of reality" (mimetic space) to the "reality of illusion" (a virtual world in which everything is possible). Three: the contemporary producer is an auteur. The underlying mechanism is technological development, encompassing both invention and dissemination due to economies of scale. (2010, p.xiii)

Key aspects of contemporary production are encapsulated here – Moorefield offers sound bites that could form an interesting manifesto, and these will be explored in subsequent text; however, underlying this is a broader

definition. Production can take many forms, but is unified by mediation. This mediation can be of performance, of composition/arrangement, of timbre, of atmosphere or attitude, or in its limit, mere quality control without proactive engagement in the actual creation of the artefact; as such it is still mediation, since without it, the creative process could deviate or terminate at a different point. Many of these aspects might not be apparent in the final (discoverable) work, yet it is these that represent the praxis.

Such praxis cannot be revealed without a holistic perspective. The forms of mediation cited above (and others, of a similar nature) are themselves influenced by a number of factors: genre (either prescribed or emergent), tools, production-environment acoustics, personnel (and their technical/musical aptitudes & limitations), intended end-listening environment and context, final playback medium and more. All of these impose priorities and limitations, thus creating tensions that might be resolved by the producer working towards an end-point. This could be considered as contributing to the phenomenology of production.

To gain a truer insight into the final audio artefact, it is necessary to fully appreciate the intuited factors above, the degree of their influence, and their interaction. The only way to do this is through a studio-based inquiry as exemplified through an exegesis. The profundity will be increased if the text is accompanied with audio excerpts of sub-mix elements, in-situ and cross-referenced as required, charting notable aspects and issues, contextualized, and finally concatenating into the ‘discoverable’ artefact. Thus, the exegesis is the nexus of praxis.

1.3 Research Questions

In the qualitative context of this practice-led work, research questions are not posed in a literal sense, but instead a number of foci are postulated.

1.3.1 The principal focus

The principal research focus will be:

1.3.1.1 A study, exploration and development of the interaction of music production techniques in a contemporary desktop setting

This is of course the title of the thesis, and is intended to imply a comprehensive evaluation of tools and techniques, primarily focused in the computer environment (largely avoiding issues of recording studio hardware). It is the interaction and application of the techniques and technologies that will shape the finished musical artefact, and so for a practice-led work are crucial. The word ‘development’ will be supported through the construction of bespoke software to aid the production process, although novel techniques will be attempted too, perhaps using new environments to find innovation. ‘Contemporary’ must be qualified through context, and so chronology is a key element of this work. When required, the development of audio technology will be discussed in order to empower the meaning of ‘contemporary’, and further, contextualize it over the lifespan of the doctorate itself. Such a study also informs the methodologies and concept.

1.3.2 Secondary foci

In addition to the above, a number of secondary questions will be addressed:

1.3.2.1 What constitutes innovation in music production, and to what extent can true innovation in production be demonstrated?

This submission will endeavour to develop and apply a number of innovative production techniques with a view to extending existing practice, or at least demonstrating it at a sufficiently advanced level. To fulfil this aspiration, it is necessary to consider aspects of the ontology of innovation in production to ensure that such a claim is valid, in what context and to what degree.

1.3.2.2 What is the worth of pre-DSP 'traditional' production values in the contemporary manipulation-oriented context?

Historically, 'good' recording practice strove for mimetic reproduction, attempting to capture and convey the qualities of live performance. The evolution of the synthetic timbres generated by manipulated samples led to a revised expectation of authenticity and this was further compounded by ever more elaborate Digital Signal Processing (DSP), often in the frequency domain. Since manipulation is a major part of the practice herein, the tensions introduced by it will be considered.

1.3.2.3 To what degree do producers typically subvert the intended function of their tools and to what effect, and how are the limitations of functionality probed as was 'traditional' in so-called innovation before the software age?

In the quest to broaden the available sonic palette, many producers and engineers have used available tools in unorthodox ways. In the days of finite amounts of expensive and physically large hardware with a relatively small

range of prescribed functionality, this seemed necessary. With the current proliferation of software tools and their extended functionality, their monetary cheapness and possibly even procurement via unscrupulous means, their actual (perceived) worth could be rendered as less, to some. This profusion and its associated learning curve encourages, coupled with macro-functionality of reduced parameter sets, only superficial engagement and the immediate exploration of the 'next tool'. This hypothesis is considered within the greater enquiry of the thesis, and contextualized via case-study practical reference points, namely time stretching and the use of preset sounds.

1.3.2.4 The approach

In order to provide insight into the above foci, mixed methodology has been adopted. A semi-structured interview of a number of professional practitioners was conducted, backed up with more detailed interviews, and their responses collated and discussed. The literature is reviewed, collated, and implied conclusions formed. This is presented through a number of contextual frameworks; however, such conventional methods alone could not inform the praxis, and so crucially, hermeneutic conclusions will then be drawn directly from the studio inquiry. These aspects are triangulated with the literature, and further informed and consolidated with practical examples from the inquiry.

1.4 Objectives

This thesis is written in pursuit of a Doctor of Music award:

> The DMus (a Practice-led Doctorate) offers an alternative route from the traditional PhD for experienced practitioners who wish to demonstrate an outstanding and innovative contribution to the area of expertise. (Rigby, 2012, p.3)

As such, the primary objective is to demonstrate outstanding professional practice contextualized within an academic framework. As will be outlined below in Section 1.5, this practice takes two physical forms of artefact: principally, the production of music, but also the development of software.

1.4.1 Originality

'Outstanding professional practice' by definition need not include the full profundity of original thought or approach typical of a PhD. Rather, it must demonstrate an exemplary exposition of such work, synthesizing contemporary techniques and approaches with an 'innovative' approach.

1.4.1.1 Music

The creation of music productions lends itself to a zeitgeist-like approach, one that reflects the most contemporary tools, trends and techniques, but this zeitgeist is a transient entity, and the very duration of a doctorate necessitates a fluxive approach to accommodate the stated objectives. Some of the music has been developed reflexively[3]; revisited as and when more sophisticated tools became available, and this approach corresponds to metaphors of action research & enquiry cycle as methodologies. It also provides a good backdrop for the accompanying exegesis in that the duration of the work itself becomes a microcosm of the greater chronology of technological evolution.

[3] In some cases, over many years.

The desired outcome in this respect is to produce a musical artefact that is the product of studio inquiry. This artefact should be able to 'stand alone'[4], but also to act as an exemplar of 'a study, exploration and development of the interaction of music production techniques in a contemporary desktop setting', as discussed in Section 1.3.1.

1.4.1.2 Software

The creation of bespoke software for a particular piece of music is not an option for commercial developers, however it is commonly understood that commercial software houses constantly release new or updated products, continually extending the range of what might be achieved by the practitioner. As such, the sole-developer (who is also likely to be learning through doing) cannot compete, and there is a probability that emergent commercial products will preemptively realize the sole-developer's objectives purely by chance. In this thesis, an approach is taken that embraces contemporary practice, but does not necessarily lay claim to true originality. Instead, it reflects an appraisal of opportunities for development, and demonstrates professional practice in the implementation of custom software design to exploit these.

Although a number of software devices were developed, due to being overhauled as above, only one will be formally presented in this submission.

1.4.1.3 Self-development

The postulant has striven to learn new tools and techniques in the creation of both music and software, and the scale of these tasks was considerable. The

[4] NB In order to validate the music as standalone, it was desired to secure commercial release – see Section 1.4.1.4.

tasks in themselves represent a scholarly journey, and in that respect infer an implicit outcome of self-development, as are appropriate to doctoral study.

1.4.1.4 Publication

In addition to the artefacts 'standing alone', an objective was to publish components of the text in advance of submission in order to act similarly. Six journal articles and conference papers have been published and passed through peer-review[5] in various Audio Engineering Society and Art of Record Production fora, and these form a large proportion of this text. Due to the large volume of matching text, these have not been explicitly referenced, but the reader is referred to Appendix 11.1.2 which contains the original publications.

Both albums have been released and are widely available through commercial retail outlets.

The bespoke software was first demonstrated at the Innovation in Music Conference (InMusic'13), and an accompanying paper published in the proceedings, and later a more developed demonstration was given at the 137th Audio Engineering Society Convention in New York City.

1.5 Submission Content

1.5.1 The Artefacts

1.5.1.1 The albums

Two albums will form a practical exposition of contemporary desktop production techniques. They are constructed in an often-showcase context to explore the convergence of existing techniques and methodologies in current practice, combined with newly formed approaches, both "hybrid" and through

[5] Five of these were also submitted for consideration in REF 2014, and indeed four were selected and put forward.

the development of custom software. It is not the intention that musical elements in this submission are subject to scrutiny; in such a context, the music is merely a vehicle for the production. Clearly, this is (usually) the antithesis of appropriateness in normal professional practice; however, the concept of producer as both composer and auteur (Moorefield, 2010 referred to in Section 1.2 is an underlying theme, and as such the contribution to composition made by production might be deemed relevant.

1) The first album is entitled *The Making of Quiet Things* by The Number (Number, The, 2006), featuring Keith Tippett. It resides in the genre of Free Improvisation; however, a number of modern production techniques have been applied, which is almost unique in this genre. Part of its purpose was to provide a palette of recordings that might be drawn from[6] for the album below.
2) The second album is entitled *Something Jaggy* and is loosely in a progressive rock/electronica style, and was composed by the postulant. It features a large number of sophisticated production techniques.

The finished albums are professionally mastered.

1.5.1.2 The software

Custom software was designed in Max/MSP act as a 'developmental' reinforcement to the backdrop of pure production work. The time lag between the MPhil Proposal specification and currently available technology highlights an anachronism, as alluded to in Section 1.4.1.2. It was originally specified that the software tools would employ different implementations of a user interface based upon both a "Playstation" and a "Wii" controller to allow a new gestural

[6] With the written consent of the musicians.

control in production. The multi-touch screen has superseded these controllers, and so a custom interface for Apple iPad was designed. This facilitates a superior form of gesture control, one that loses the abstraction of the Wii, which must operate proprioceptively in free space. A multi-touch interface offers visible feedback including finite boundaries of parameters, line of sight user/controller interaction & parameter information and more.

A number of discrete tools were originally defined in the proposal for this doctorate, and as mentioned above, several of these were jettisoned; however, some were hybridized into a single much more complex tool with slightly different functionality. The final tool that was created is called The Wavefondler.

1.5.2 The Text

1.5.2.1 The exegesis

The exegesis is principally concerned with exploding and replicating the process of studio inquiry – it cross-references theory and practice, and highlights significant moments in the creative process. Case studies of particular techniques and concepts are relayed in more detail, and elements of the postulant's publications that feed the greater methodological approach are included here to empower this. The exegesis is comprised of three stages:

1.5.2.1.A **Contextual frameworks**

The stated 'secondary foci' are discussed in Chapters Four and Five. This leads towards the formation of a context that informs why and how aspects of the music production came about. These texts loosely align to the musicology of record production.

1.5.2.1.B **The studio process**

Based upon the above, Chapters Six and Seven offer practical perspectives of the technologies & methodologies employed, and they will endeavour to increase the reader's understanding of the creation of the productions by offering details of the development of the project.

Due to the numerous mentions, in the interests of uncluttered text, the albums and tracks will not be referenced in every instance, but instead only referred to in any ambiguous contexts.

1.5.2.1.C **Consolidation**

The previous two sections are then consolidated by dialectical discussion and conclusions in Chapters Eight and Nine.

1.5.2.2 Format

In order to best facilitate such representation, this text is presented in both hard copy and an interactive PDF format, plus software; see Section 1.6.12.

- *The Making of Quiet Things* is presented as an audio CD[7], its original release format. Something Jaggy is submitted as 24-bit/44.1 kHz WAV files.
- A video demonstration of the self-designed software was created.
- No optimized sessions are provided.[8]
- The electronic component of the submission is on USB stick.

[7] Although the release of the album The Making Of Quiet Things predates this submission, authority to include it was granted by the University during transfer to DMus registration.

[8] The DMus in Music Production course specification requires optimized session files to be submitted alongside finished audio; however, the postulant originally enrolled in a DMA, which did not have this requirement; transfer was in 2013. Since much of the audio was completed by this point, UWL dispensation was granted to omit this part of the formal submission requirement.

1.6 Outline of chapters

1.6.1 Abstract

Self explanatory.

1.6.2 Chapter 1 — Introduction

The introduction establishes the field and asserts the studio inquiry as relevant to the stated outcomes. It then outlines the research foci and objectives, and identifies the practical artefacts. Its function is also to establish a hierarchy of themes and working trajectories that are addressed within the research. The chapter then concludes with synopses of the constituent chapters of the thesis.

1.6.3 Chapter 2 — Literature and Practice Review

Unlike the traditional text-based ‘literature review’, the performative research paradigm also requires a review of practice. Literature and practice are initially examined individually, but later in the submission are hybridized into an exposition of the subject area with a view to placing the thesis in its greater context.

1.6.4 Chapter 3 — Methodology and technical framework

Haseman’s (2006) performative research paradigm is utilized as an interface of practice and research, and this framework is contextualized with reference to production. The preceding chapter concatenated approaches in practice and discourse, and here, this intertextuality is now built upon to justify choice of both working methods and the technologies employed in the studio inquiry. A personal context of the greater study is offered, and ethical considerations in studio inquiry are discussed and related to the methodologies.

Lastly, the contextual frameworks presented in the following two chapters are introduced.

1.6.5 Chapter 4 — Contextual production frameworks

This chapter offers ontological discourse around the secondary research foci of Sections 1.3.2.1 and 1.3.2.2, taking a chronological approach in order to provide the widest context. It firstly considers the notion of innovation and the form that it might take in production, and then highlights a number of landmarks that influenced the practice in this submission. As a foil to the extensive mediation in much of the practical submission, it then synthesizes the views of a number of professional producers who consider ‘traditional’ production values and links this to a perspective on perceived authenticity.

1.6.6 Chapter 5 — Contextual technological frameworks

Three case studies aligned to the practice of this submission are considered in order to illustrate the secondary research focus of Section 1.3.2.3 and contextualize subsequent ‘development’ with regard to the primary research focus. The first section investigates the implications of using the presets found in typical studio tools. Such presets have consciously been avoided in the practical work herein, and further, the notion of the preset has been extended in the implementation of the Wavefondler software. The next section considers the concept of time stretching, and looks at both a historical perspective of this process and the spectromorphological implications of deliberately creating artefacts through excessive application of the algorithms, a technique employed extensively in *Something Jaggy*. Finally, interaction with audio visualizations is traced from its inception as relates to the concept of the Wavefondler design, and these will contextualize the operation and functionality

presented in Chapter Seven. Brief extrapolations as to how some of these technologies might evolve in the future are offered.

1.6.7 Chapter 6 — The Studio Process: *The Making of Quiet Things* and Wavefondler

After a brief contextualization of the genre of Free Improvisation, a selection of notable technical highlights of the titled album are presented with a view to offering insight into their creation and application. This is contextualized through reference to a number of examples of both theory and comparable practice. A number of audio examples are included. The implementation of The Wavefondler is then presented, although low-level operational detail is avoided. Various aspects of its concept and implementation are offered, followed by an overview of its functionality and operation.

1.6.8 Chapter 7 — The Studio Process: *Something Jaggy*

Here, a selection of the production techniques applied in the creation of this album are presented in a track-by-track manner. This chapter focuses on operational detail in order to illuminate notable aspects of the process. A number of audio examples are included.

1.6.9 Chapter 8 — Discussion

This chapter discusses the practical aspects of this submission. It considers the significance of the work and how the studio inquiry revealed aspects of it that could not have been so apparent if considered through other modes of research. It highlights how existing practice has been extended and includes brief personal reflections on each principal artefact. Aspects of the research are placed relative to existing theories.

1.6.10 Chapter 9 — Conclusions

Firstly, the pertinence and significance of the project are reiterated. This chapter then considers the implications of the project, and makes reference to a number of developing technological trajectories. The limitations of the research process are discussed. The chapter closes with a final reflection on the research foci.

1.6.11 Chapter 10 — Appendices

A range of supplementary information is presented here, including the full text of the postulant's peer-reviewed publications that contributed to the thesis.

1.6.12 Beyond text – the electronic submission

All of the above chapters are also incorporated into an interactive multimedia environment, a PDF created in Adobe Acrobat Pro, which is presented on the supplied USB stick. The full text is replicated in this PDF and where appropriate – in Chapters Six and Seven, the PDF also features in-situ excerpts of audio that demonstrate aspects of the creative and technical journey through the productions. The most immediate experience will be obtained from reading and engaging with the PDF, at least for those chapters. To do this, the free Adobe Acrobat Reader[9], version 9 or newer, must be used since most other PDF readers such as Apple Preview do not support the necessary Adobe PDF layers.

It can be seen that each audio file has its own dedicated transport bar. Double-clicking on a link, e.g. — Audio Excerpt x.y — will play an MP3 (the best quality supported format in Adobe PDF whilst still allowing transport control).

[9] Available from https://acrobat.adobe.com/uk/en/products/pdf-reader.html.

Where multiple references to the same audio file are made, each link will trigger it from a different time location that is relevant to the text at that point. The visible page may jump to highlight the appropriate transport bar. Once the audio is triggered, the transport bar must be used to stop playback, but can also be used for further navigation through the audio file, although a given file will likely contain only a finite excerpt.

In the interests of concision in the Appendices, clicking the designated links will reveal the full peer-reviewed publications. These papers will open up as new PDF windows and might overlay the main text, but it will remain open underneath. The PDF also contains an interactive index of document headings for ease of navigation. View 'Bookmarks' in the sidebar to utilize this.

The USB stick also contains:

- ‘AudioVideo Excerpts’ – a separate folder for the audio and video excerpts (although these are also actually embedded into the main PDF)
- ‘PDFs’ – a folder for the individual PDFs that are linked from the Appendices
- ‘Something Jaggy’ – a folder for the tracks of the album *Something Jaggy*, as 24-bit/44.1 kHz WAV files
- ‘Wavefondler’ – a folder that contains:
    1. ‘The Wavefondler.maxpat’, which can be opened with the Max/MSP application (if installed) to view the construction of the software
    2. ‘The Wavefondler Movie’, an MP4 version of the Youtube movie (link in Section 6.2.2)
    3. ‘The Wavefondler’ application, which can be opened on a Mac (only) – this application can be used to inspect the software too, but does not require Max/MSP to be installed; the red objects are clickable subroutines. It also allows operation of the patch with the demonstration drum loop, but requires the Mira app to be installed on an iPad.

2 Literature and Practice Review

Every age has its own perfect fidelity.

(Sterne, 2003, p.222)

2.1 Literature

2.1.1 The developing knowledge base

Whilst Eisenberg (2005) and Zak (2001) have written retrospectively on the work of the recordist, little primary analysis has been performed on music production from the creator's perspective as a project is realized. Academic writings on the theory of the practice traditionally came only as secondary outcomes of disciplines within musicology, technological development, undergraduate education or elsewhere. Burgess (2002) published the first discourse that attempted to bridge between theory and practice with an inflection towards the business side of production, and Hepworth-Sawyer and Golding (2010) provided a further broad overview of the producer's role. Moylan (2007) developed a system for categorizing and notating studio production values with the focus on applying this to completed mixes.

Since its inception in 2005, the Art of Record Production (ARP) conference series has attempted to address this praxis directly. (Hill, 2005), (Carter, 2005) and (Kvifte, 2005) all proposed a 'Musicology of Record Production' in different ways[10], and an architecture proposed by Zagorski-Thomas (2007) suggests a model for all to move forward in unison whilst debating and establishing the (then) new boundaries. Frith and Zagorski-Thomas (2012) collated a number of

[10] At the inaugural Art of Record Production (ARP) conference, London 2005.

(then) new boundaries. Frith and Zagorski-Thomas (2012) also collated a number of perspectives with reference to historical and theoretical approaches, compounded by case studies & practice with contributions from professional practitioners. Zagorski-Thomas (2014) later consolidated the musicology of record production, drawing aspects of different disciplines such as sociology, using metaphors such as actor network theory and embodied cognition to contextualize music production. Although some ARP papers do address practice as research, the vast majority of publications are retrospective and with a musicological slant. This thesis will adopt this timbre in places; however, it will also exploit the opportunity to develop this by linking it directly to the practice associated with the artefacts of the submission..

Aligning with the musicology of record production and published via the Audio Engineering Society (AES), a mildly ontological approach was taken by Paterson (2011a, 2011c, 2011d, 2012b). These directly address the secondary research foci of this thesis and place them in a historical context, an approach given value by Manning (2013) and Holmes (2012), and indeed Chanan (1997) relates such time-stamping directly to listener experience and perception.

2.1.2 The Journal Dichotomy

Much has been written on cutting edge technology, for instance in the fora[11] offered by the AES, although by definition, such technology is often yet to be disseminated and applied practically, and so its functional application is only anticipated and its artistic ramifications speculated upon.

[11] Its Journal, and the proceedings of both its Conventions and Conferences.

Although authors like Durant (1990) bemoaned the lack of academic practice-oriented literature, this historical perspective of the literature is now largely superseded and there are extensive writings on the methodology of music production in numerous books e.g. (Owsinski, 2009), (Izhaki, 2011) and (Lellis Ferreira, 2013). These typically focus on treatments of specific techniques, albeit isolated from any specific context. Due to the fast moving development of commercial software tools, in this regard publication lead times tend to render books out of date quickly, and so such developments are often introduced through periodicals.

The *Computer Music Journal* is generally oriented towards device or system-specific algorithms; and it rarely explores the creative implications around production. Further, the *Journal of New Music Research* takes a scientific slant, and again rarely forays into production. Electroacoustic music has a number of journal representations, for instance *Organised Sound*. The *Journal on the Art of Record Production* continues the ARP scope and provides a forum for articles of greater depth, and has developed into a substantial knowledge base.

There are both professional and consumer periodicals such as *Sound on Sound*, *Resolution* and *Audio Media*, which although providing regular up to date articles on professional practice, are not peer-reviewed and therefore are not ideal as academic sources. Despite this, these are proving to be a valuable supplementary repository of discourse on professional practice for many academics. The range of articles might include retrospective analysis of productions, interviews with leading practitioners with primary accounts of production details, and analysis of case studies in progress. One good example

of this is *Secrets Of The Mix Engineers: Michael Brauer* (Tingen, 2008) in which Brauer discusses the mixing of Coldplay's *Viva La Vida* (Coldplay, 2008) using his trademarked 'Brauerize' multi-bus compression technique. Brauer also maintains a 'Q & A' section of his website in which he details many of the relevant techniques within his practice (Brauer, 2014). There are many such online resources, and they are increasingly relevant in presenting professional (although sometimes less so) practice.

Many contemporary academic writings (and doctoral submissions) on the subject of music production seem to embrace the need to cite 'popular' sources of information. Just one example of this is Bennett (2009) who synthesizes numerous references from consumer periodicals, television documentaries and books into an article in the *Journal on the Art of Record Production*.

2.1.3 Parallels

As will be discussed, a characteristic of the practice in this submission is bricolage, where at times a conscious effort was made to utilize readily accessible pre-recorded audio, and as a discipline, this was used in preference to searching for a 'more appropriate' excerpt or indeed making a bespoke recording of a conventional performance. Such an approach provided a foil for the subsequent production shaping to be a creative driver. To this end, Yockey (1998) developed a metaphor from art presenting the producer/composer as a bricoleur, and this metaphor is embodied in the practice here.

In film, Sonnenschein (2001, p.56) noted that Cocteau's "accidental synchronization" (of music for cinema) was frequently serendipitous. Aleatoric music is long established, but beyond establishing a process to be followed, the spirit of Cocteau was adopted here when auditioning excerpts for the bricolage.

Although often alluding to the themes of this submission, Porcello and Greene (2004) consider the application of technology in non-Western contexts, but do this from an ethnomusicological and ethnographic perspective. Von Seggern (2005) discusses the potential of the laptop in music production, but has a primary focus in live performance. A number of books have addressed historical and cultural perspectives and implications of production, one example being *Living Stereo* (Theberge *et al.* (eds.), 2015) which traces the evolution of multi-channel sound, and Massey's (2015) insight into the classic UK recording studios.

2.1.4 On Production as Composition

One of the cornerstones of this thesis is that of the producer utilizing the capability of the recording environment to act as composer. At numerous times, commitment to such processes could lead from dozens to hundreds of repetitive tasks in a single channel of audio, however although focused specifically on jazz, Brown (2006) used the writings of Cage, Varèse and Lewis to describe composition as advancing through electronic augmentation, unafraid of any resulting complexity, and it was in this spirit that industry prevailed. Rudy van Gelder was splicing tape to create hybrid jazz performances in the 1950s (Skea, 2001), so if not composing, then certainly arranging. In fact, M. Katz (2010, p.188) asserts that throughout its history, the act of recording has guided music, and said, "recording does not simply record", the implication being that the process is creative, and again, this provided a guiding doctrine that was applied beyond actual recording to a more generalized DAW-driven creation. Moorefield (2010) amplified Zak's (2001) view

that production can indeed be considered composition and also presents the producer as an auteur, and offers an extensive argument to this effect.

In the context of Electronic Dance Music, Gilbert and Pearson (1999) discuss how older technologies such as turntables and vintage instruments can find new and innovative applications when placed in more modern electronic styles, and concentrating on the sampler as a compositional tool, Harkins (2010) builds on Kvifte's (2007) four modes of sampling (although these rather disregard its use as a sonic manipulator). Perhaps akin to arrangement in the jazz-age, remixing might be also considered as a profound creative act (Tankel, 1990). Although no actual remixing features in this submission, it does offer relevance since another element that weaves a connection between a number of the tracks presented in this submission, is that of recycling audio.

In Cox and Warner (2004)[12], Oswald argues the case for 'plunderphonics' – a doctrine that legitimizes the repurposing of previously released audio, even whilst under copyright restriction, and Miller (2008) broadens this philosophy towards DJ practice with a cultural perspective. The sampling of others is of course widespread, established and 'accepted' across many current genres of music, however the notion of musical self-referencing predates this through jazz and back to the classical era, with signature motifs recurring in different opuses of a given composer. In this submission, in some cases a finite palette of a number of performances have been heavily edited and reused across a number of separate tunes in different contexts leading to dissimilar musical results. Here, this approach will be referred to as iteraphonics[13]. It does align in part to

[12] Plunderphonics was first published in in MusicWorks 60 (Fall 1994).

[13] From the Latin iterare – 'to repeat'.

the existing Electronic Dance Music (EDM) sampling taxonomy proposed by Ratcliffe, particularly: “Short, isolated fragments: pitched elements used as a basis for new musical material” and:

> short, isolated fragments: non-musical sounds recontextualized as individual notes or events within a phrase or sequence. (Ratcliffe, 2014, pp.101–102).

Whereas Ratcliffe draws from the established language of electroacoustic music (specifically that of Emmerson and Smalley), in EDM the techniques are typically applied to one, two or occasionally four-bar phrases, but instead, in the productions submitted here such techniques extend to entire performances, sometimes over 10 minutes long[14]. As such, new virtual performances are created, with no audible connection to a loop-based approach, hence warranting a new descriptor.

Enhancement of musical performances through editing is detailed by Savage (2005), and the concept is taken further by Keep (2005) who alludes to “Creative Abuse” in production; a lateral application of the intended function of a given tool. It could be argued that Emmerson’s (1986) mimetic discourse is an appropriate paradigm to describe the replication of human performance through manipulation as employed in this submission – this is a major production aesthetic of the practice.

2.1.5 Workflow

A recurrent theme in the practice that leads this inquiry is that of process, including sub-texts of workflow and the user’s interaction with complex suites of software, and indeed how this leads to a specific range of results.

14 Such run-times are more commonly the case in the so-called art music.

Théberge (1997) discusses the link between musicians' output and the capabilities of their tools as offered by contemporary manufacturers. Zagorski-Thomas (2014) considers this in more detail, whereas Marrington (2011) considers the impact that the Digital Audio Workstation (DAW) has on the creativity and compositional process through case-studies of a number of students. Whilst these various studies take a third-person overview of the salient processes, this thesis does not document or attempt taxonomy, but instead demonstrates the concatenation of successive applications of production techniques through iterative audio examples, elucidated with commentary.

Some such workflows have previously been analysed, for instance when the postulant produced a detailed comparison of functionality and implied workflow across a number of professional DAW platforms specifically with regards to audio quantization (Paterson, 2008). Draper (2012) also considers such functionality and discusses how studio improvisations might be re-appropriated, and Jago (2013) discusses how jazz was first exposed to studio mediation, again both core themes of this submission. The postulant also developed a number of specific techniques for creating and manipulating percussive performances in this submission, and these were disseminated to peers (Paterson, 2014, 2011b, 2012a, 2013a, 2013c).

2.2 Audio

The cited audio examples that follow represent cadence points in the application, development and cross-pollination of production technology, all of which have influenced this submission.

Building on the earlier tape-based work from musique concrète, Cage (1952) introduced the notion of (what is now often referred to as) hyper-editing in his piece, *Williams Mix*. Although aleatoric, in principle this deviation from the linearity of music was to have a profound impact on future studio approaches. The Beatles' (1966b) track *Tomorrow Never Knows*, brought an ordered application of such techniques to popular music. Progressive studio production techniques such as more 'creative' tape editing and effects came to jazz with *In a Silent Way* and *Bitches Brew* (Miles Davis, 1969, 1970), although even earlier was the radical use of stereo in Ornette Coleman's *Free Jazz (1961)*.

In 1972, Davis' producer Teo Macero extended the tape-editing approach to early funk-based grooves with *On The Corner* (Miles Davis, 1972). This spirit was continued in Bill Laswell's 1998 reworking of Davis' albums of that time to create *Panthalassa: The Music Of Miles Davis 1969-1974* (Miles Davis, 1998). This represented a second-generation creative mediation, both tonally and structurally.

Whereas Davis & Macero had conducted their work with 'related' ensemble performances, Frank Zappa drew from Cage's turntable piece, *Imaginary Landscape No.1* (1939) by adding previously unrelated musical parts together in the multi-track domain, for example in the tracks *Keep It Greasy* and *Rubber Shirt* (Frank Zappa, 1979a, 1979b). DJ culture and the use of the sampler in the

digital age made such approaches commonplace to the point of ubiquitous in many electronic dance-related genres. One example relevant to this thesis is Amon Tobin's (1997) *Bricolage*; beyond just its name, this album is notable because of its application of such editing and layering-based workflows to a jazz-oriented aesthetic.

Following the introduction of MIDI in 1982, sequencing came to dominate many areas of popular music, by definition a succinct art form, although often with much technical detail buried beneath outward simplicity. In a parallel approach however, and inspired by Conlon Nancarrow's unplayable (for humans) pianola music, in 1986, Zappa released the Synclavier-based *Jazz From Hell* (1986) in which complex pieces were programmed in step-time from a MIDI score editor (Zappa and Occhiogrosso, 1990). Through the 1990s, sequencing developed in the genre of Intelligent Dance Music (IDM) with a number of artists such as Autechre, Aphex Twin and Squarepusher exploring the technical boundaries. Aphex Twin's *Omgyjya-Switch7* (2001) is a track that typifies this movement.

Although the electroacoustic music establishment has long developed bespoke software to drive or create compositions, Brian Eno is widely regarded as a pioneer of applying Sseyo software to contour what he dubbed 'generative music' – a machine-controlled/user-influenced increment in the evolution of sequencing (Eno, 1996b). Autechre also extended the idea of bespoke tools in IDM to Max/MSP software design, an example being the generative track *Reniform Puls* (2003).

In parallel, as the DAW became ubiquitous, new levels of integration between (edited) audio and MIDI became commonplace. Many albums

combined virtuosic performances[15] with processed audio and sequenced backing tracks, e.g. *Krunk Jazz* (2006) by Russell Gunn's Bionic, but albums such as Lamb's *Fear of Fours* (1999) and the collaboration between Robert Miles and Trilok Gurtu (2004) demonstrated maturity in this regard, with fine human performances seamlessly blended with sequenced components.

Squarepusher's (2012) *Ufabulum* and the Autechre album *Exai* (2013) feature highly-detailed MIDI programming in more contemporary music, and Skrillex's *Bangarang* (2011) demonstrates technical complexity in a more commercial setting. In stark contrast stylistically, Richard Skelton demonstrates controlled manipulation of acoustic recordings (Skelton, n.d.) with a classically-influenced inflection e.g. *Noon Hill Wood* from *Landings* and *Ivystrung (Richard Skelton, 2010, 2013)*.

[15] Often derived from the technical complexities of the jazz idiom.

2.3 Custom designs and software

Electroacoustic musicians have long-employed custom designs of electronic instruments and interfaces to aid their performance and composition. Dean (2002, p.1) points out: “a performer may develop multiple novel and transforming instruments, whether for purposes of composition or improvisation”, but such practice is less ubiquitous in more 'accessible' styles. Artists such as Autechre (2013), Tim Exile (2013) and Leafcutter (2014) and are currently popularizing mediation in this context with bespoke designs in Max/MSP, Reaktor and hardware. Offshoots from academia in the form of commercial start-ups and crowd-funded projects are increasingly common, and many can be found in the non-peer-reviewed Music Tech Fest[16]. Examples of such projects that also gain general academic acceptance include the user-programmable guitar effect pedal (Webster *et al.*, 2014) and McPherson’s (2014) multi-touch keyboard overlay. The *New Interfaces for Musical Expression* (NIME) (2015) website has a large repository of conference papers covering both hardware and software innovations.

Commercial software pertinent to the design presented in this submission is discussed in Section 5.3.

[16] See http://musictechfest.org/.

3 Methodology and technical framework

No aspect of human life, be it music, medicine, or technology, can be adequately discussed if we are always restricted to a scientific mode of discourse.

(Pacey, 2001, p.33)

3.1 Methodology

Haseman (2007) formed the ideal research methodology for this project, that of performative research. Haseman argues that performative research can exist as a third paradigm alongside the classic quantitative and qualitative, a multi-method paradigm that is optimized for practitioner-research. The premise is centred on its expression:

> … in non-numeric data, but in forms of symbolic data rather than in words in discursive text. These include forms of material practice. (Haseman, 2007, p.151)

Further:

> ... when research findings are made as presentational forms they deploy symbolic data in the material forms of practice; forms of still and moving images; forms of music and sound; forms of live action and digital code. When a presentational form is used to report research it can be argued that it is in fact a 'text' – in the way that any object or discourse whose function is communicative can be considered a text – and should be understood as such within the qualitative tradition. (Haseman, 2006, p.102)

Typically, the necessary mixed-methods that are utilized to augment the performative paradigm include the enquiry cycle and reflective practice, yet crucially these are consolidated with methods specific to practitioners in a given discipline, in this case music production. This provides a powerful and adaptable strategy that also allows the artistic artefacts (albums and software) to communicate in their own right, going beyond the mere textual or numerical.

Accompanying the artefacts with an exegesis reinforces this strategy. Crucially, beyond its traditional explanatory/interpretative connotation, this allows the performative researcher even greater latitude over which to convey the full meaning and implications of the work – specifically its process, rather than just replicating meaning that is implicit in the end-artefact. Barrett elaborates further by presenting the metaphor of exegesis as meme. She contests:

> The evolution, stability and successful application of ideas and knowledge derived from research depend on how well such knowledge is replicated and understood by others. However, the replication mechanisms that have traditionally valorised and validated creative arts practices have focussed on product rather than process. Moreover, such mechanisms have tended to rely on the mystification of artistic products as commodities rather than an elucidation of creative arts practices as alternative modes of understanding the world and of revealing new knowledge. (Barrett, 2007, p.160)

It is also important to contextualize this thesis by offering a chronological perspective to the secondary research foci; only by doing this can their currency be evaluated. Consequently, the convergence between such ontological/epistemological perspectives (as are presented in Chapters Four and Five) and the technical methodologies of Section 3.3, plus the specific techniques detailed in Chapters Six and Seven will converge to underpin and form the exegesis. As such, the exegesis in the context of this project allows the unique 'inside perspective' of the contemporary creative process to be placed, disseminated and understood by others, thus augmenting the artefacts themselves.

Vernooy-Gerritsen (2009) introduced the concept of Enhanced Publication; this allowed media such as video and data sets to augment traditional textual formats. This developed into Research Objects, "semantically rich aggregations

of resources" (Bechhofer *et al.*, 2010, p.1), which are often favoured by the software development community, and allow the use of code and other artefacts to be presented and linked for the communication of research. In the spirit of these methodologies, an electronic document is submitted here alongside the traditional hard copy to facilitate multimedia intertextuality. This document is a multi-layered Adobe PDF. It contains links to other media embedded in its text.

3.2 Justification of Choices

3.2.1 Approach and technologies

Beyond the methodology, it is necessary to explain the reasons for the choice of approach and technologies. The DMus requirement is for the creation of "a portfolio of recorded music, 120 - 140 minutes in duration" (Rigby, 2012, p.25), which aligns with two complete albums. It was felt that two technically contrasting projects could offer the broadest range of academic discussion. *The Making Of Quiet Things* (Number, The, 2006) is an album that was recorded naturalistically, then enhanced and subtly[17] processed through studio technique. *Something Jaggy* is a highly produced hybrid of recording, sequencing and processing; however, due to the much more extensive level of mediation in this album, it naturally attracts more commentary. Between the two, a useful bipolar study is formed.

With regard to the title of this thesis, "contemporary desktop production" implies a particular set of tools – primarily music production software. A wide range of software has been employed, and its functionality concatenated and

[17] In general.

converged. "Study" has two connotations. The first is a contextual study relating to the research foci, as will be further explained in Section 3.7. The second relates to a study of the application of tools and the extension of the postulant's techniques as will be referred to in Section 3.3; indeed, this also segues into the word "exploration". Lastly, "development" was taken not just to refer to the above, but also to generate tools with new functionality, not currently available commercially.

3.2.2 Genre

Mainstream jazz has long attracted the highest production values, from the classic 1950s recordings of Rudy Van Gelder to the recent Grammy award-winning *Life In The Bubble* (Gordon Goodwin's Big Phat Band, 2014), recorded and mixed by Tommy Vicar. *The Making Of Quiet Things* however, lies in the genre of free improvisation. Such music tends to be played by highly evolved musicians, yet due to its niche in the greater field of jazz does not attract budgets that allow mainstream studio production, and further, practitioners in the genre have typically resisted studio mediation. As an academic project largely free from commercial pressures, it was desired to afford such production to this album and extend the sonic palette in a sympathetic fashion.

By contrast, *Something Jaggy* offers a platform for maximum mediation and manipulation in a highly synthetic-sounding genre, drawing from progressive rock, electronica, cinematic sound-design and jazz – all styles that are tolerant of manipulation to varying degrees. Albums such as *The Foley Room* and *ISAM* (Amon Tobin, 2007, 2011) demonstrate a sophisticated fusion of desktop techniques, albeit in a different setting, and prove that listeners can be accepting of such hybridization. It could even be said that it is the mediation and

placement in the hybrid context that precipitates listener engagement with otherwise alien genres.

3.2.3 Self development

The postulant was already experienced in many aspects of studio production, however the creation of the material for this thesis also provided a multidimensional platform for self-development, as is appropriate to doctoral study. The self-imposed disciplines within the project offered significant challenges that might have been sidestepped in any equivalent commercial undertaking. As such, the overall approach is well suited to submission towards a DMus in Music Production.

3.3 Technologies, Studio Methods and Assumptions

Of creative arts investigation in the broadest sense, Barrett (2007, p.191) states that “the materials[18] and methods used in the studio form part of the enquiry itself” and for this reason recommends an overview of these, with a focus on innovative application. Application of technology will form a discrete component of the exegesis in Chapters Six and Seven, but just to contextualize, a broad insight into the studio methods will be offered here.

It should first be understood that *The Making Of Quiet Things* is an album that was recorded naturalistically, then enhanced and subtly processed through studio technique. Something Jaggy is a highly produced hybrid of recording, sequencing and processing.

[18] "materials" in this case are analogous to technologies in the context of this thesis.

3.3.1.1 Recording

A wide range of approaches to recording was employed. To create *The Making Of Quiet Things*, a four piece jazz band was recorded improvising spontaneously via a Pro Tools HD interface, to 24 tracks via an Otari analogue console. The musicians were largely separated into different rooms with video links and acoustic screening as required. A large number of microphones were employed. High-end ones in a conventional sense according to standard industry practice – considered microphone placement with close attention to tone, phase coherence, acoustic separation etc. Alongside these were some more radical microphone choices (e.g. headphones) and a number of unusual placements such as close mic'ed cymbals.

Best recording practice often assumes that the best phase coherence for stereo and multi-microphone recordings will be achieved through long-established approaches to placement; however, these latter microphones were intended to offer challenges to this. Further, clean signal paths, carefully managed gain structure and hi-end ADCs are considered essential for accurate capture of audio information – such an established approach was adhered to for this album.

In contrast to this, most original recordings for *Something Jaggy* were simple mono or stereo single-instrument overdubs captured with portable interfaces. These ranged from the use of professional microphones to the budget one that is built into a trumpet mute, the internal laptop microphone and even a pair of headphones acting as a quasi-binaural microphone, as well as DI'ing. The alternative approaches were employed either as artistic choices or where subsequent processing was expected to be so extreme that in something

of a statement, source quality became less relevant. ‘Anti-theory’ was also employed through the use of moving microphones to achieve natural phasing effects, SPL overloading and low signal-to-noise ratio.

When ‘lower quality’ recordings were made it was hoped that the re-purposing or subsequent processing of the audio would forgive what would be conventionally perceived as shortcomings, and ultimately yield a satisfactory result that the spirit of bricolage and iteraphonics might salvage. It was accepted that certain recordings might not function in the context for which they were originally intended, and that considerable mediation might be required to help them function at all.

Most commercial recording is done directly into a DAW with a high-end interface. Typically, high sample rates are used for optimal quality. With a focus on mediation and conforming to the discipline of the desktop environment, recording for this thesis was done at 44.1 kHz in order in order to offer the greatest proportion of CPU cycles to processing whilst still retaining reasonable quality. Arguably, this decision has the greatest impact when applying the extensive use of time stretching as was the case in this project, however since this was often employed to creative effect as a tool of timbral generation, the subsequent artefacts were not deemed a problem.

3.3.1.2 Sequencing

Fastidious MIDI sequencing was employed extensively. MIDI was used to control commercial synthesizers and ROMplers, custom-built sampler instruments, self-designed Reaktor instruments, self-designed Max/MSP instruments and MIDI-controlled effects. Sequencing approaches ranged from emulation of humans, extended hyper-editing and automated extraction of pitch

information from audio, as well as more conventional real-time recording and step sequencing.

Sometimes, hyper-editing approaches were used to generate new timbres by repeating notes so rapidly that frequency modulation was introduced. Many performances were manipulated and nuances applied by associating articulations with specific MIDI channels and manually adjusting the channel numbers of individual notes in order to action both articulations and klangfarbenmelodie. MIDI control changes were used extensively and in tandem with native automation to both create the subtle emulation of human performance through conventional application of modulation, through forming metaphors for human performance through synthetic timbral manipulation, and to generate morphological strings to the effect of that applied by Blackburn (2009). Polymeters are a significant stylistic element, and often these were also applied to multiple control signals operating on unrelated sequences of notes.

In *Something Jaggy*, very few if any notes were actually unmediated, in the spirit of Moorefield's (2010) auteurism. MIDI sequences were often bounced into the audio domain and manipulated – both temporally and spectrally. Sometimes the manipulated audio was then sliced and re-sequenced with a sampler. As a performance aesthetic with MIDI instruments, man both emulated machine, and machine emulated man.

It was assumed that with sufficient consideration, industry and technique, desktop-driven MIDI performances could be shaped to offer performance expression and detail that could sit comfortably alongside evolved human performances. It is commonly understood that the mindset of the programmer differs from the live trajectory of the performer. Here, synthetically imposing

(almost) all of the nuances of performance through the non-real-time programming environment offers a natural impediment to fluidity. Further, it is hoped that the self-imposed discipline of total auteurism is not detrimental to music that originally carried multiple personalities.

3.3.1.3 Editing

Audio editing was taken to an extreme and in *Something Jaggy* there was no unmediated audio. Not only were there a large number of wide-ranging corrective issues to resolve, but editing was at the heart of the creative impetus in order to control the implementation of the bricolage and iteraphonics. Editing was carried out in four modes, two of which were in the time domain, those being: 1] macro – 'normal' slicing and moving of regions, 2] micro – including extensive audio quantization and the rephrasing of performances, and 3] timbral – where the techniques developed by Paterson (2011b) were utilized and developed further as a tool of sound design. The fourth mode was spectral, using tools such as iZotope RX2 and Melodyne DNA. One example of this might be how the valve clicks in a recording of a muted trumpet were removed without affecting the time line.

If played by humans, most human-sounding performances on the album are reconstructions derived from performances associated with different compositions (sometimes more than one) often on a note-by-note basis, with a density reminiscent of Cage's *Williams Mix* (Holmes, 2012).

Editing was also used to more subtle effect in *The Making Of Quiet Things*, and in the spirit of free improvisation, was employed to extend naturalistic human virtuosity in occasional passages, both in a corrective capacity and to tighten certain phrases. In contrast, it was also used to increase the authenticity

of the programmed emulation of humans in *Something Jaggy*. The creative applications of the spectral mode were not just to shape the gestures, but manipulation was carried out at a harmonic (i.e. overtone) level, whereby individual harmonics were manipulated in terms of their dynamics, pitch & glissandi, formants and timing in order to generate 'new' performances and accompaniments. The boundaries between 'editing' and 'processing' are not very clear at this level.

Again it was assumed that with sufficiently dexterous and persistent mediation, the bricolage and iteraphonics could create something worthy – clearly there was an element of risk here. Further, it was assumed that the editing would be transparent where necessary, and ostentatious where appropriate, and that both would be sympathetic to the context. Over the time span of this submission, editing tools developed dramatically and whilst newer tools yielded more sophisticated results, it was hoped that these would not expose the shortcomings in earlier work that had not benefited from them.

3.3.1.4 Mixing

Technically, the mixing of *The Making Of Quiet Things* was conventional in that it drew from mainstream popular music; however, it was its application that was novel. The genre of Free Improvisation does not generally engage in creative and nuanced aspects of mixing such as the automation of effects for specific musical statements. Further, automation was also used as a virtual conductor, shaping the dynamics of sections of the music in order to define them beyond their original performance. It was hoped and assumed that both the musicians and the audience would be accepting of the result.

In *Something Jaggy*, the approach was very different. Highly synthetic and dynamic textures were created from application of nested automation throughout the signal path. Sessions were typically around 70 tracks deep, and so numerous sub-mix strategies were applied. Most of the tunes went through their production phase in Logic Pro, but were mixed in Pro Tools. This approach involved committing many mix decisions to the audio that was bounced out for transfer, and it was hoped that all of these decisions would continue to be appropriate throughout the remainder of the mixing process. Final mixing took place in a hardware studio of much lesser track count (for its superior sound quality), and this transfer again incurred considerable commitment to bounces, a modern metaphor relating to the workflow of The Beatles 50 years earlier (Everett, 1999). Numerous advanced techniques were applied, some of which will be highlighted in Chapter Seven.

. A common production strategy is to first ensure that the musical arrangement interweaves sympathetically, not least to offer less resistance to a transparent mix. In *Something Jaggy*, musically dense arrangements were a considered feature and a self-imposed discipline despite such arrangements being much harder to mix successfully. An unflinching approach to maintaining this was attempted, using combinations of EQ pockets, side-chaining, panning and automation. The assumption was that again, with sufficient industry, a professional-sounding mix could be created despite this density.

3.3.1.5 Processing

The processing of audio was an essential mode to this work. It is the nub of creating Moorefield's reality of illusion (2010, p.xiii) and further, allowed extension of production technique and broadened the available sonic palette. In

The Making Of Quiet Things, processing was minimal in the name of mimetic authenticity. Corrective processing was applied in places, and occasionally dramatic artistic licence was taken, for instance when taking a pianissimo section of drum kit performance and applying enormous compression and make-up gain, something never previously done in that genre.

In *Something Jaggy*, processing was applied to completely subvert the original meaning of certain performances, recontextualizing them iterphonically. Zagorski-Thomas (2014, p.82) affirms that such processing "can enhance and perhaps even change the meaning of a performance". In some cases and out of necessity, processing was applied iteratively over long periods of time and in different DAWs, and this gave rise to some highly synthetic textures. Whilst some ultimately proved unsatisfactory, yielding to this sonic life force also proved an interesting discipline to embrace, sometimes attracting even further processing in order to optimize pieces of audio that were placed in a new setting. This processing will go beyond Zagorski-Thomas' slightly tentative statement and profoundly assert change of meaning.

It should be pointed out that 'processing' in this context does not just refer to the application of effects, but rather complex families of hybrid operations applied in specific orders. One 'typical' example might be to spectrally isolate the second harmonic of a guitar note, increase the amplitude of its natural vibrato, time stretch the harmonic beyond the length of the original note to create interference between the differing vibrato rates. Then, treating the note as a whole once again, stage it with a custom effect chain before printing to audio, adjust the formants and then time-compress back to the original note length, and then the result used to replace the original note. Such a convoluted

spectromorphological process was not an isolated incidence and further it was bespoke to each note in its own context. Different manipulations of this nature were conducted in a plethora of such bespoke processes, hundreds of times overall. "The contemporary producer is an *auteur*" (Moorefield, 2010, p.xiii).

It was assumed that such complex and time-intensive mediation could still yield musical, coherent and sonically interesting results, despite this going against the spirit of many popular professional workflows – although it does align with the MIDI hyper-editing ethic of the 1990s. Further, it was hoped that processing could successfully form a sonic bridge between recordings of a acoustic instruments and synthetic creations.

3.3.1.6 Software development

A number of software tools were developed in pursuit of this DMus, but were jettisoned as commercial systems overhauled them over the duration of study. Such tools included a virtual drummer. Inspired by Steinberg Groove Agent 1, this system was populated by a palette of MIDI files that could be randomly accessed (at any position in their duration) allowing complex deterministic performances to be assembled by a number of algorithms. This tool was used to generate the drum performance in the middle section of the tune IZZYSX. Since then, Apple has implemented Drummer and FXpansion has released BFD3, both of which devalue the novelty of the tool. Another tool emulated and extended the Native Instruments (NI) Kore controller hardware (with a multi-touch interface), which was discontinued, but NI has since dropped support for the associated software that might be controlled.

It might not be unreasonable for a doctoral candidate to persist with submission of superseded technology that was original at the point of

conception. Instead it was felt was felt that the thesis would carry greater integrity if older designs were omitted and a focus was maintained on a contribution to knowledge.

One tool that was developed and has retained currency to the point of writing[19] is The Wavefondler. This allows multi-touch control via direct manipulation of an audio waveform visualization on an iPad. The novelty lies in that it is the world's first system to offer this for audio that resides on a host Mac computer. It is sample accurate, and can control the DSP in its sister DAW plugin. It offers a variety of gesture-driven stuttering and glitch-style effects to be placed at precise points on an audio waveform, allowing a haptic control of identifiable sections of the audio, which can be streaming in real time. It contributed many effects to the tune *Anathemaofanenema*.

3.4 Personal context and procedure

3.4.1 Time frame

Enrolment into the MPhil was in June 2008, with the objective of pursuing a DMA. UWL discontinued the DMA and the DMus was introduced as a replacement practice-led doctorate. MPhil to DMus transfer was completed in May 2013.

3.4.2 Relation to the postulant's previous work

The postulant is an experienced programmer and producer who has worked in many styles and genres with a range of developing technologies over the past two decades. Drawing from a number of skeleton compositions spread over some 10 years prior to DMus registration, the album *Something Jaggy*

[19] Since its peer review in 2013.

represents not just the culmination of all this experience, but an extension to it and has been approached as such, quite consciously. Although such experience brings with it a level of technique, contemporaneous approaches and tools have been analysed throughout the timeframe of this submission, and the technique advanced across all aspects of the production process.

The Making Of Quiet Things was recorded live in the studio, a completely new discipline to the postulant[20] and as such proved challenging and educational. Its subsequent processing represented a new and unknown context for the application of the associated technology, and so also presented a considerable learning curve with extensive experimentation required.

3.4.3 Recording of observations and documentation of the studio process

As an academic study beyond pure practice, it was essential to record significant moments in the studio process. As text, this was done in a variety of ways at different points in the project: pen and notepad, electronic documents and native DAW text entry; this last mode allows textual notes to be placed and associated with specific audio tracks. In addition to this, screen grabs were taken at potentially useful points in the process.

It was also important to document the evolving audio, and so an archive was created. This archive also contained session files and proprietary audio/manipulation software documents. Even redundant audio was almost never deleted from this archive in case it proved useful only with hindsight, although those tracks that first emerged in obsolete technologies could not have

[20] Who was more familiar with overdub-style recording.

all their data stored in a readable format. This archive ended up being around 120 GB in size.

In addition, multiple video cameras ran throughout the recording of *The Making Of Quiet Things*. These served two purposes: both to provide live video feeds for the musicians who were situated in different rooms, and also to capture footage of the recording that might later aid documentation.

3.5 Approach and Methodological frameworks

3.5.1 Practical strategies

The professional studio practitioner generally exists in the moment and remains mindful of a forward trajectory towards the objectives of a given project. Of course, there are times when material from earlier in the project must be revisited, perhaps the most obvious one being consideration of preproduction – especially a demo, if there is one. Other examples include revisiting earlier performances or parts that had been subsequently jettisoned from the production, or reconsidering an earlier arrangement or rough mix.

In this studio inquiry, what had gone before was considerably more significant by its very definition. It was important to constantly consider the decision-making process and its motivations in order to relate the creation of the various tracks to each other in a fashion that could withstand subsequent evaluation and analysis. Reflection became an active tool in the fashion of Reflective Practice (Schon, 1984), and compounded by the long time-span of the project and the need for bricolage, ‘what had come before’ became a significant driver in the forward trajectory.

This strategy affected many completed tasks, for instance if a new tool or technique was adopted to good result in one track, another track that had been considered near-complete would be revisited in order to incorporate that development and maintain parity. This could not happen in the professional environment with all its associated pressures, and as such it represented a significant revelation of the studio process, and indeed its consolidation.

In combination with the associated documentation, this mode of investigation revealed an insight into the production process that could not have been achieved through linear procedure alone, and certainly allowed insight beyond the retrospective studies typical of the musicology of record production. Having said this, the chronological aspects of the approach herein might certainly contribute to this musicology in some way and furthermore, they precipitated a panorama from which the stated research foci could be informed.

This is not a wholesome claim to uniqueness, since it is conceded that the interface between the application of technology and the creative process has already been performed, for instance by Paterson (2008) and Draper & Emmerson (2011; 2012). The former contrasted technical functionality and its musical implications across a number of DAWs, whereas the latter two placed established functionality into specific and novel case studies. The latter aligns to the approach taken in *The Making Of Quiet Things*[21], but *Something Jaggy* is different in that it lays claim to extended technique within its creation.

[21] Although this album predates them.

3.5.2 Problems[22]

The timeframe over which this work was undertaken presented numerous practical issues as have already been mentioned in Section 3.5.1. An extension of this was that the literature was also changing, and work that started out with an original trajectory often became devalued by the publication of similar concepts.

The Reflective Practice employed here could precipitate an infinite feedback loop that impeded closure, and so eventually each track has to be declared immune from this, and thus complete. Sometimes, this felt a disservice to the ethos of the project, but was of course necessary in the interests of pragmatism.

Another issue was that of 'forcing' certain dissociated performances to be compatible. Whilst this could be done, sometimes in the most labour-intensive fashion, the results were sometimes disappointing, not just musically, but tonally. If deemed too disappointing to accept or repair (sometimes a function of the available time), then the attempt had to be abandoned and started afresh.

[22] Further and specific discussion of these issues will be offered in Chapter Nine, but they are introduced here to support the greater methodological perspective.

3.6 Ethical Considerations

Since study towards this thesis commenced before the current UWL Ethics Policy was implemented, the University does not require the submission of an associated ethics approval form[23]. Nonetheless, a number of principles typical to ethics in research (Shamoo and Resnik, 2009) will be briefly discussed in terms of their relevance to this submission.

3.6.1 Carefulness

Every attempt has been made to avoid negligence and careless errors. Inevitably, errors have been made in pursuit of this thesis, but these have always been rectified and remedied as fully as possible. All work pertaining to this submission has been examined critically and carefully, and remedial action has been taken are necessary. Careful records have been kept of all research activities and design, and correspondence associated with this work.

3.6.2 Competence

Professional competence has been consciously developed through pursuit of this thesis. This is a part of lifelong learning that will not cease upon submission.

3.6.3 Honesty

All results, methods, publication status, citations and procedures have been honestly reported in this thesis. All musicians, colleagues and associates with whom any dialogue has been had in connection with this thesis, have been treated with honesty and respect at all times. A large proportion of the analytical

[23] This dispensation can be seen in Section 11.1.4.3.

content of this thesis has been published, and the publishers' guidelines were always strictly adhered to.

3.6.4 Integrity

The musicians involved in *The Making Of Quite Things* and the postulant all signed a contract in advance of the recording. A professional music-business lawyer prepared this contract especially to permit subsequent sampling of the performances, and all parties were comfortable with its content in advance of signing – see Appendix 11.1.3. All other associates and musicians involved in the creation of the audio offered their services out of good will, and this was always explicitly discussed in advance.

Two musicians' performances were utilized on *Something Jaggy* without their initial consent. One has now given consent (see Appendix 11.1.4.4), however the other has not. The use of the performance is clearly in breach of integrity. It is justified in this context by the fact that the musician, known to the postulant only as Jed, offered his performance for sampling at the time of recording in the mid-1990s; however, he and the postulant have since lost touch. Legal advice was taken on this matter, and since the offer was never revoked it can be regarded as validating the use of the performance in this submission, subject to application of certain good practice. On that advice, Jed was registered with PPL to ensure that credit is apportioned. It was also recommended that a witness statement be procured since the original offer was witnessed, and the witness has been contacted and testified that this was the case. Further details of this situation can be seen in Appendix 11.1.4.5.

In addition, the postulant has always striven for consistency in both action and thought, and always kept promises and agreements pertaining to the thesis.

3.6.5 Legality

No laws have knowingly been broken in pursuit of this work.

3.6.6 Objectivity

It is not always easy to be purely objective when embroiled in any creative process. It is a fact that the creative artefact is generated through an emotional and subjective impetus, and to suppress this would constitute an ethical issue in itself. Having said that, objectivity has always been striven for in the evaluation and decision making associated with this thesis. Self-citation has been employed in this text, but only where relevant and necessary.

Bias has been avoided in the appraisal of the artefact as far as possible; however, once again this can be difficult with an intimate understanding of the creative process, and when self-composition is involved, this is by nature based upon choice and is therefore subjective. Awareness of these issues and a proactive attempt at objectivity likely carries the most integrity for the researcher. Appraisal of composition is irrelevant to this thesis, and so this issue might be deemed as being mitigated.

Psychoacoustics influence the originator's perception of sonic quality – one tends to hear excerpts of technical interest and pleasing aesthetics as masking concurrent aspects of audio, and of course vice versa. Every producer is aware of this (perhaps implicitly), but every effort is taken to form an unbiased holistic overview.

There are no personal interests that affect this thesis beyond a desire to achieve acceptable quality for successful submission. Despite the commercial release of the music, it has not generated sufficient revenue to impact upon this work.

3.6.7 Openness

A key part of the methodology has been openness, specifically to new ideas and approaches. This might be regarded as essential in this context. Openness is further demonstrated through the dissemination of papers and artefacts that contribute to this text. A number of associates have offered criticism of aspects of the practical work, and this has always been graciously received and acted upon if possible and appropriate.

3.6.8 Non-Discrimination

There has been no discrimination against anyone associated with production of this work, including (and not exhaustively) on the grounds of: sex, race, ethnicity, religion, sexuality, disability, etc.

3.6.9 Respect for colleagues

Respect has been shown to all colleagues associated with this submission.

3.6.10 Respect for Intellectual Property

This thesis contains comprehensive acknowledgements and credits, and accurate citations. Currently, the database that hosts industry credits – allmusic.com, holds inaccurate information on *The Making Of Quiet Things*, including failing to record the postulant's role as producer of that album. Allmusic.com have been notified of this on numerous occasions, but seem unable or unwilling to rectify this. The other industry database Discogs.com

does list the postulant as producer, but has omitted his credit as mastering engineer. They too have been notified; both databases are known for their inaccuracies.

3.6.11 Responsible Publication

All publication associated with this thesis has been done purely in the interests of scholarship. There has been a degree of duplication in the content of tutorials given to the Audio Engineering Society on the theme of drum programming (Paterson, 2011b, 2012a, 2013a, 2013c, 2014), some of the content of which refers to techniques devised in pursuit of this submission. These presentations share similar titles, but featured broadly incremental content and were given to different live audiences on both sides of the Atlantic. The content was discussed with the Tutorials Chair in each instance, and received full endorsement.

3.6.12 Responsible Mentoring

The above tutorials disseminated applied techniques that were developed in pursuit of this thesis both to attendant students, as well as peers and professionals.

3.7 Contextual frameworks

The DMus requires an analysis of existing techniques. An in-depth analysis of contemporary production practice would take many volumes and still feature elements that were obsolete before completion of the analysis. Consequently, instead of attempting this literally, the secondary research foci will be contextualized by being placed in a chronological framework with an ontological inflection. In addition, there will also be a section pertinent to the software development that was performed for this thesis.

These will be subdivided into two areas: contextual production frameworks and contextual technological frameworks, covered in Chapters Four and Five respectively. A summary of these frameworks will now be presented, followed by a brief encapsulation of contemporary practice to augment them.

3.7.1 Contextual production frameworks

Here, a 'production framework' operates at a more conceptual level, and whilst technology is embedded, it is the significance of the application of the technology that is the focus.

3.7.1.1 What constitutes innovation in music production, and to what extent can true innovation in production be demonstrated?

Innovation has often been at the core of record production, yet as production has advanced from Fred Gaisberg through the techniques of Musique Concrète to the plethora of possibilities afforded by the present digital age, the opportunities for genuine innovation might now seem limited.

This notion is explored by considering the ontology of production with reference to audio examples, forming a chronological thread that highlights pieces commonly perceived as landmark innovations, their technological

backdrops, and the recurrence/evolution of effect & aesthetic through successive generations of technology, and ultimately a nexus. The perception, attribution and value of ‘quality’ is another factor, and whilst this is a separate subject in its own right, some discussion of it better contextualizes the topic.

3.7.1.2 What is the worth of pre-DSP ‘traditional’ production values in the contemporary manipulation-oriented context?

Moorefield’s (2010, p.xiii) "illusion of reality" was focused on the perception of authenticity in recordings, something that often continues to concern music producers. Editing techniques have increasingly been applied to move beyond this mimetic reproduction and ‘re-perform’ musical elements, and furthermore, DSP commonly offers such extensive manipulation possibilities that all identifiable components of authenticity might be masked, even subverted, offering ‘virtual timbres’ and revised sonic meaning.

Here, editing & processing are considered along with their aesthetic and technical implications, placed in a historical perspective and augmented through the synthesis of contributions from a number of professional producers. Several perspectives are presented, and their tensions considered. The fluxive nature of authenticity will be further revealed in the trajectory towards the "reality of illusion" (Moorefield, 2010, p.xiii).

3.7.2 Contextual technological frameworks

A ‘technological framework’ here refers to specific technological phenomena, and through a series of case studies examines the implications on creativity that surround the evolution of these areas.

3.7.2.1 The trajectory of preset sounds

The use of preset sounds in audio production has long been scorned by professional producers, some of whom have cited a lack of originality or integrity, or perhaps a proliferation of homogenization in productions. Despite this, manufacturers have continued to develop ever-larger ranges of presets, now extending beyond instruments and effects, to EQ and even whole channel strips. Developmental work continues to further automate aspects of the mixing process itself.

This section examines the implications of presets from yesterday to today, and using Logic Pro as a case study, offer some insight into the relevance of this evolving arena to the professional, and the implications to the enthusiast. It concludes with some conjecture for the future.

3.7.2.2 Creative abuse in time stretching

An area of digital audio manipulation currently in flux is that of time stretching. Following the emergence of real-time granular synthesis as a compositional tool, early sampler-based implementations were pushed beyond ‘authenticity’ to create new timbres in the commercial music of the 1990s. As the algorithms improve, allowing more flexible and transparent implementation today, even more opportunities for a new ‘creative abuse’ exist.

This section will firstly contextualize through consideration of the metaphor of authenticity in the tape recording of the 1940s and its soon-parallel abuse, which offered new pathways into multi-tracking and Musique Concrète. This section will chronologize, then continue by examining potential for exploitation of stretching *artefacts* in some contemporary algorithms, and discuss a quantification of this effect.

3.7.2.3 The trajectory of interaction with audio visualizations

It has long been a dream of those involved in audio manipulation to interact directly with a visualization of the target audio. In recent times, the mouse has been giving way to multi-touch interfaces, allowing a more tactile, immediate and intuitive interaction with the audio, and importantly offering more than one point of parametric contact. New modes of manipulation and performance are increasingly possible through a number of systems.

This section will document the trajectory of interaction with audio visualizations and recent developments in relevant multi-touch applications, and also consider workflow and its implications via a number of case studies. This chronology will contextualize The Wavefondler – the custom interface design presented in this submission.

4 Contextual production frameworks

Ideas are one thing and what happens another.

(Cage, 1973, p.220)

The first part of the third secondary research focus in this submission is 'to what degree do producers typically subvert the intended function of their tools?' This section considers one perspective of this through examination of innovation in production.

4.1 What constitutes innovation in music production, and to what extent can true innovation in production be demonstrated?

4.1.1 Introduction

Music production takes many different forms, and as such might be subject to many different definitions. The earliest documented instance of mediation during recording is attributed to Fred Gaisberg (Gronow and Saunio, 1999) in the 1890s, who manually led a singer to and from the recording horn, exploiting only the inverse square law to enhance existing performance dynamics – the forerunner to the mic-technique commonly employed by vocalists today, although the same effect is sought and automated by software such as Vocal Rider (Waves, 2011) or Wave Rider 2 (Quiet Arts, 2015), the latter also first released in 2011. The journey encapsulated by this century of evolution epitomizes the development of production and defines its poles; from no-tech to hi-tech (ironically, the latter of course being a chronologically-subjective term), yet actually only aspiring to achieve the same readily conceivable end. The parallels are endless in the fluxive world of production.

This section is concerned with the identification and linking of comparable benchmarks, thus contributing to the evolving ontology of production and placing those benchmarks in the hierarchy of 'true' innovation in the field.

4.1.2 The ontology of production

A perspective of this ontology must first be offered. To re-cite from Section 1.2 in order to elaborate, Moorefield opens his argument for the 'producer as composer' with:

> …I make the case for three central developments in production and claim that they are all driven by an underlying mechanism. One: recording has gone from being primarily a technical to an artistic matter. Two: recording's metaphor has shifted from one of the 'illusion of reality' (mimetic space) to the 'reality of illusion' (a virtual world in which everything is possible). Three: the contemporary producer is an auteur. (2010, p.xiii)

Key aspects of contemporary production are encapsulated here, all of which might be explored and contextualized; however, underlying this is a broader definition. Production can take many forms, but is generally unified by mediation. This mediation can be of performance, of composition/arrangement, of timbre, of atmosphere or attitude, or in its limit, mere quality control without proactive engagement in the actual creation of the artefact; as such it is still mediation, since without it, the creative process could deviate or terminate at a different point. Many of these aspects might not be apparent in the final (discoverable) work, yet it is these that contextualize the praxis.

Such praxis cannot be revealed without a holistic perspective. The forms of mediation cited above (and others, of a similar nature) are themselves influenced by a number of factors: genre (either prescribed or emergent), tools, production-environment acoustics, personnel (and their technical/musical aptitudes & limitations), both monitoring and intended end-listening environment

& context, final playback medium and more. All of these impose priorities and limitations, thus creating tensions that might be resolved by the producer working towards an end point. This could be considered as contributing to the phenomenology of production. This perspective is underpinned by Richard Lightman (2011a), who stated that "the very essence of music production in its true form is hardly definable". It is this lack of tangibility (common enough in the creative arts) that makes such ontology worth considering, although it cannot be fully defined in a text of this scale. Various authors such as Cunningham (1999), Zak (2001), Burgess (2002), Hepworth-Sawyer (2010) and Moorefield (2010), have developed insight into production, and efforts are underway to expand on this via papers submitted to ARP and its affiliates. Savage (2009, p.37) suggests that:

> In The *Recording Angel* Evan Eisenberg notes that "perfect preservation is a matter not simply of technology, but of ontology as well."[21] Perhaps so, and perhaps because perfect preservation is not possible, we are forced to leave an essentializing ontology out of the picture. Instead an ontology that recognizes historical contingencies is the appropriate model for understanding the nature of recordings.

What can be therefore considered here are a number of 'pinnacle' production developments that might be regarded as key to the evolution of the art form. These in turn will help to understand the notion of 'innovation'.

4.1.3 Innovation

The tacitly complex concept of innovation can have various degrees. There is an argument to cite technological breakthroughs that empowered the evolution of production, e.g. the development of the condenser microphone[24].

[24] The first being aimed at radio, Bell Telephone Labs selling one in 1922 (Chanan, 1995).

This is in line with the Linear Model of Innovation (Godin, 2006); however, this model is often now considered archaic, for example due to its disregard for feedback loops between 'innovation' and 'invention'. It would be easy to cite the inception of recording itself, but such technology cannot really be considered as innovative to production, since it is by definition, its naissance.

Beyond 'invention', the Open University (n.d.) states that:

> Innovation by development is about changing the bit that doesn't work, or that could work better, to improve the function of the whole.

One example of this might be "this battery lasts longer" (ibid.. 'Innovation by development' validates a second tier of innovation, and such development could of course find metaphors in music production.

Further, it is possible to innovate by finding new contexts for approaches that might be more established – this has long been understood beyond just the creative arts. For instance, the wind-up radio (Baylis, 1999 is broadly acknowledged as a landmark innovation, yet it represents a novel application of centuries-old clockwork technology. This can be categorized this as "innovation by context" which is "as much a process as a result" (Open University, n.d.).

Lastly, in order to qualify innovation in a 'creative' frame, Von Hippel's (1986 'User Innovation' model will be primarily adopted in principle, to represent concepts that carry little precedent in artistic effect and act as inception for numerous derivative techniques.

In summary, with regard to this submission, innovation in the various facets can be categorized as being developmental, by context, or as User Innovation. Technological breakthroughs are of considerable significance, and in advance of the application of technologies presented in Chapters Six and Seven, an

example selection of seminal instances are discussed in this section (and further in the following chapter) to add a holistic inclusivity and strengthen the technological and methodological context.

4.1.4 Quality

Quality in production lies purely in the ear of the beholder. Those with musical training/experience develop their sense of pitch and timing as they evolve, gradually becoming more discerning as to what sounds 'correct' or simply acceptable. Regardless of the collective pitch/time resolutions of a given band or ensemble, it generally falls to the producer, at his or her own stage of evolution to determine when a given performance is 'accurate' enough, or indeed use available tools to mediate in order to approach their ideal. This quality control, however good, is still ultimately subjective. As stated in Section 4.1.2, production might require many other interlinked concepts, however these are typically bound by rules with less quantifiable boundaries, and so might be regarded as closer to the subjectively aesthetic. Zak (2001) said:

> What makes the Kingsmen's [1963] 'Louie Louie' a good record? Neither lyrics nor melodic design, harmonic motion, rhythmic groove or instrumental arrangement […] hold the key to the answer. The record's power is in its sound.

The end-listener, on statistical balance, will not be as likely to share the critical technical ear of the producer, and might therefore respond directly to 'the sound' without such a perspective of the constituent elements. Listener perspective also becomes a function of cultural and marketing forces, hence a genuine *perception* of quality that is distinct from that of the cognoscenti. Apart from this, 'the sound' is of course influenced profoundly by the various innovations discussed both in and out with this section, and whereas some of

them are more ostensible than others, their contribution will still likely influence the end-listener's overall attribution of 'quality'.

4.1.5 Tape techniques

The significance of the introduction of tape as a recording medium cannot be underestimated, and as such its development is worth brief consideration. As one the most seminal 'technological breakthroughs', it is now worth considering its chronology – 20 years between inception and application to production/composition[25]. Daniel et al. (1999, pp.47–64) chart some of the development of tape technology, condensed as follows. Fritz Pfleumer patented his 'Sounding Paper' in 1928, which after years of development with AEG, supported by BASF, led to the launch of the Magnetophon in 1934 – magnetic tape was born. Tape technology continued to develop, notably adopting the AC bias credited to Walter Weber[26], a PVC base, and better wow and flutter performance, and in 1941 proved able to offer a dynamic range of 60 dB and a frequency response of 50 Hz–10 kHz. In 1942, tape-based test stereo recordings were made with three microphones. Enhanced fidelity was the principal goal, and remained so throughout the development of recording to the present day; however, there were other possibilities that beckoned those with neo-creative aspirations.

[25] Paradoxically, the development of the technology was driven in quite some part by World War Two, but this precluded the technology from entering the cultural domain for a number of years.

[26] Weber was not the first to observe the phenomenon of AC bias, but is widely credited with its integration into the Magnetophon (Daniel *et al.*, 1999).

It was the commercial availability of more sophisticated magnetic tape systems in the late 1940s that precipitated true engagement with recorded audio from composers of the day. Tape editing is generally accepted to have been first implemented for creative ends by the pioneers of Musique Concrète, perhaps most notably Pierre Schaeffer in 1948 with his *Étude aux Chemins de Fer.* Here, the driving force was more the juxtaposition of (non-contiguous) sounds. Although timbral manipulation might seem a major component of the greater techniques of the genre, Pierre Henry maintained, perhaps surprisingly that "Musique Concrète was not a study of timbre" (James, 1981), and acceptance of this notion instead leads elegantly to a focus on the tape-splice, or cut.

4.1.5.1 The Cut

Following on from Rudy Van Gelder's work in jazz (Skea, 2001), by the late 1960s, such creative editing had became commonplace in popular music. The Beatles (1966b) were well known exponents of this and whilst *Tomorrow Never Knows* features an innovative guitar solo, composited from notes individually reversed as discrete tape splices to maintain the tonal progression originally played, *Strawberry Fields Forever* (The Beatles, 1966a) employed the 'legendary' vari-speed edit to address a studio problem, that of juxtaposing two different versions of the song at different tempi and keys. Tape editing grew to become embraced more broadly by popular music, with other early exponents such as Jimi Hendrix, Led Zeppelin – and many others. The focus was often on the principles of looping or take selection; however, the approach was also adopted to correct timing anomalies.

Such corrective applications of the splice became more and more widespread, with producers regularly 'comping' and tightening performances through dexterous application of the razor blade. Although hugely time-consuming, a high level of skill could produce profound results. Steely Dan were one band who took such an approach (Sweet, 2000) – the use of a metric loop to utilize the most rhythmically precise section of their track *Show Biz Kids* (Steely Dan, 1973) and repeat it. They went on to engage in an intense level of hyper-editing purely to 'correct' drum performances to a metric ideal (Micaleff, 1992). Tape editing, although cumbersome, first defined a crucial aspect of composition and studio production; the retrospective control of a performance's timing – something that was significant in the development of the *Something Jaggy* album, as discussed in Chapter Seven.

Digital technologies first facilitated a new mode of the cut in 1976, as described by for instance by Paterson (2011a). Cuts could soon be related to a tempo reference by playing back portions of audio aligned to a grid, and performance correction became the norm. The Soundstream 'Digital Editing System' of 1978 might be regarded as the father of today's computer-based DAWs. DAW-based splice-type editing became so prevalent in all genres of audio production that it is difficult to identify an individual track that epitomizes this, however it is worth highlighting the post-90s genre of 'Glitch', which typically employs huge numbers of edits per track as a compositional feature, much as John Cage proposed in *Williams Mix (1952)*.

4.1.5.2 The Overdub

Since the release of Les Paul's *Lover*[27] (1948) – widely regarded as the seed of multi-tracking, overdubbing has evolved into a backbone of studio recording in popular music. Paul used acetate disks for this process, a precursor to his own development of tape-based systems. Dedicated multi-track systems evolved through 4, 8, 16, 24 and synchronized multiples of these.

4.1.5.3 Layers

Producers however, continued to push the capabilities of each given system by feeding multiple inputs into given tracks and using bouncing techniques to give even greater numbers of layers than tracks (initially via the so called 'Network' module, which led to today's buss). Phil Spector's 'Wall of Sound' (from 1962) based initially on (3-track)+(2-track)+Mono tape machines demonstrated this to an extreme (Cunningham, 1999).

Track counts later expanded with the increasing power of DAWs, but the significance of the overdub is more profound than density of layers. It also facilitated punching-in for individual instruments, a recording technique that revolutionized studio performance. Yet another approach (a derivative of Musique Concrète) was the dubbing of 'unrelated' pre-recorded performances, a technique dubbed "xenochrony" by Frank Zappa (Watson, 1998, p.130).

4.1.6 Air

Man has long understood the grandeur imparted to sounds subjected to natural reverberation, and from an early stage, recordings were staged to benefit from this. It was the development of the dedicated echo chamber that

[27] Although Lawrence Tibbett, Elisabeth Schumann and Sidney Bechet technically predated this (Kane, 2014).

emancipated this sonic character, allowing artificial (psychoacoustic) impressions of space. The Atlantic Studio chamber built by Tom Dowd (Cunningham, 1999) imparted a unique ambience to the music played through it, along with the then-unusual 8-track facility, shaping the 'Atlantic Sound' of the 1960s. Similarly, the 'Wall of Sound' also owed much to the echo chambers of Gold Star Studios. Synthetic reverb generation came to be dominated by digital technologies: algorithmic, convolution and in 2011, the three-stage algorithmic simulation of IRCAM's Verb (2011). It is hard to think of a recording of any genre that does not have elements of its perceived 'quality' rooted in its ambience, regardless of how it was generated or treated.

4.1.7 Technologies

Moorefield (2010, p.xiii) continued the previous citation by stating:

> The underlying mechanism is technological development, encompassing both invention and dissemination…

and indeed functional innovation cannot be exclusively attributed to user-adoption of existing technologies. In many cases, the development and application of technology is actually the driver, and so to acknowledge this, certain broad technological milestones can be considered merely as exemplars.

4.1.7.1 The Sequencer

The notion of sequencing pre-ordained music might be traced back to clock-chime mechanisms, musical boxes, barrel organs, and the pianola. Electro-mechanical, punched paper and analogue (step) sequencing of synthesizers gave way to ever more sophisticated digital systems, and the birth of MIDI in 1982 empowered sequencing to actually take over from multi-tracking within certain genres. Although the Fairlight CMI facilitated the basic

sequencing of samples in 1979, the act 'Shock' recorded what producer/programmer Richard J. Burgess called "the first completely computer-generated record" (Cunningham, 1999, p.286), *Angel Face* in 1980. The 1985 Atari ST with its built-in MIDI ports running software such as C-Lab Creator from 1987, and subsequently Steinberg Cubase, which allowed users the luxury of 'part-based' graphical arrangement for the first time in 1989. Today, MIDI sequencing is largely unchanged in principle, although it is generally performed by DAWs running software sound sources.

4.1.7.2 The Sampler

Although disparate excerpts of audio were combined by Cage and others in the mid 20th century, the concept of sampling can be taken here to refer to the triggering of segments of pre-recorded audio on demand, (as perhaps epitomized and first 'revealed' to the record-buying public by Paul Hardcastle's stuttering *19 (1985)*). Formerly, the tape-based Chamberlin 100 had first allowed such sample playback in 1949 (Friedman, n.d.), gradually giving way to the rival Mellotron from 1963. Digital techniques superseded these (in functionality) from the Fairlight CMI onwards, and the 1984 Ensoniq Mirage heralded the beginning of the 'affordable' sampler revolution, subsequently dominated by the Akai series. Contemporary systems are often software-based, and offer sophisticated modulations and manipulations.

4.1.7.3 The Processor

The range of available processing and effects has evolved from mere gain changes, notably employed by Stokowski in 1929 (Zak 2001), through outboard EQ and dynamics processers in the 1960s, through analogue then digital hardware, to the plethora of software systems of today, often operating in the

spectral domain. Whilst the range of functionality has grown immeasurably, their function has always been simply to enhance or modify sonic components, realizing an ideal imposed by the producer. The zeitgeist of the application of such technologies has profoundly influenced the evolution of production; however, maintaining brevity and a primary focus on 'user innovation' precludes further discussion here.

4.1.8 The Nexus

Although clearly contrived with technical examples notwithstanding, reflection upon the dates cited herein demonstrates a tendency towards seminal examples in the range 1940s-60s, which might even be branded sentimentally as a (the?) golden age of production. Whilst the sound of (popular) music since that time has changed enormously, much of this might be associated with the emergence of new tools, but what of the application of those tools? The decision to apply a delay might as easily employ a tape loop as a sophisticated plug-in. Retrospective modification of ambience could come from a chamber or a current Lexicon. Has the ability to treat pitch and time separately resulted in better representations of vocal performances? No, but perhaps more singers can pass 'quality control'. When combined, the range of contemporary tools cumulatively offers vastly more possibilities, but the current reverence towards 'vintage' equipment demonstrates its persistent relevance. It is the decision and importantly, its context that offer opportunities to innovate.

It is quite apparent when innovations emerge from the world of engineering and product development; these are artefacts with little precedent. Further, it is clear that innovation in the creative practice of music production is closely linked to the emergence of such technologies. Often it was the early uptake of

the technology and its application that gave the strongest impression of innovation. Von Hippel's (1986) model is accommodating of such uptake and application, and qualifies this as innovation. Zagorski-Thomas (2014, p.149) remarks "This, in turn, encourages further creative practice in the domain of new product design, and the cycle continues". The caveat however, is context. Extant productions must be devoid of a particular sound, and then feature it, and it is only the context which allows this transition that facilitates innovation. Innovation might therefore be regarded as the application of a technique that hitherto had not existed in that context, whether the seed for this technique came from a novel artefact or simply a different context. It is the context that is in fact is the nexus.

It could be argued that nowadays, producers tend not to push boundaries of their existing palette, simply because there are so many aesthetically equivalent options, often 'off the shelf' that require less time and thought in this commercial world[28]. It could even be suggested that any individual's (typically hugely complex) system now offers possibilities that are new, at least to that individual. It is therefore relatively easy to pull something that appears new to that individual 'out of the bag', whether or not someone else has also employed such a preordained technique, notwithstanding the technologists who placed the tool 'in the bag'. This provides any contextualization with a dichotomy – it can be subjective.

That is not to denigrate modern production in any way, but it has evolved into a different art form based on less apparent *need* for the individual to stretch functionality. To innovate in today's music production is the same now as it was

[28] This will be discussed further in Chapter Five.

for Schaeffer or Burgess – to be lucky enough to be presented with a novel toolset, and then boldly experiment within a new context. As spectral, convolution and modeling technologies saturate in their capabilities, the human spirit will continue to strive to create the ‘unheard’, and we may yet experience the second golden age of production as man re-masters machine.

4.2 What is the worth of pre-DSP 'traditional' production values in the contemporary manipulation-oriented context

4.2.1 Introduction

Imagine that it is 1916 and you are shopping for records. Upon entering a store you are invited to take what is called "The Edison Realism Test" (Katz, 2010, p.18). Music Production evolved from the pursuit of 'realism', and the technologies of recording, processing and delivery have all contributed to this quest over many years. Technological mediation came to evolve beyond the mimetic and developed its own vocabulary, much of which became the norm of the meme. Chronology too plays a part in perception; the highly synthetic timbres commonplace in popular styles today would have seemed quite alien before the technology that creates them became ubiquitous, yet only the most landmark innovations actually caused a step-change in timbres being created, and as Glenn Gould stated, "recordings deal with concepts through which the past is re-evaluated" (Chanan, 1995, p.120). Genre and listener-expectation might be considered to be further guiding factors in this context. It is unlikely that a recording from the Western Classical tradition will sound mediated, yet contemporary House styles would sound strange if wholly 'performed' by humans. Many Classical listeners are unaware however, that current recordings are often the result of many edits, and House listeners might not notice the demarcation between a sampled loop of human performance and the sequenced framework around it.

In the context of this text, 'traditional' might typically involve capturing a good performance via the use of 'good' microphones, optimized gain-structure to maximize the signal-to-noise ratio, minimal application of equalization and

other processes (Toulson, 2008), and perhaps staging the music such that it replicates live performance. This of course extends into the application of dynamics processing, reverb and time-based effects, (for the purpose herein, it does not matter whether such processing is hardware or software). Robert Orton (Orton, R., Interviewed by: J. L. Paterson, 2012) points out that the word 'traditional' in this context is itself fluxive, a function of available technologies and how long they have been embedded in commonplace workflows. Here, 'post'-DSP might be taken to discuss processes that offer an extended sonic vocabulary, often through operation in the frequency domain, and indeed the essence of non-linear workflow itself.

4.2.2 Bricolage and workflow

Since the tape era, artists have recorded demos at home, often in non-professional formats, one example being cassette portastudios. Such demos were often re-recorded in professional studios, by professional engineers for final production, thus ensuring that all aspects of the recording met technical quality thresholds (although of course, the artistic content warrants a separate discussion). The ubiquitousness of 'home' DAWs has led to many artists continuing this tradition, however the compatibility of digital formats has increasingly led to these recordings being used for final mixes, perhaps to maintain the definitive attitude/performance originally captured, in times of ever-tighter budgets. One consequence of this is the pressure on the mix engineer to adjust pre-production decisions. Orton observes of this:

> That can be one of the downfalls of having DSP at people's fingertips… If they don't quite know what they are doing, and sometimes they commit the choices that they make… that can make life difficult (ibid.).

It might be taken that in such situations, ‘traditional’ production values have been compromised at tracking, and remedial action is required, perhaps ironically by the application of further DSP.

The sheer profusion of workflows in the contemporary production process questions any context for authenticity. Whereas in the pre-sequencer heyday of tape recording, pushing the finite array of techniques was essential to stretch the available palette, MIDI sequencing opened a potentially parallel mode of operation, converging perhaps only in the mixing process. The DAW increasingly offers integration of the latter, facilitating complete music creation & production. Some practitioners might create finished music artefacts from soft synthesizers, others from samples or pre-recorded audio loops, and others still from hybrids of those, each with its own associated approach and range of techniques; none of these people need ever record to facilitate their instrumental music – extending the ‘tradition’ into the digital ethos.

4.2.3 Edit/process & context

Producers have always sought to capture the best possible performances. The profundity of editing has revealed itself since the tape era[29], but the convenience of its implementation in the digital world has seen its application grow exponentially. Aside from its artistic application, its corrective capabilities have led to new modes of ‘acceptability’ in studio performance, with musicians offering multiple (perhaps even flawed) takes as a palette for subsequent compositing. Classical producer Jakob Händel states:

> When it comes to the meaning of authenticity showing the performer's authentic (coherent) character, in my opinion "authenticity" can hardly be

[29] As was discussed in Section 4.1.5.

> destroyed – neither by a bad microphone setting, nor by unattractive mixing – perhaps only by bad editing. (Händel J., Interviewed by: J. L. Paterson, 2012)

In contrast, DAWs currently offer numerous methods for adjusting drum performances. These are perhaps centered on tightening via slicing or stretching, but also offer a number of creative possibilities, e.g. groove or tempo-map locking. Where once the side-chain triggering of analogue noise gates to let other sounds[30] through was an exotic production technique, there is now drum replacement software that has evolved to facilitate the velocity-sensitive, multi-sample-based replacement of individual drums. Although it requires a degree of user-mediation, the results can make retrospective adjustment of drum hits as easy as changing sound in a MIDI sequence, although complications currently arise from overhead/ambient microphones etc. Whereas once recording a great sound was essential, in some recording/mixing situations, this can be rendered redundant, and doubtless technology will advance to broaden this subset. Pip Williams attributes “using real spaces and ambience as opposed to artificial reverbs” (Williams, P., Interviewed by: J. L. Paterson, 2012) as key in pursuit of sonic authenticity (beyond just drums), and so perhaps such digital approaches can only ever contribute to the illusion of reality without actually asserting it, although this is unlikely.

The prevalence of excessive auto-tuning as a stylistic feature on contemporary Pop vocals brings an interesting dimension to this discussion. Aurally, the effect is often far from subtle; however, more quantitively, on a ‘well-recorded’ two note phrase (G4/F4), spectral analysis reveals typical accentuation of harmonics f6 to f8, changing them from relatively dispersed

[30] Bursts of un-tuned radio static have been used to augment snare drums.

bands into more resonant ‘tuned’ frequencies with some loss of low-amplitude detail above 2 kHz.

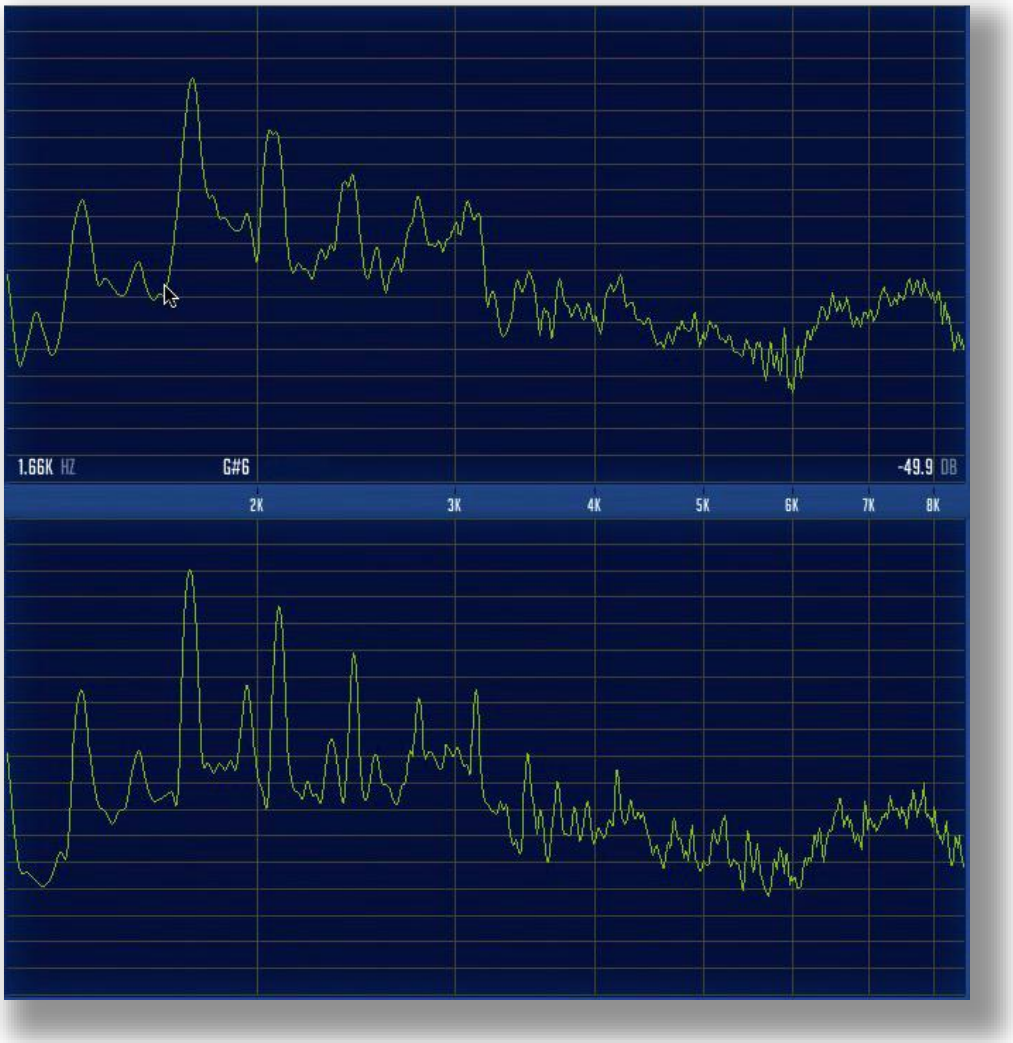

Figure 4.1 The upper spectrogram is the natural vocal, and the lower is passed through auto-tuning

Such frequencies are often indicative of specific microphone characteristics, and so the application of auto-tune might be said to offset certain desired characteristics of a given microphone, perhaps those that influenced its very selection at the tracking stage. Of such tools more generally however, Martyn Phillips attests that:

> These are able to open up and manipulate aspects of human performances that were previously inaccessible and opening up awareness of possibility (Phillips M., Interviewed by: J. L. Paterson, 2012).

This all encapsulates the fluxive nature of production values and further illustrates Orton's view of 'traditional'.

The record label-driven/DSP-facilitated 'loudness war' is contributing to palpable corruption in mastered Masters, exacerbated by further compression during broadcast. The mix engineer might carefully select and set specific compressors, only to have the entire mix squashed en-route to eventual delivery to the consumer. Current research suggests "sudden gain changes, modulation of the noise floor and signal distortion" are all potential consequences of maximization processes (Campbell *et al.*, 2010), the very antithesis of conventional production values, traditional or otherwise. EBU R-128 is currently making great progress against this in broadcast, but until such practice is reflected throughout the production chain, the problem will exist[31].

The consumer seldom listens in acoustically ideal situations. This has long been understood, and the creation of 'radio mixes' is just one response to this. Whilst typical computer monitors might be considered comparable to radio playback, increasingly, many people listen on mobile electronic devices in noisy environments and in the extreme, even 'speaker-phone' on mobile phones. The loss of fidelity and signal to (ambient) noise ratio in these situations is considerable, and it might be argued that many sonic details were unapparent, even to the cognoscenti. Orton (Orton, R., Interviewed by: J. L. Paterson, 2012)

[31] Apple's 2014 decision to turn 'Soundcheck' on as a default in Apple Music might yet drive improvements here.

however argues that the mix must still be of sufficient quality to withstand such playback whilst retaining intelligibility.

4.2.4 Conclusion

The purpose of this text is not to offer a literal and definitive answer to the title's question; such would always be subjective, however the reader might now be better placed to form his or her own stance on these matters. Synthesis of the above issues could imply that that authenticity is a subjective concept, dependent on the experiential and developmental status of the listener. Professionals seem to treasure their own identifiers of production values and yet over time, these morph and realign. The pre- and post-DSP aesthetics are still symbiotic in the hands of the professional; as Händel infers:

> Although in classical editing we cut hundreds of times, do speed and pitch corrections to make it sound musically coherent. We're most of the time using omnidirectional microphones to reproduce the real room where the performance takes place (Händel J., Interviewed by: J. L. Paterson, 2012).

Phillips summarizes:

> As the tool-set becomes larger with the addition of DSP-based processes, a larger number of parameters may be considered and refined. … The understanding gleaned from being in a situation where a tool had to be mastered as it was the only one in the box is an important asset when presented with a much wider choice (Phillips M., Interviewed by: J. L. Paterson, 2012).

In today's hybrid world, the reality is illusion, and illusion is the reality.

5 Contextual technological frameworks

The presence of even a recorded sound is the presence of the implied performer.

(Frith, 1996, p.215)

The first part of the third secondary research focus of this submission is '*to what degree do producers typically subvert the intended function of their tools?'* This section considers one perspective of this through examination of the implications of preset sounds from yesterday to today.

5.1 The trajectory of preset sounds

5.1.1 Introduction

A 'preset sound' (henceforth 'preset') in the context of this text principally refers to specific values of parameter settings prepared by the manufacturer of a given piece of equipment, designed to invoke a particular function. The term is rooted in synthesizers, but this chapter will also consider effect units, channel strips and hybrid combinations.

Early electronic synthesizers were largely modular, and therefore to create a sound, it had to be physically configured with patch cords. Other than by adjusting analogue parameters, there was no way to change the sound dramatically unless the patch cords were reassigned. Given sufficient modules, a large variety of sounds could be created.

5.1.2 Time line

Although precedent electric organ-type devices featured stops, perhaps the first ‘synthesizer‘ to feature presets was the (non-modular, non-CV) *Clavioline*, released in 1947. It too featured ‘stops’ and the manufacturer, Selmer published a table of how to set them for ‘Alto Saxophone’, ‘Mandolin’ etc. (Reid, 2007). Although not yet one-button presets, there was indication here of specific intended sounds.

1972 saw the emergence of the *ARP Pro-Soloist* (Friedman, n.d.) monophonic synthesizer, which had a choice of 30 preset sounds. The 8-voice *Yamaha CS-60* offered a single user-programmable memory[32] alongside factory sounds in 1977 (VintageSynth, n.d.). This was implemented via secondary VCO, VCF, VCA and envelope sliders under a small flap, although no modulation or performance settings could be stored (Forrest, 1998). In 1978, the Sequential Circuits company launched the Z-80 microprocessor-powered *Prophet 5* synthesizer, featuring 40 patch memories; the first fully programmable polyphonic (5-voice) synthesizer (Coates, 1998). The *Yamaha DX7 Mk. I*, released in 1983 featured 32 memories, although extra cartridges could be inserted to offer further (i.e. alternative) sounds. Relatively few musicians managed to program original sounds into it, hindered by the then-alien FM synthesis, and the tiny LCD display. This led to the reality being for many users that they were restricted to the factory settings of the memories.

[32] Although sacrificing a preset to facilitate this.

5.1.3 Attitudes

Perhaps technologically limited and mindful of cost, manufacturers initially provided presets in small numbers, and because of this, anyone who was familiar with a particular machine could immediately tell if it was featured on a given track. This was one element in the neo-sound culture of musicians buying the latest synthesizer releases; as technology advanced, for a short time they could appear to have a unique sound. Of course as each instrument proliferated, the cognoscenti started to recognize its presets, the myth was exploded, and the sound passed into folklore or even cliché.

Over time, the number of presets featured in typical devices increased and thus so did the possible permutations available, but the notion of presets still conjured up connotations of unoriginality amongst professional musicians. Further to this, however good preset sounds were, it was unlikely that they would fit a given track exactly, and so they also came to be regarded as a demo-esque or a ‘cheap’ solution. Producers often looked for sonic originality throughout their work, or certainly at least in terms of electronic sounds.

The following citations come from a number of top professional producers and practitioners.

Although actually discussing alternative recording approaches, Mick Glossop demonstrates this common disdain:

> ...that will bring originality to your work, and it's fun as well. You just have to work a little harder mentally, rather than just calling up preset 25. (Massey, 2000, p.235)

Having said this, there is also evidence of professionals valuing preset sounds. Jimmy Jam states:

> Basically, I'll roll with any keyboard that has a good bunch of presets, but I don't like to spend all my time creating new sounds because there's some guys sitting at Yamaha or wherever, getting paid to come up with good ones. (Savona, 2005, p.106)

There are of course arguments for using presets as starting points, simply saving time in the full setting of all parameters. On compression, Phil Ramone said of John Patterson:

> For the basic tracking, John had used a compressor preset from the 02R's library and modified it for Fran. He also saved this new compressor into the library. When we switched the vocal input, we went into the library and assigned Fran's compressor setting and EQ to the new channel. Again, this was all done in a matter of seconds without disrupting the flow of the session. (Savona, 2005, p.235)

This citation also demonstrates an example of a professional's integration of presets with a customized workflow and user settings. This notion could be extended into the context of the usage; producer Phil Harding told the postulant in correspondence:

> I NEVER use presets on hardware outboard effects equipment or virtual computer effects such as reverbs/delays/compressors and gates. In my view these always need custom adjustment to the overdub or song that you are working on. I may sometimes use synth presets though as my experience is more from an engineering background than a programming background. (Harding, 2011)

The implication here is that in areas of particular expertise or preferred focus, the professional might shun the preset, whereas such usage could still qualify as valid when less familiar with a specific functionality.

Sound On Sound magazine's Editor-In-Chief, Paul White bemoaned the generic nomenclature of presets, and of EQ wrote:

> If all male singers sounded exactly the same, then perhaps an off-the-shelf 'Male EQ' setting would be appropriate, but, in my experience, every voice is different and has to be treated accordingly. (White, 2003, p.1)

Clearly, ‘Male EQ’ is intended as a guideline, but to those who are less experienced, this can be a problem. White observes that in situations where he assisted less experienced producer/engineers, sometimes people would select a preset, un-customized setting, lulled into an impression of appropriateness simply because of its name:

> While I can appreciate the benefits of some preset effects, I really worry when I see people using a compressor preset on vocals simply because the patch is called 'Vocal Compressor'. (Ibid.)

He also says:

> Furthermore, most synths come loaded with exciting presets that help them sound good when you try them out in isolation, but many of these sounds are too dense to use in a practical arrangement. So you need to create your own patches, which might, when played on their own, seem less exciting than the stock presets. (White, 2007, p.1)

Considering these comments holistically, an implicit tension is noticeable between the literal use of the term ‘preset’ and user-defined settings. It is perhaps telling that tomorrow’s technology might seek to converge the two, as will be discussed later in Section 5.1.6.3. There is also an explicit tension regarding the appropriateness of the preset in professional work.

5.1.4 The value and ethos of the tools

The secondary research focus asked: to what degree do producers typically subvert the intended function of their tools and how are the limitations of functionality probed as was ‘traditional’ in so-called innovation before the software age?

In the days of purely hardware studios, the arena was different. The range of technical functionality was less than today, and a sizeable cash outlay was required for each unit. Classic devices such as the Urei 1176 compressor from 1966 did not have ‘settings’. Although it featured radio buttons to define the

ratio and meter-mode, all other control had to be exerted via the four rotary potentiometers. This device is universally revered, and encapsulates a number of features: it had a very simple interface, had an easily identifiable function, and it sounded great. With so few parameters, there was barely need of a preset facility, since after a short amount of experimentation, the user could learn how to apply it wholly flexibly. Once understood, and given a finite range of available equipment, those in search of sonic progression or discursion would often seek to hybridize functionality across various units and innovate.

In contrast, the very nature of software encourages the development of complex and possibly unfamiliar functionality, and the provision of presets (being virtual) is extremely easy – even necessary.

It is also possible that spending money encourages an appropriation of intrinsic value. It is commonplace today to purchase software for a fraction of the cost of hardware equivalents, or even acquire it unscrupulously. This, when combined with the sheer profusion of available tools, can lead to consumer-indifference; an attitude that briefly investigates and appraises functionality of a new acquisition via its presets, notes it for future use, and then next considers a different piece of equipment for any extended functionality. Thus, such a contemporary producer is disincentivized to experiment, explore the boundaries of possibility and even grow to subvert intended functionality.

5.1.5 Logic and users

5.1.5.1 Case study: Apple Logic Pro 9

Apple's Logic Pro 9 represents a state-of-the-art software DAW at the time of writing this chapter, however the principle under discussion here easily translates to equipment systems both now and likely at a later stage of their

evolution. Logic trades under the slogan “Be a musician. Sound like an engineer.” (Apple, n.d.), with the marketing centered on an improved workflow, empowered by sophisticated yet easy to use tools.

Logic’s workhorse ES1 subtractive-style synthesizer currently offers 105 factory preset sounds, grouped into categories (lead, bass etc.), with typically between 2 and 8 sounds in each. The newer and more sophisticated physical modelling synthesizer, Sculpture has 391 preset sounds. There are many more plug-in synthesizers also included with the application, all similarly stocked.

Logic also has a considerable number of preset channel strips. These are based around chains of insert effects, and are themed around categories like ‘Spaces’ (Compressor → Reverb), and ‘Guitar’ (typically Amplifier Simulator → EQ → Compressor). There are exactly 12,000 of these preset strips in total.

This means that the number of synth/FX preset combinations for the ES1 is 126,000, and 469,200 for Sculpture. Obviously, such large numbers are beyond typical human ability to navigate or absorb easily. What, therefore are the implications for both professional and amateur-enthusiast producer?

5.1.5.2 The amateur

The amateur in this case will be assumed (rightly or wrongly) to be someone who is unlikely to have time or training to meaningfully engage with all the parameters of the relevant devices, or possibly even a mature understanding of the range of capabilities of a given device. This person is likely to wish to use named presets as a starting point in their productions, possibly not even adjusting them to any great effect. Just as was the case for most users selecting sounds 1–32 on the DX7 in the eighties, there is a quantal palette available, and the selection of a new sound might mean clicking through the

range, albeit guided by the nomenclature of the settings. Such an approach is facilitated (encouraged?) in Logic via the provision of the Key Commands 'Next [or Previous] Channel Strip Setting of Selected Track'. Whilst such a heuristic approach might yield immediately exotic and 'professional sounding' results on an individual track, it provides no education or indication of the aspects of the sound that emerge as appropriate. The user is left to repeat the process on future occasions. Whilst the provision of large numbers of presets offers the greatest choice (and possibly a useful marketing approach), it might also appear intimidating and to a degree, impenetrable. White's (2003) point about nomenclature becomes all the more lucid in the face of so many options; the user is guided through the plethora purely by these names. Manufacturers such as Steinberg and Native Instruments offer management of presets via meta-tagging, although this facility does not yet exist in Logic.

Experimentation is potentially negated in this modus operandi, both at a configuration level (e.g. signal flow ordering of compression and EQ), and at a parametric one.

Having said this, user-favourites from this palette can be saved and revisited, and many users will of course actually investigate the parameter settings in an effort to deconstruct them, the latter thus providing a potentially excellent in-situ education for the curious. There still exists the danger of misinterpreting intended functionality, e.g. mismatching signal level to a default dynamic processing threshold.

5.1.5.3 The professional

As testified by some in Section 5.1.3 above, the heuristic approach just described does not always sit comfortably in professional production. Although

the strife for integrity (via timbral originality) is often paramount, there can be occasions when professionals resort to or require presets. Range of expertise is one; with preset options pervading so many aspects of the complex environment that is the modern studio, it is not unreasonable to find people engaging with less-familiar equipment, and resorting to the preset as a starting point. Harding, again in Section 5.1.3 offers one such scenario.

Another situation common in the professional world, especially when exposed to commercial constraints, is speed. Programming 'uniqueness' is not often a swift task, and sometimes integrity is sacrificed for workflow, as indicated by Jam and separately, Ramone (Savona, 2005). The huge numbers of presets now available necessitate even those who might work this way to be reasonably familiar with their palette in order to navigate it (meta-tagging is becoming a powerful tool in this), just as was the case when sample libraries expanded exponentially with the introduction of CDs of commercially available libraries. Large libraries have another implication by their magnitude. With so many options available, the statistical chance of too many people utilizing the same sound decreases, perhaps then offsetting the 'timbral originality' issue referred to above, although of course still leaving the phenomenological notion of originality as questionable. Despite this, media composer/producer and sound designer Richard Lightman (2011b) asked the postulant in correspondence, "How often[33] does one hear a track or television underscore and recognize the preset sounds of Logic or East West sample sound sets?"

[33] Meaning very often.

This could suggest the presence of 'go-to' sounds. These might exist for a number of reasons, the most obvious being that they are the 'best', which in this context could indicate idiosyncrasy, authenticity, performability, ease of transferability, or just originality. Other factors could be their being near the top of a categorization listing, possession of an alluring name, or an association with a well-known user/artist or track.

Lightman's observation also suggests a lesser-documented trend amongst professional media composers[34] – engagement with presets. It is commonly understood that deadlines are tight and reimbursement is not always forthcoming for the multiple revisions that are often requested. It is therefore easy to understand a motivation to assemble finished pieces quickly, instead focusing 'integrity' and energy towards compositional aspects.

5.1.6 Research movements

There is currently considerable momentum in furthering the concept of the preset, coming from perceptual and HCI as well as DSP angles.

5.1.6.1 Current commercial development

There are some technological trends worth noting. 'Patch breeding' is a fairly established software phenomenon whereby two presets (or in fact user-patches) can be auto-combined into a derivative hybrid. This means that presets can form new presets, in infinite variations. Auto-intelligence has yet to be applied to the essentially stochastic breeding process.

Plug-in manufacturer Waves has recently been developing its signature series tools. These are hybrid effect chains, each with a number of functional

[34] Who are often self-producing.

aspects that would more typically require a greater number of parametric adjustments; however, a much-reduced number of controls are provided and presets of these 'macros' are also provided. This approach has been extended to the *Oneknob* series, which literally feature a single knob for some function such as 'louder'.

5.1.6.2 Research

Sabin and Pardo (Sabin and Pardo, 2009b) have described an intelligent equalizer that allows personalization of equalizer settings, learning responses to the user's interpretation of descriptors like 'muddy', and allowing subsequent control of this aspect with a single slider. This concept of semantics in production has since been developed by others such as De Man and Reiss (2013). Such an approach extends to the notion of the preset; although more analogous to the CS-60's user-defined setting, it demonstrates that macro-approaches to parametric control are developing and converging with subjective personal ideals. Sabin and Pardo also describe a two dimensional space, again programmed by user-hermeneutics which dispenses with multiple parameters again, and offers X-Y control of (say) bright–dark and warm–tinny axes (Sabin and Pardo, 2009a).[35]

Considerable work is underway to automate many aspects of the engineer/producer's work. Reiss offered an insightful summary of current research with particular respect to mixing tools, aiming:

> …to automate the technical tasks related to audio mixing while freeing the audio engineer to perform the more subjective tasks. (Reiss, 2010, p.1)

[35] It is perhaps worth noting with regard to the previous case study of Logic, that its Sculpture synthesizer features a similar notion of X-Y pad for its physical modeling modes.

The above initiatives encapsulate the legacy function and spirit of the preset, but also demonstrate continuing aspirations. It is feasible that the preset as a single entity will become replaced by a simplified user interface[36], an intelligent functionality and a more conceptually aware paradigm – almost an analogue of the 1176 user-experience.

5.1.6.3 The future

The next situation is likely to bear increasing relevance as technology develops; the preset as a professional tool will develop to the point where it is simply too good to ignore. Already there are situations where, as Lightman points out "…even the professional will not bother to explore the full capabilities of a plug-in as it just seems to work." (Lightman, 2011b).

Technology around the preset (as everything else) is poised for a quantum step as multi-touch screens, 3D cameras and 3D graphics evolve and converge into new modes of HCI. Perhaps tomorrow's preset will extend Pardo's model and Reiss's vision to manifest itself as a 3D blob in space with aspects of its shape and appearance analogous to 'colloquial' sonic descriptors previously obtained from the individual user. It would take a user of spectacular introversion not to want to shape it, at least slightly, with both hands at once whilst simultaneously hearing sophisticated sonic changes being actioned with all the tactility of turning the input knob on an 1176…

[36] Optional stripped down GUI views with macro controls are common, e.g. in Ableton Live's Instrument Racks, or Native Instruments' Kore.

5.1.7 Conclusion

The preset is an essential part of modern music production. How and when one should use it is still open to some debate, but it is not going to disappear in the near future. Instead, perhaps the preset will evolve from its current largely bipolar persona into a more organic and contextually aware entity, allowing both a simplistic plug and play approach, and an intelligent manifestation of the user's vision, be that inexperienced or expert.

5.2 Creative abuse in time stretching

Part two of the third secondary research focus is: 'how are the limitations of functionality probed as was 'traditional' in so-called innovation before the software age?' This is now explored via an area of digital audio manipulation that was used pivotally and extensively in the *Something Jaggy* album – that of time stretching.

5.2.1 Introduction

The ongoing journey that Eno[37] (2004) predicted can be represented by the 'microcosm' of recordists' efforts to manipulate temporal aspects of audio. The opportunity therefore exists to explore the applications of the technologies, contextualized by reminding the reader of earlier efforts that shaped the temporal manipulation of recorded audio. In addition, this section will investigate sonic and musical implications of currently available commercial systems, not the obvious corrective applications, but that of consciously exploiting their side-effects for laterally creative ends; creative abuse.

[37] Referred to in the introduction of this submission.

5.2.2 Background

From the dawn of recorded audio, pitch has been linked to time (duration). The primal Edisonian/Berlinerian systems could be run at different speeds, thus imposing a pitch shift inseparable from the playback speed. Composers subsequently embraced this facility, as exemplified by John Cage in his turntable piece, *Imaginary Landscape No.1* (1939)[38]. The result was predictably a heterodox to the 'musically trained' ear since there was conscious disregard for established tonality and tuning. The principle however is important in that (amongst other things) it demonstrated, indeed established, a curiosity towards temporal manipulation in pre-recorded audio as a compositional device, and further, that the primary process might induce secondary artefacts (pitch versus time versus timbre) that were acceptably bound together.

5.2.2.1 Tape and timbre

Tape manipulation has already been introduced in Section 4.1.5 with specific regard to its evolution and the splice edit. Here, its applications will be continued with a focus on timbral manipulation. Unlike precedent direct-to-disk recording (in addition to splicing and looping[39]), tape could be recorded, stretched and re-recorded. In-situ sonic manipulation was now a reality, and this medium formed the backdrop to the new defiance of tonality, Musique Concrète. Cage told Thom Holmes in conversation:

[38] A recording can be heard online at: http://www.medienkunstnetz.de/works/imaginary-landscape-1/audio/1/ [Accessed: 11th April 2011].

[39] As discussed in Section 4.1.5.

> It made me aware that there was an equivalence between space and time, because the tape you could see existed in space, whereas the sounds existed in time. […] We could put a sound at any point in time.
>
> (Holmes, 2012)

In 1952, Cage pioneered a form of what might today be referred to as 'hyper-editing' with his piece *Williams Mix*. This was a 4 ¼ minute piece, with a 192-page graphical score, mostly comprised of editing instructions (Holmes, 2012). This ratio of editing to duration is prophetically reminiscent of the intensity of audio quantization and manipulation approaches today. Cage was not exclusively attempting to gain a temporal ideal, but instead was focused on exploring the consequences of radical editing techniques utilizing different shapes of cut; a form of spectromorphological synchresis, which also incorporated chance elements – coin tossing selected which from a palette of edits was applied at any given point. Authenticity was no longer a factor, and indeed was now relegated simply to antecedent.

Les Paul is remembered for his association with Ampex to pioneer multi-track recording, and he produced a number of what Theberge (1997, p.216) coined "unperformable experiments (and hit records)". Paul also subverted authenticity with half and double speed overdub recordings, each of which had temporal and spectral implications as well as the obvious pitch shifts; it is notable that Paul's music represented the first such manipulations that the majority of the record buying public had heard, and these sounds were subsequently embraced.

5.2.2.2 The granular evolution

Gabor (1947, pp.591–594) first postulated the notion of the "quantum" of sound, opening the way for composers to separate pitch and time in a given

piece of audio. Xenakis first developed a compositional theory for this approach using tape-splicing and analogue tone generators, but it was Roads (1996) who first implemented it via computer in 1974. Truax (1986) subsequently pioneered real-time granular synthesis in 1986, utilizing PODX to realize *Riverrun*[40]. Granular techniques have evolved through phase vocoding, which shares a timbral similarity due to the STFT-type time windows, and these in turn have led to patent processes such as Serato Pitch'n Time (Hoek, 2001) and even more contemporary systems, for example Zplane's élastique range (Zplane, 2011). The multitude of further contemporary permutations and advancements are beyond the scope of this historical perspective. When pushed beyond the range of its specification, the sound of digital time-stretching bears its own aural watermark, and this will be returned to from a practical perspective in Chapter Seven.

5.2.2.3 The sampler

Although 'raw' digital recording first entered the commercial market in 1977 via the Sony PCM–1, it was the digital sampler (the Fairlight CMI was the first to be launched in 1979) that was the vanguard of temporal correction. Empowered by the quantization capabilities of MIDI sequencing, digital recordings could be sliced, and individual segments' timing adjusted to suit the context. In addition, being of a finite length, musically coherent slices could conceivably be placed such that a gap between contiguous sections appeared, and in the absence of any audio-stretching technology, if the gap was to be

[40] An audio excerpt that demonstrates the characteristic sound can be heard on Truax's website: http://www.sfu.ca/sonic-studio/excerpts/excerpts.html [Accessed: 12th April 2011].

filled, a loop might be enabled to sustain the slice. Such looping facility was optimized to emulate sustain of acoustic instruments, and if applied to (say) percussive segments, unnatural stutter effects could be created. Such looping was usually implemented so as to avoid overly harsh, discontinuity-induced clicking, but cross-fading ameliorated this, allowing a range of loop lengths to be employed, each with a unique sonic character; with unpitched material the choice of loop point was basically arbitrary, and to taste. Another strategy could be to transpose the slice down; if this was done by an amount determined by the gap length, the resultant pitch shift would be essentially stochastic. In either case, the aleatoric transitions of Cage were thus replicated in commercial music of the digital era.

5.2.3 The nexus

The temporal manipulations available in contemporary software are primarily designed to facilitate transparent 'correction'[41]; however, such manipulations are also justified purely as a vehicle to generate new timbres in an appropriate musical context. Talking of mechanical sounds in 1913, Russolo (2004, p.15) said:

> We want to give pitches to these diverse noises, regulating them harmonically and rhythmically.

The corollary also holds; in temporal manipulation, anticipated pitch and other spectral artefacts could be useful. Influenced by phenomenology, Pierre Schaeffer discussed the expression 'acousmatic listening' in 1963, quoting the Larousse Dictionary thus; 'Acousmatic, adjective: is said of a noise one hears

[41] Although some manufacturers do allude to the creative potential of side-effects.

without seeing what causes it' (Schaeffer, 2002). Although Schaeffer was principally referring to recorded or broadcast sound, the phenomenological analogy can equally be applied to the tangible ('seen') source audio's mutation when time stretched.

The artefacts induced by temporal manipulation today might easily fall into this category, thus qualifying the preceding history as a metaphor for a modern methodology. The less than predictable results need not be discounted as worthless, but rather embraced (and controlled if necessary) as homage to masters, doctrines and technologies past. Thus, time stretching for timbral creation could be viewed as an acousmatic process.

5.2.4 Discussion of artefacts

Numerous (software-based) time-stretch systems exist, produced by different manufacturers featuring considerably different workflows, although employing a relatively few actual algorithms. Some comparisons have been made, for instance in sonic results as shown by Audiofanzine.com, (Audiofanzine, 2008)[42] and for workflows by Paterson (2008).

5.2.4.1 Artefacts

Current commercial systems might typically employ a number of user-selectable algorithms, each of which might have a small number of modifiable parameters. These parameters might include: grain-size, crossfade, decay, loop length, and transient preservation (nomenclature varies). When stretch and/or these parameters are applied beyond a certain threshold, the artefacts become

[42] An excellent range of audio examples comparing numerous algorithms can be heard here.

apparent. These artefacts might be loosely categorized as follows: transient smearing, fluttering, formant distortion, pitch-shift and timbral corruption, several of which might also vary over the duration of a given segment of stretched audio.

Transient preservation is crucial for an impression of authenticity, however the inverse also holds – that smearing can offer interesting new timbres. For percussive material, extreme smearing of the leading edge of the transient can give the impression of 'out of time', which might not be desirable. Should such a timbre still be appropriate, a manual timing compensation might be applied. In some cases, the original transient can be split into two or more discretely discernable transients. These could be manually edited 'into time', or if undesired, compressed back together until musically satisfactory.

The characteristic robotic fluttering often heard in the stretched vocals of 1990s 'Jungle' tracks e.g. *Timeless* (Goldie, 1995a) is still prevalent today in different algorithms, sonically reminiscent of granular synthesis. It can be mediated through adjustment of parameters such as grain-size and loop speed. Careful adjustment of these parameters can yield metrically related stutters, and a heuristic approach can produce other interesting rhythmic and textural effects.

Formants are traditionally difficult to preserve convincingly when stretching, and are a major contributor to loss of authenticity, however if starting with 'synthetic' audio, formant distortion can also be a powerful sound design tool since the listener has lesser preconceptions of the source.

For pitched material in tonal music, any operation that modifies perceived pitch could be seen as undesirable, although this might not be the case for

percussive audio. Sometimes, a stretching algorithm only alters the pitch at the beginning (and sometimes also the end) of a slice, which does align with certain performance techniques, and so depending on the degree and context, can be acceptable. Windowing-type operations can also impose a sense of pitch on un-pitched material. In both cases, the actual pitch might be dependent on the source, amount of stretch, window (grain) size and amount of crossfade, and FM processes can occur.

Timbral corruption overlaps with all the previous artefacts, yet holds as its own category when sounds change in ways not readily associated with specific and identifiable phenomena. Algorithms that induce extreme pitch changes linked to playback speed could be said to produce these.

Once categorized, the potential exists for quantification of these artefacts. This would be an interesting development, however given the (evolving) range of algorithms and their associated nomenclature/parameters, and manufacturers' likely reluctance to highlight 'side-effects', quantification is unlikely to become a reality. Instead, some other potential developments are now suggested.

5.2.5 A future model

Temporal manipulation might be more easily exploited with more sophisticated tools. To better understand what has changed, a wavelet transform-type function could compare spectral content before and after stretching, leading to a citable or plottable 'Fidelity Index'. This could be represented as an envelope superimposed on each slice, and adding an editing facility that fed back into the parameters would be useful too. Being copy and

paste-able regardless of slice duration would extend this functionality, maintaining a focus on timbre beyond duration, if required.

Also, an evolved visualization of the waveform could greatly aid interpretation of artefacts. If instead of the current 2D representations, a 3D waterfall was implemented independently for each segment of audio, much more information could be conveyed visually. See Figure 5.1.

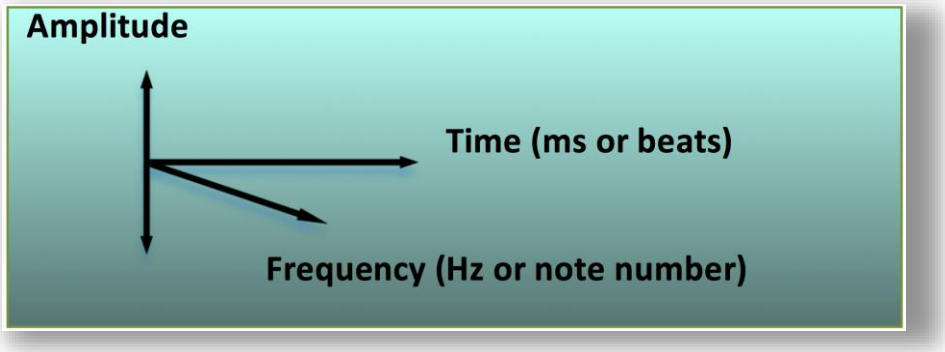

Figure 5.1 The time base should be switchable between time and various beat subdivisions to allow visual alignment of stutters.

The frequency axis could display Hertz or MIDI note number, with a secondary resolution to cents. Each slice could be represented on a Celemony Melodyne-esque (Celemony, n.d.) piano roll that could clarify pitch further, but a z-axis for frequency would still be necessary[43]. The image should have two colour-coded layers[44] that can be toggled or superimposed, one for the original un-stretched waveform, and the other for the stretched version. Reversible amplitude and frequency axes would be useful, but facilitating a fully rotatable

[43] Such an implementation might be considered as overkill solely for this (obscure!) purpose.

[44] Since this text was written, the DJ tool Traktor Pro 2 (Native Instruments, 2015b) has been released, which employs a crude frequency-content to colour graphic.

system similar to that employed in Audioease Altiverb (Audioease, n.d.) would yield even more flexibility.

Stating grain size or loop length as a tempo-related note value and/or pitch equivalent would be useful (rather than simply an absolute time or percentage of a slice duration), allowing considerably more control. Even more sophisticated would be to incorporate corrective tuning for every slice, although this does rather defy the aleatoric doctrine cited earlier.

5.2.6 Conclusion

Time stretching is now a long-established creative tool beyond mere corrective function and is a multi-faceted weapon in sound design. It overlaps with granular and FM syntheses, and it carries stochastic and aleatoric qualities. Despite powerful and flexible contemporary algorithms, its lateral application precipitates the random ruling the predictable. Whilst this can be mediated to produce exciting compositional effects, the ultimate (or perceived) lack of sonic control can be a deterrent in many situations. DSP-driven temporal functions are still in their infancy, and as they evolve, doubtless also will their creative abuse.

5.3 The trajectory of interaction with audio visualizations

5.3.1 Introduction

Multi-touch (MT) control is one of the most rapidly expanding areas of Human Computer Interaction (HCI). In audio production, particularly on iOS, there are a plethora of applications that facilitate various forms of mediation with visualizations of the audio stored and played back from the local device. Current devices tend towards categorization as sampler/synthesizer, DJ tool, or the novel.

Microsoft Windows has featured MT support since version seven, yet few DAWs on desktop and laptop machines are responding to this[45], despite the much stronger media propagation of this facility since the launch of Windows 8. Whilst there are a small number of systems available enabling MT via Windows, there is also the unique Slate Raven which features both dedicated hardware and software. In addition, there are multi-purpose touch screens such as CTOUCH which is multi-OS, but currently optimized (and only fully functional) for Windows.

Further to the above systems, there are a number of editor packages available for iOS, typically allowing creation of custom interfaces for MT control of Max/MSP using a range of knobs and sliders etc. Of these, only MMF-Fantastick (Chamagne, n.d.) allows a visualization of the waveform with MT control whist running on Windows (only). The Cycling '74 Mira app allows realizations of many native Max/MSP objects on iOS, however at present it

[45] The MT facility of the OS cannot be used unless a given application also supports MT.

does not support the waveform~ object, which is the principal (amplitude/time) Max/MSP audio visualization tool.

The opportunity therefore exists to facilitate MT control of a waveform visualization on Mac-hosted audio; this is a primary function of The Wavefondler, the bespoke piece of software designed for this submission. The Wavefondler is a Max/MSP patch under MT control from Mira that recreates an image of the waveform, and allows the user to interact directly with this visualization, controlling audio on the host Mac computer. When running in 'Max for Live', it can effectively act as a real-time insert effect on any length of audio file that is resident in Live, thus integrating into the greater DAW environment. To contextualize this, The Wavefondler also replicates a number of control features already available on commercial iOS apps (except again, this control is available for host-based audio), but in addition also allows a number of unique proprietary effects to be controlled.

5.3.2 Background and related work

5.3.2.1 Chronology

In order to contextualize the current state-of-the-art and ensure the novelty of The Wavefondler's design, a brief chronology of landmark products that influenced human interaction with visual representations of audio is now presented. The representation of an image as sound, or indeed sound as an image is sometimes referred to as an audiovisual transformation. The earliest of these was created in the late 19th Century by André-Eugène Blondel with his invention of the paper-based oscillograph (Miguel Dias Pereira, 2006) which could offer a visualization of a telephone audio signal; the oscillograph was later to evolve into the more familiar oscilloscope.

Audiovisual transformation has been explored in numerous contexts ever since. Whereas the oscilloscope was of course purely representational, sound film was a largely unseen playback medium, however it was that which allowed the first creative generation of sound from shape. In 1930, Arseny Avraamov drew analogues of audio waveforms by hand before photo-reducing these for transfer to sound film. (Thoben, n.d.) Such approaches were notably developed by Daphne Oram – the Oramics system, which she developed for a number of years from 1957 (Manning, 2003). Iannis Xenakis defined the UPIC 'syntax' in 1977 (Marino *et al.*, 1993), which extended the earlier haphazard approaches to visualization into a more defined system of timbres and manipulations. The scientific study of cymatics is now rapidly advancing – applying the principles of wave mechanics to enable new modes of sonic visualization (Jin Oh, 2012).

Such work facilitated the generation of sound from image, and indeed empowered its relevance, but the true mediatory relationship between musician and audio visualization did not start until 1979 with the release of the Fairlight CMI. (Anon, n.d.) This revolutionary and hugely expensive device featured a CRT monitor that could display a sampled or synthesized waveform that the user could interact with via a light-pen as seen in Figure 5.2 (left).

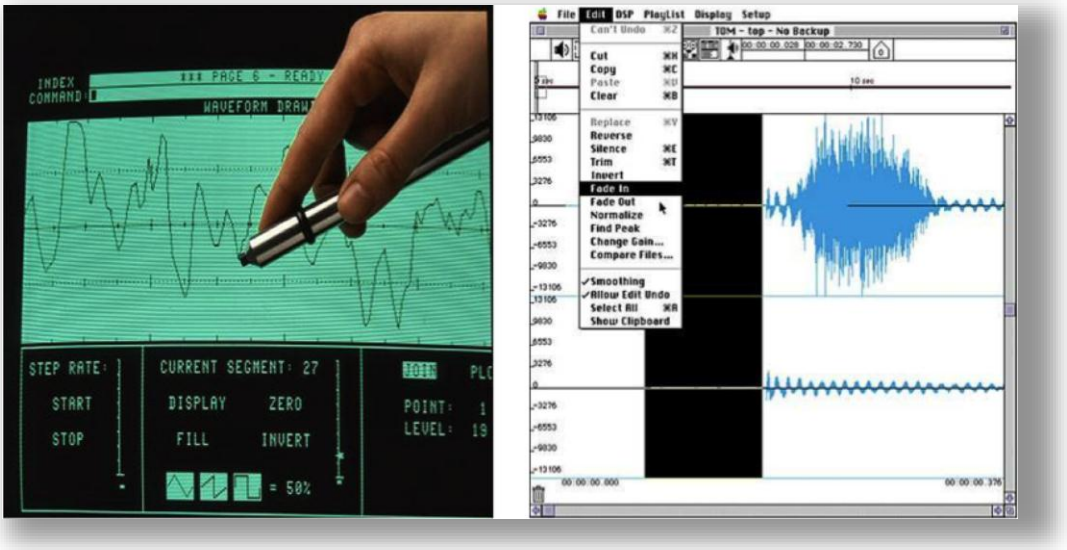

Figure 5.2. Left: The CMI light-pen in operation[46] Right: The Sound Designer sample editor GUI[47]

By dragging over and reshaping the visual, the user learnt the audio reaction in terms of timbre and amplitude, and thus began a new paradigm in studio workflow. In the 'mouse age', a further milestone was the Digidesign Sound Designer sample editor, released in 1985 and shown in Figure 5.2 (right). This represented the first piece of software to display a visualization of audio that 'resided' on separate hardware (any of a number of supported samplers), and communicated via RS-422, a rather slow serial protocol. This software allowed fades and gain changes to be rendered, and provided visual feedback via the waveform image. Further integrated hardware was quick to follow, and in 1988 the Akai S1000 sampler featured a small LCD screen with a scrollable split image of the waveform to view 'end & start' loop points more easily.

[46] Image from (Anon, n.d.).

[47] Image from (Halaby, n.d.).

1990 ushered in the Opcode Studio Vision as shown in Figure 5.3, the first MIDI plus audio sequencer. (Mixonline, n.d.) For the first time, audio regions could be edited and placed on a time line alongside MIDI regions. This represented a major increment in interaction with the waveform as 'musical' placement and timing augmented the cropping and fading-type edits previously available in sample editors.

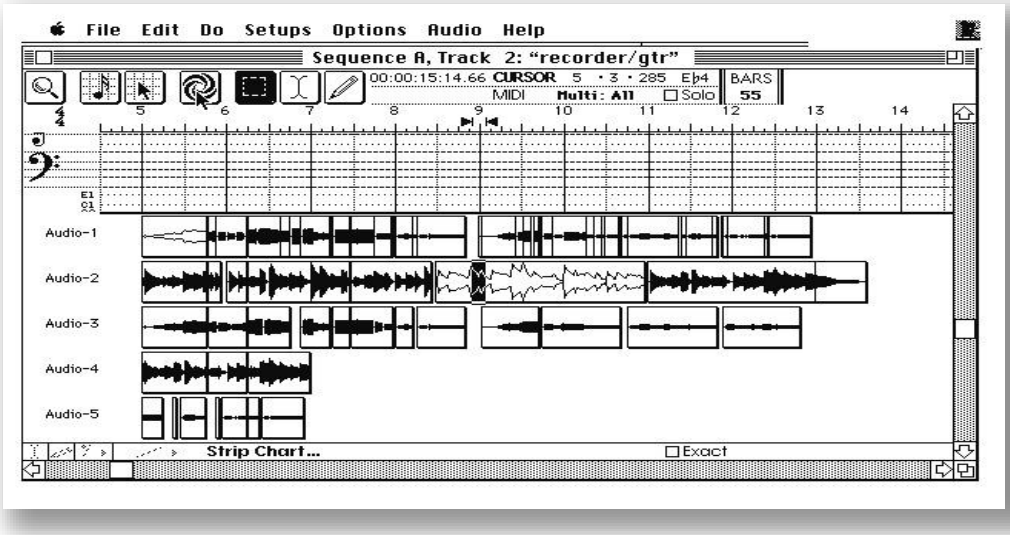

Figure 5.3. Opcode Studio Vision[48]

The audio waveform was now an iconic meme and developed in many products throughout the 1990s. Transient detection & slicing, time stretching and off-line effects processing all became represented visually in what has become a familiar paradigm today and so will not be discussed further.

5.3.2.2 Multi-touch

Despite the principle first being realized in 1982 via an optical system (Mehta, 1982), commercial (capacitive) implementation of MT is a recent development, and direct manipulation of a waveform is greatly enhanced by

[48] Image from (Halaby, n.d.).

such interaction. Current MT devices fall into loose categories: Windows machines, 'iDevices'[49], non-iOS tablets and bespoke devices. Within the iDevice/tablet categories, there are both commercial applications and user-constructed interfaces constructed with editor software.

As mentioned, MT has been available on the Windows platform since version seven in 2009. Although the OS supported this and MT-responsive monitors started to emerge, pro-audio manufacturers have been slow to implement MT. One reason for this could be the fashion for densely packed GUIs that do not lend themselves to finger control, and further, hands might often obscure important areas of the screen during operation. A full GUI redesign is not a trivial affair, especially given the enormous range of functionality that would need to be replicated on a larger 'finger-sized' scale. Released in late 2012, Cakewalk Sonar X2[50] shown in Figure 5.4 is to date the only DAW to implement MT functionality. Whilst highly effective in offering movement of multiple faders simultaneously, the intricacies of audio editing have been avoided, and only pinch-zoom and scroll have been implemented with the waveform visualizations.

[49] This term is adopted as a collective to include MT Apple units such as the iPhone and iPad etc. Other tablet operating systems such as Android do not currently offer much audio-related functionality.

[50] The current version is the Sonar Platinum.

Figure 5.4. Sonar X2[51] in operation

Whereas .NET is used for coding MT applications on Windows, JUCE is a C++ class library that can compile to several platforms: Windows 8, iOS and OSX etc. A device that is built with JUCE will respond to MT if run on a suitable platform, e.g. on Windows 8, the D16 Lush 101 plug in runs with MT capability in Cubase, despite the latter not being MT. (Vincent, 2013)

In 2013, the Openlabs Stagelight of Figure 6.5 became the first of a new generation of DAWs that featured a GUI that was optimized for MT finger control, with larger and more spaced controls. It does not offer any interaction with a visualization of the audio.

[51] Image from http://www.youtube.com/watch?v=zh-fpA2-fto.

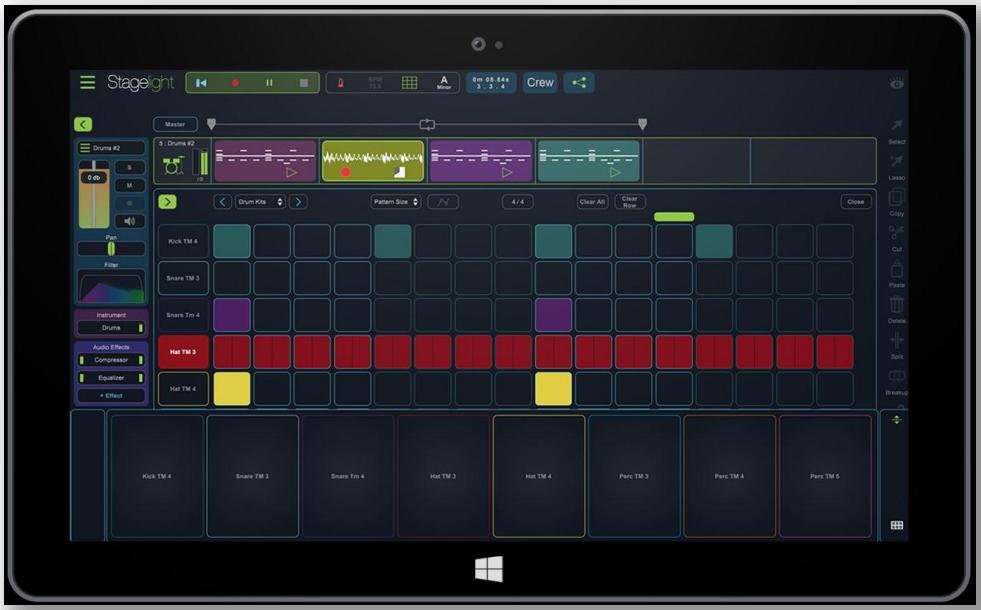

Figure 5.5 Stagelight's GUI[52]

Figure 5.6 The Emulator[53]. Note the waveform displays, directly from Traktor underneath the 'overlay' GUI.

[52] Image from http://us.openlabs.com/index.php/products/stagelight.

[53] Image from http://smithsonmartin.com/products/emulator-pro/.

An editor package exists for Windows; the 2010 SmithsonMartin Emulator, as shown in Figure 5.6. This device can host a custom MT interface that controls a third party application, and currently it seems to be closely aligned to Native Instruments Traktor – almost exclusively. In order to feature waveform visualization, it allows regions to be defined in its 'overlay' GUI layer to allow the third party graphics to show through from beneath, but since Traktor does not support MT, these of course do not respond to it at present.

Perhaps due to Apple's legacy with music applications, iOS is the dominant contemporary platform for music-related apps. The taxonomy of these apps tends towards devices which are holistic in their operation on the iDevice, act as 'fixed' functionality control surfaces for manipulation of an application on a host (desktop or laptop) computer which likely has its own control over DSP and audio functionality, or user-configurable editor packages that can control a target application on a host. Only the 'holistic' tend to feature audiovisual transformation. Firstly, to discuss some examples of apps of the former 'holistic' type, Jordan Rudess' Samplewiz (shown in Figure 5.7) offers many classic synthesizer features and modes of playback.

Figure 5.7 Samplewiz, showing two-finger operation.

The most relevant here allows the user to polyphonically touch a visualization of a sampled waveform stored locally on the iDevice. Each finger can play a different (looped) section of the waveform, and the vertical axis transposes playback chromatically, although with a minimum resolution of ±12 semitones, exact pitching can be hard to control. Despite this, it is a hugely gratifying and novel mode of performance; however, (although there is a two level zoom function) due to the fixed size window, if longer samples are imported, the relative size (on the x-axis) of meaningful sections of the waveform become too small to accurately highlight with fingers.

Figure 5.8 Samplr[54]. The two white circles on the waveform represent where fingers touched.

Another excellent example is Samplr of Figure 5.8, which offers several modes of polyphonic playback, and a multi-track type facility. Playback modes include both grid & transient-based slicing and looping (that can arppegiate between selected slices) with volume on the vertical axis, a pseudo-tape mode where the virtual tape can be scrubbed in either direction with various enveloping and effects functions. Again, the window size is fixed and as such the target audio is 'fitted' to the window.

Lastly notable here is Traktor DJ, shown in Figure 5.9. Primarily a DJ tool, this app can run much longer pieces of audio then those above and features effective scrolling into manageable 'loop-windows', which can in turn be resized

[54] Image from http://samplr.net/.

with two fingers, thus allowing its ‘freeze’ and ‘slice’ modes that play back individual samples from the longer audio.

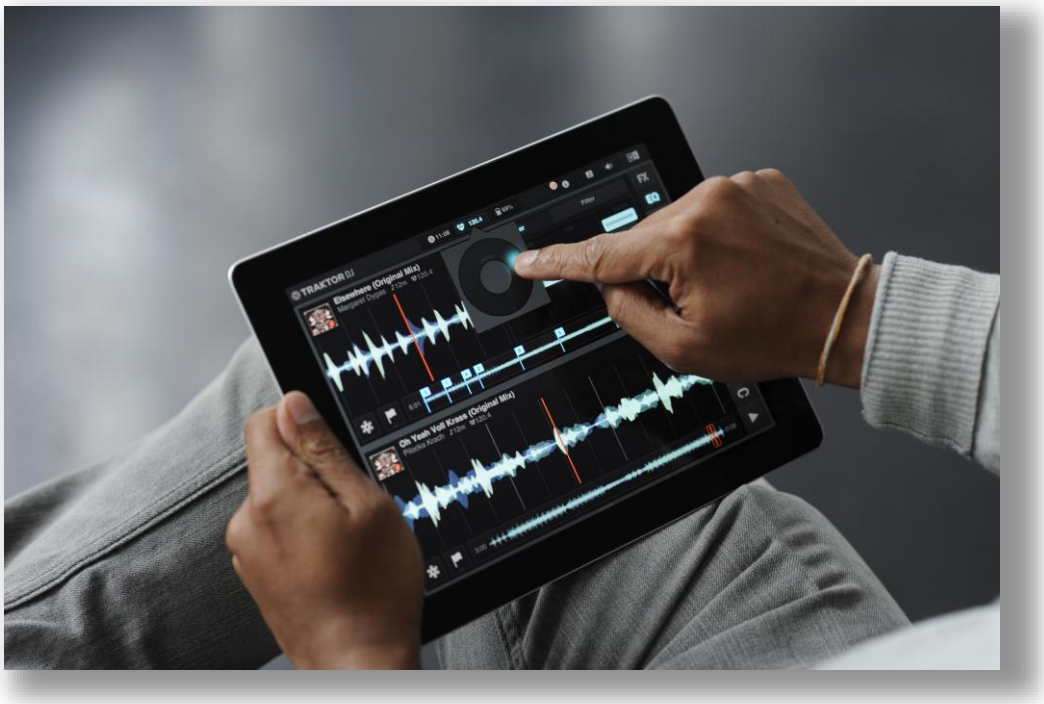

Figure 5.9 NI Traktor DJ[55]

The three apps above all feature the same degree of isolation from a host (DAW) and although featuring a degree of support for Core MIDI, typically require third party utilities such as Dropbox or Audioshare to import/export files to a host system; clearly an impediment to integrated workflow with a greater DAW environment. Although highly tactile and capable of delivering genuinely new modes of performance, they are also tied to purely ‘live’ performance, since there is little retrospective editibility of sequence/automation type events.

[55] Image from http://archive.wired.com/geekdad/2013/03/traktor-dj/.

Apps with fixed functionality control include the Apple[56] Logic Pro X Remote, which facilitates useful, but basic mixer functions.

Alongside the already mentioned Mira, there are a number of editor systems available for iDevices, tending to interact and control Max/MSP – C74, Lemur, Fantastick, and MMF-Fantastick (an extension of the former) all offer MT control, however of these only the MMF-Fantastick system of 2010 (Chamagne, n.d.) offers a visualization when used on PC. This is important, since it was the first MT way of interacting with an audio visualization.

Figure 5.10 Wavetable, showing puck-driven operation[57]

[56] It might also be noted that the new/revised GUIs in Logic Pro X are all 'finger sized', a strong hint towards Apple's desktop implementation becoming MT.

[57] Image from (Roma and Xambo, 2008).

With regard to bespoke devices, in academic circles, the WaveTable (Roma and Xambo, 2008) of Figure 5.10 appeared in 2008. This was based on the reactable framework, reacTIVision. (Kaltenbrunner and Bencina, 2007) This system used a MT light table to display a visualization of a sample, and use Reactable-style hand-positioned pucks to manipulate parameters such as: zoom, selection, gain, LPF and erase. Although the system is visually arresting, it could be argued that the pucks might impede fluent real-time operation and accuracy.

Further academic systems include the Twkyer (Yerkes and Wright, 2014) which is focused on looping operations, but with interesting gestural performance control – again it is iPad native[58]. There is also the DJ tool, Random Access Remix (Forsyth *et al.*, 2011), which makes innovative use of dual timelines and a visualization of the waveform to orient the user. This system does not significantly exploit MT and is iPad-native. There is currently one bespoke commercial system that facilitates MT on larger screens, released at Winter NAMM 2013 – the Steven Slate Raven interfaces (Slate Pro Audio, n.d.) shown in Figure 5.11; only available for Pro Tools at the time of writing.

[58] Despite being published a year after The Wavefondler.

Figure 5.11 The Slate Raven MTX[59].

Despite impressive MT control of the mix environment on a host computer with an number of GUI functions that optimize and speed workflow beyond native Pro Tools, these only offer single point control when editing waveforms.

MT clearly offers a plethora of possibilities to the musician of today. Section 5.4 will offer a response to this study and present the design of a novel tool, The Wavefondler.

5.4 The Wavefondler

5.4.1 Concept and implementation

During the development of the track *Anathemaofanenema*, it seemed appropriate to implement a number of hyper-edit-type effects to process the audio – always a time consuming task. Whilst commercial options such as the keyboard-operated iZotope Stutter Edit (n.d.) exist, there was clearly an opportunity to create a multi-touch (MT) controller that offered extended real-

[59] Image from http://www.slateproaudio.com/products/raven-mtx/.

time functionality, alongside a development of the 'preset paradigm' that was discussed in Section 5.1. Cited in Chadabe (1996, p.258), bespoke music-software designer Barry Truax states "that most people are unaware of how commercial software colors their musical process and causes standardization". The Wavefondler Max/MSP patch was developed in order to provide a bespoke and unique form of control over the desired audio manipulation, and act as a tangible 'development' of music production as in the primary research focus[60].

As will be noted from Section 5.3, it would appear that there is broad acceptance of the benefits of MT for performance and mixing operations, but it is clear that direct interaction with an audiovisual transformation on a desktop/laptop is yet to come of age, and that at the time of writing there is no way of using MT control on a visualization of audio that resides on an Apple Mac computer. The release of Mira (Cycling '74, n.d.) in Summer 2013 offered new possibilities of implementing this. Mira is able to display a number of Max/MSP objects, however Mira does not include the waveform~ object, which is normally used within Max/MSP for audio visualization. As such, this did not represent a complete solution in itself, however Mathieu Chamagne produced an innovative Jitter-based abstraction (based on his MMF-Fantastick (Chamagne, n.d.)) that represented the audio waveform using the multislider object, an object that can be displayed on the iPad using Mira. Rewire apart, Max/MSP generally functions as a standalone environment in normal usage; however, patches can be opened in the Max for Live (commonly referred to as

[60] A study, exploration and development of the interaction of music production techniques in a contemporary desktop setting.

M4L) application within the Ableton Live DAW. M4L comes with a number of dedicated objects to extract timing from the host sequencer, and therefore can facilitate sample-accurate integration of the patch into a DAW environment with automatic tempo-matching.

In order to maintain a consistent magnification of the waveform visualization on the iPad that was easy to touch with fingers, it was decided to copy each progressing bar of real-time audio into a dedicated buffer for the real-time manipulation displaying only a single bar at a time; this incurs considerable latency at initial start-up, but once the buffer is ‘charged’ then latency is minimal through continued use. The patch makes extensive use of the multitouch.mira object, which allows MT control over a prescribed screen area on the iPad. Each of the three separate tabs (shown in Figures 5.12 – 14) provided an iPad screen that was divided up into various areas including some that were multi-function depending on which order fingers reached them from adjacent areas. The GUI comprised many layers in order to facilitate these objects and provide visual feedback.

5.4.2 Functionality and operation

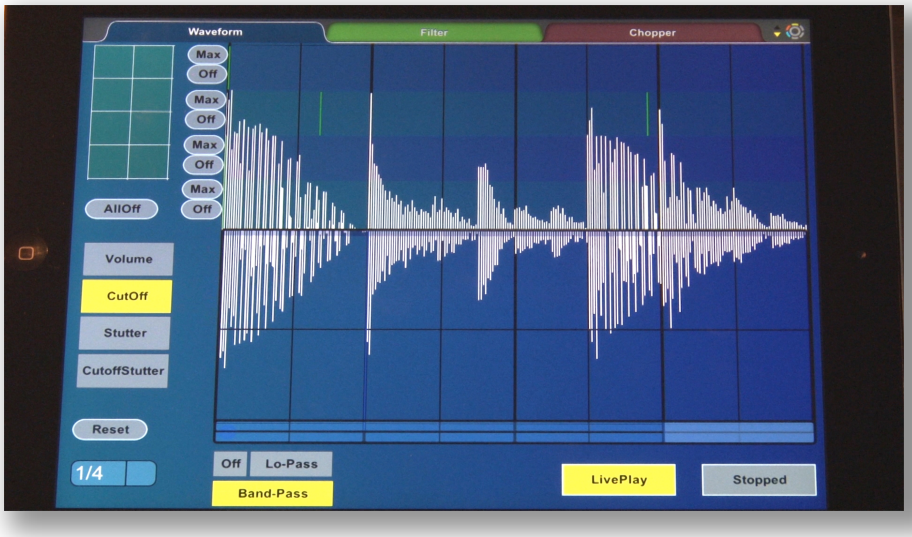

Figure 5.12. The Wavefondler: of the three different tabbed screen views, this is the Waveform tab view.

The Wavefondler Waveform tab (Figure 5.12) allows the user to specify areas of a bar for operation (in quantized note values of 1/4, 1/8/ 1/16 & 1/32) and provides three modes of playback: 1] slice playback with transport stopped, allowing the user to tap and play a selection in the fashion of a one-shot from a sample set on a MIDI keyboard, 2] overdub slice playback with transport running and output quantized to a clock, and 3] looped slice playback with transport running. Several effects processes can then be applied via MT: volume, filter, stutter, and combined filter & stutter. The user can select a slice for playback in the lower area of the waveform view, and then by sliding one or two fingers into the upper area, manipulate parameters associated with these effects, responding to the waveform visualization. Modulation was limited to 2-finger at the design stage, since earlier experiments with multiple fingers proved difficult for the user to meaningfully control. For volume, one finger controls

volume itself whilst the other selects different slices. Broadly speaking, the stutter increases in rate as the finger moves higher on the y-axis, however there is an algorithmic process which plays back a variety of rhythms and pitch sweeps, tempo-locked in addition to 'just' finger placement. In the case of the filter, one finger's vertical position controls resonance and the other, cut-off frequency. Combined stutter/cut-off simply applies both at once. A matrix of eight presets is available to the user, and these can be freely switched between with a third finger. In addition, there are four horizontal lanes in the upper area of the waveform each of which allows one of: filter, stutter, chopper and transposer[61] to be applied to a particular (quantized) area of each passing bar of the real-time audio[62] via 2-finger pinch-selection, independently of the real-time gestures described earlier.

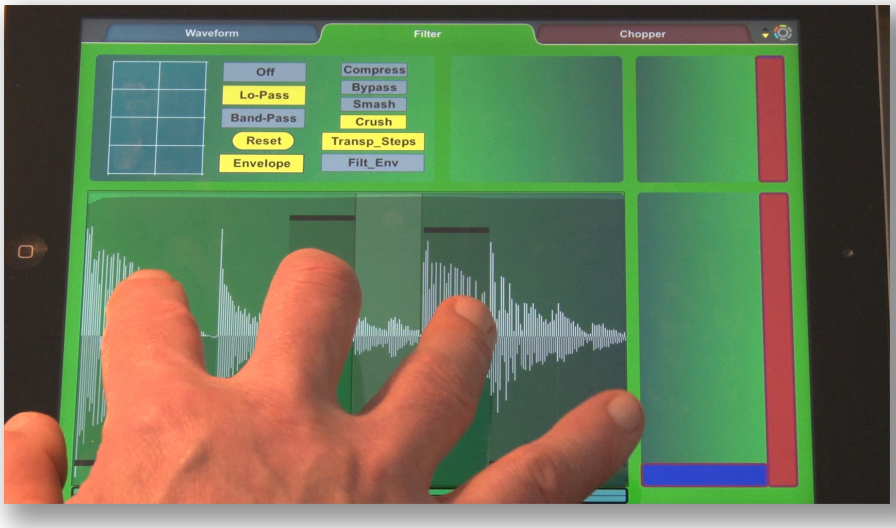

Figure 5.13 The Wavefondler Filter tab view

[61] See the chopper section below.

[62] This concept was originally a 'multi-track' development of the dBlue Glitch VST (discontinued), however over the course of development of this patch, both 'Sugar Bytes Effectrix' (Sugar Bytes, 2015) and 'Illformed Glitch^{2}' (Illformed, 2015) were released with similar (superior) functionality, albeit without the haptic interface.

The Filter tab (Figure 5.13) features an x-y pad that allows 2-finger Independent control of cutoff and resonance of an LPF; this proved a very tactile approach. A second pad above allows control of an alternative BPF alongside a frequency shifter. Again, there are a number of presets available on a small matrix that set numerous parameters on both filters and feature algorithmic real time variations linked to tempo. A one-bar envelope (not shown) that modulates cutoff frequency can be drawn directly on the waveform with MT allowing intuitive interaction with multiple waveform peaks. There is also a transpose facility that offers MT control over the pitch of 1/8-note slices of each bar, again easy to relate to the visualization of the audio.[63]

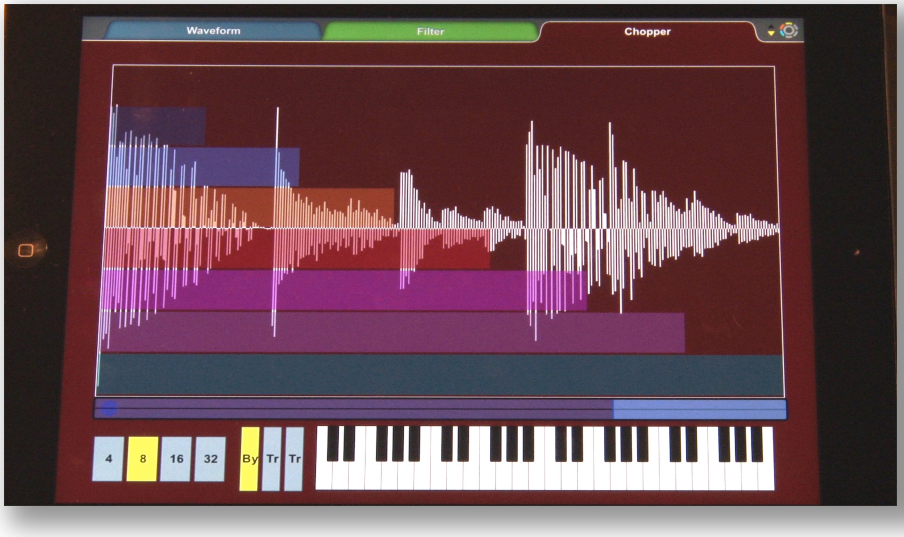

Figure 5.14 The Wavefondler Chopper tab view

The Chopper tab shown in Figure 5.14 uses a time-line that runs top to bottom, divided into note values as indicated in the coloured histogram running horizontally (in Figure 5.14, there are 8 bins, thus representing 1/8-notes,

[63] Similar to the 'M4L Buffer Shuffler', which was unknown to the postulant at the time of development.

although other note values are selectable). The right-hand edge of each bin aligns with points on the waveform, and it is a slice of the same note value at that point that will play from each bin. In Figure 5.14, the displayed bar will play back 'as normal'. The user can adjust the histogram with MT to make different slices of the waveform play at different times, allowing a visual and tactile approach to pattern-based beat-slicing that is easily adjustable in real time. Different note-values can be selected to influence the slice-rate/size. In addition there is a transpose option on this page. There are two different-sounding algorithms, and the amount of transposition is selectable in real time via the piano-style keyboard. Transposition can happen simultaneously with beat-slicing.

In combination, the above feature-set offers a large number of sonic manipulations controlled by a relatively small number of gestures. The reader is strongly recommended to watch the explanatory demonstration video at: http://youtu.be/41B6FKAowXc

5.4.3 Multiple iPads

The Mira software allows The Wavefondler to function effectively using multiple iPads. The Wavefondler was thoroughly tested using two devices simultaneously: a single iPad 2 and another iPad 3. The iPad 2 proved to have an insufficient data-transfer rate over Wi-Fi to offer a functionally fast enough screen redraw, however music control information seemed prioritized, and was transferred with sufficient lack of latency for performance.

5.4.4 Summary

This device was specifically applied to a number of audio tracks in the tune *Anathemaofanenema*, and this will be discussed further in Section 7.2.6.2. It is

perhaps unsurprising that its effect seemed entirely appropriate to this application, since its functionality was designed primarily for this purpose. Having said that, in testing it proved itself to be a versatile tool that could function in a broad range of environments.

6 The studio process: *The Making of Quiet Things*

Some machines intended to serve more mundane functions take on a musical role.

(Pacey, 2001, p.17)

This chapter is the first of two that contribute aspects of the studio practice to the exegesis. The intention is that the reader will gain increased insight into the artefacts thought understanding technical highlights, novelty of context and concept, and the application and extension of praxis. The first part of the chapter will deal with production of the album *The Making Of Quiet Things*, and the second part with the development of the Wavefondler software.

6.1 Album – *The Making of Quite Things*

As a fringe genre, 'Free Improvisation' does not normally attract large production budgets. Often time-constrained, the subsequent technological approach to the production tends to emphasize the naturalistic and neglects many of the tools & techniques that are commonplace in contemporary popular music.

The postulant produced the album, *The Making of Quite Things* by The Number, featuring Keith Tippett (2006). This album consciously employed a range of contemporary approaches such as creative & corrective automation, reverberation-matching, audio editing and extreme compression, whilst maintaining an overall impression of minimal mediation.

The following text considers and contextualizes such an approach, reflecting on the practice and its implications for the genre.

6.1.1 Introduction

Free Improvisation has evolved for some half a century. In his genre-defining album of 1960, *Free Jazz* (The Ornette Coleman Double Quartet, 1961), Ornette Coleman and producer Nesuhi Ertegun utilized the bold new format of stereo, with all instruments hard-panned left and right – an approach that was particularly sympathetic to use of the two simultaneous quartets. Even as the genre evolved, such embracement of 'high technology' was to become rare in subsequent decades. The impressionistic construction of Free Improvisation has never been easy to listen to, and as such it has generally alienated the mass market, resulting in its marginalization, yet it has maintained a dedicated global band of followers. Since 1960, although many prominent artists have engaged with the genre, many principal exponents struggle to raise the finance to create and release albums. One example to illustrate this is that of composer Barry Guy:

> Guy's Ode for Jazz Orchestra is one of the most convincing free-jazz compositions anywhere, but Guy has not yet been able to find a record company willing to risk a production (Jost, 1994).

A common scenario is procurement of (say, Arts Council) funding for a day's studio time, and into this day will be mic'ing, recording and mixing – the antithesis of a typical contemporary pop recording approach. This can even be followed by self-funded CD duplication for supply to established record companies, who undertake only distribution. Such rushed production can result in 'rough edges' in comparison to the highly polished DAW-based releases in

many other genres (more-mainstream jazz included), however the artists are often focused on the performances and their interaction, and are quite accepting of accurate (naturalistic) capture without feeling the need for studio enhancements. As Watson (2004, p.154) says:

> Improvisation finds a more robust beauty – and humour – in the physical act of music-making itself, and hence does not fetishise 'quality' recording.

In reaction to this, the concept was to explore the application of DAW production techniques in this genre. The album was recorded in Vestry Hall Studio One at the University of West London. This studio featured a control room of professional specification, but was limited in its number of acoustically isolated separate spaces. The approach was not intended to recreate the processed aesthetic of much popular music, but rather to offer new levels of control to both enhance the (spontaneous) arrangements and to correct perceived recording anomalies[60]. The DAW was able to implement crescendos that were never played, alter certain phrases to enhance the collective's function, change ambience, and occasionally modify timbre – acting retrospectively as a metaphorical score, perhaps a strange notion for music that attempts to completely break from the page. However, Pierre Boulez was cited by Davis (2008, p.364) as saying:

> That doesn't necessarily mean that it is a score with the notes and scales. It can be a different type of score, numbered and digital, any imaginable form is possible.

For free-improvised music, this is not a familiar mode, but perhaps the metaphor still offers some legitimacy as its own extension of tradition – thus

[60] This approach has since been replicated for the album *In For Each And Every One* (Polar Bear, 2014) as reported by Tingen (2014).

qualifying the production as aligned with the secondary research focus regarding innovation in music production[61].

Of musical analysis, Butterfield (2002, p.327) discusses the concepts of 'autonomy' and 'musical objects', and states:

> What one says about the work is said in a general sense and pertains to all its potential performances, at the cost of the particularity of any actual performance.

Due to its unrepeatability, Free Improvisation is perhaps (apart from aleatoric music) the most distanced from any such analysis, and as such the studio creation is the only reference for persistent enquiry. In that context, this text is crucial to expound the sound.

6.1.2 The Setup

Two days were allocated for tracking, however subsequent production time was unrestricted. The world-class musicians were all highly experienced in the genre. They explained in advance of the recording that close eye contact was essential to their optimal function as a collective. This was fundamentally at odds with the separation of instruments desired for the recording. On tracking day 1, piano, upright bass and tenor saxophone were all placed in a single hall, partially acoustically isolated from each other by baffles and distance. The drums were placed in a separate booth, and two-way video links were implemented. The musicians were very uncomfortable with this, desiring a linear eye-line, which they felt could not be facilitated by a video monitor that required the head to be turned. In addition, some deemed headphones a further

[61] What constitutes innovation in music production, and to what extent can true innovation in production be demonstrated?

impediment (perhaps surprising given their experience). As Crooks (2012) observes, "the highly developed improvisational lexicon of jazz is problematized through engagement with recording". An intermittent patch-bay crackle delayed the start of recording, and all these factors aligned to create considerable tension amongst the musicians; this required tenacious diplomacy from the producer – an often-overlooked production skill. Actual recording could not commence until the second day, upon which musicians played well, and appeared satisfied with a number of pieces, some of which lasted nearly half an hour.

6.1.3 Techniques

The following text presents a subset of the techniques that were applied in the creation of this album. This subset is simply intended to illustrate the spectrum of the production approach.

6.1.3.1 Reverberation-matching

In a clumsy act of destructive editing whilst short of disk-space, the opening minute of the piano track of *Collective 2* (Number, The, 2006) was deleted. The piano had not been playing in this passage, but overall, the saxophone spillage into the piano mics was detrimental to the staging of the saxophone. Naturally, when the piano recording recommenced, the ambience on the saxophone altered significantly. In order to rectify this, the room was modeled with an automated reverb unit, and this was used to stabilize the ambience over the

duration of the edit[62]; the exercise yielded a completely transparent result. This act of correction also provided inspiration for further production developments, a studio phenomenon observed by Keep (2005), and specifics will be detailed below.

Audio Excerpt 6.1 Reverberation matching

6.1.3.2 Automation

It is the nature of totally improvised spontaneous music that certain passages will work to the utmost, yet others will be weaker, sometimes due to the collective musical direction, or sometimes when just one part is less complementary to the greater thrust of the ensemble. Producer's license was taken with dynamics in the fashion of 'a score' and both crescendi/decrescendi and attenuations were implemented, as illustrated in Figure 6.1, part of the multi-track of *Collective 3* (Number, The, 2006).

[62] The edit is where the prepared piano comes in with a glissando produced by rubbing the strings with a woodblock.

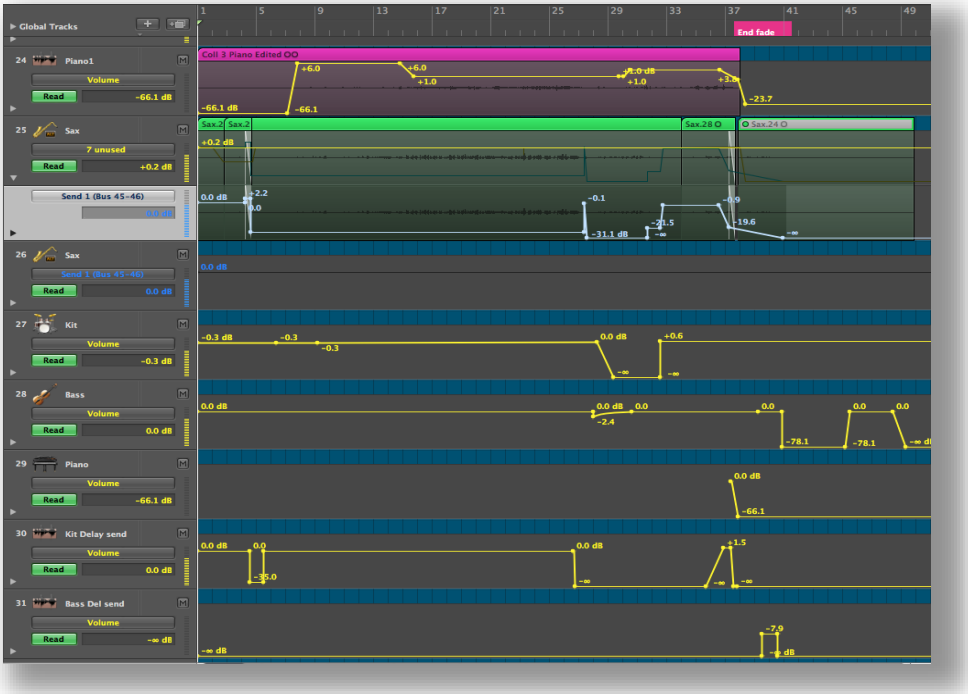

Figure 6.1 Volume automation over a whole track length

Further to this, aspects of Gould's 'acoustic choreography' (Bazzana, 1997) were employed, particularly on the saxophone. As mentioned in Section 6.1.3.1, saxophone spillage imparted a purely reverberant and rather unpleasant signal to the piano mics. In order to turn this to creative effect, a send was set up from the (close-mic'ed) saxophone track in order to produce a 'fade-able' second (modelling) reverb, and automated to modify the presence of the saxophone. One example of where this can be heard is in *Collective 1* (Number, The, 2006) where it was used to underpin a delay effect, its automation giving the more delay modulating amounts of 'wash' from the time 15:16 – end.

Audio Excerpt 6.2 Synthetic acoustic choreography on the saxophone

The synthetic reverb also served to 'sweeten' the saxophone's natural ambience throughout the album.

Perhaps in part due to the acoustic-baffling, quieter saxophone passages failed to impact on the piano tracks giving the natural effect of a further reverb-send level side-chained to gain, much as Visconti experimented with (Buskin, 2004) in the recording of David Bowie's *Heroes (1977)*, although here without the use of actual gates. This was sometimes countered by automation, as above.

Overall, the approach taken here is an extension of the pure close mic'ing pioneered in jazz by Rudy Van Gelder – deemed classic by Tresize (2009, p.207) who went on to say:

> The record and associated equipment are telling us about a performance, but it is not the performance itself; it is filtered through a large number of processes and contexts with which the original performer has nothing to do.

Indeed this still holds, and as such, the application of the techniques applied here do contribute to the secondary research foci[63]; however, as was implied in Chapter Four, although their context might be considered innovative, in reality they are just a repurposing of an established repertoire.

When a piano is prepared with woodblocks on the strings, it is not possible to impart significant energy to make them vibrate effectively without fairly aggressive playing. In *Collective 1* (12:43 – 15:17), there was such a performance of a rapid ostinato phrase, however the automation kept the piano

[63] Specifically: What constitutes innovation in music production, and to what extent can true innovation in production be demonstrated?

pianissimo until building to a crescendo at 14:43, thus creating a unique yet realistic texture, although technically 'unplayable'.

Audio Excerpt 6.3 Automated prepared piano crescendo

Another instance in the same track (11:21 – 11:56) was a passage where the piano was playing a 'vamp' and the drums went into quite a busy groove. The piano was attenuated and the drums boosted to give an impression reminiscent of a drum-solo in a montuno (guajeo) style – a 'conducting' metaphor borrowed from Stokowski who "settled on making the [mixing] engineer a member of the orchestra" in 1929, as cited[64] by Eisenberg (2005, p.124).

Audio Excerpt 6.4 A contrived drum 'solo'

The bass was played with a huge variety of gestures that carried a very large dynamic range, from scratching to slapping the strings, and bowing the wood to drumming on the body. In order to avoid the need for excessive compression, 'micro-automation' was applied to soften transients and shape the dynamics down to a per-note basis throughout the album. This approach was also applied occasionally to other instruments as required. Such techniques feature in the most fastidiously-created popular music, for example as Jochem van der Saag implemented in Seal's seventh album, *Soul* (Tingen, 2009), but are virtually unknown in the context presented here. It is notable that in 2011

[64] Although not referenced.

Waves introduced the Vocal Rider and Bass Rider plug-ins (Waves, 2011), which were designed to automatically implement this very style of labour-intensive automation.

Occasionally, the pan position of the saxophone was slightly adjusted, automated to offer subtle movement. This was a technique first employed (manually) in the mixing of some psychedelic music of the late 1960s and early 1970s, although the vocal on Beach Boys' *California Saga (Big Sur)* (1973) offers a good example in which the change of localization itself draws the listener's attention to the musical part.

6.1.3.3 Audio Editing

Editing was used in small part to shape the performances. One example was to create looped ostinatos that were not actually played, sometimes implying formidable musical technique in line with the native virtuosity of the musicians. This was initially implemented to correct minor musical inaccuracies, but subsequently turned into a creative feature. The bass (4:18 – 4:30) and saxophone (5:33 – 5:55) in *Collective 2* are such examples. On successive repeats, both loops were subtly changed so that they followed natural fingering, and did not repeat exactly to maintain the illusion of intense human performance (circular breathing in the case of the saxophone).

Audio Excerpt 6.5 An example of creative bass editing

Audio Excerpt 6.6 Emulated circular breathing on the saxophone

> 'It could have happened' performances are a key element in the transformation of music making in which the new paradigm of construction is replacing the old linear progression from composition through performance to master recording. Savage (2009, p.34)

Savage's context was blues, and although common in popular styles, such editing is unknown in Free Improvisation, and so again this approach might align to the research foci, both for innovation as above, and also for the application of tools in unfamiliar settings[65].

In very occasional instances, the drum kit performance was edited to produce an idealized and continuous take. Because the music had no metric reference, these phase-accurate edits were aligned with transients derived from the principal parts of the kit – kick or snare. Subtle amounts of manual time stretching were necessary in order to match the slightly shifting tempi of juxtaposed sections, since the music was not referenced to a click. Again, although such mediation is rare in Free Improvisation, the result here was stylistically appropriate, transparent, and does demonstrate Savage's "new paradigm's" potential function in more 'resistant' genres.

In addition, a number of occasional staccato notes were time-aligned into precise tutti with manual[66] time compression/expansion at either side of the edits to compensate, and 'multiple-microphone' tracks were time-aligned for phase-accuracy to enhance timbre. Also, an unnoticed word-clock error during tracking had imparted characteristic 'splats' (each lasting several milliseconds)

[65]Specifically: To what degree do producers typically subvert the intended function of their tools and to what effect.

[66] At the time of production, 2007, Flextime was not available in Logic Pro, the DAW hosting this project.

on the entire piano recording. Although not generally obvious during ensemble playing it was necessary to repair them in the interests of ethics and quality. Restoration software of the time did not seem able to repair them, and all 200 or so were removed manually. The approach here was borrowed from contemporary classical music editing where small segments of harmonically matching material were copied and pasted (phase accurately) into the gaps, before cross fades were constructed. This is akin to what classical editor/mastering engineer Stephen Frost (2007) refers to as a patch, although he remarks that the smallest he had been asked to apply was two-bars long; these patches were milliseconds, and phase coherence was the most challenging aspect – often minute amounts of time stretching were required to ensure this.

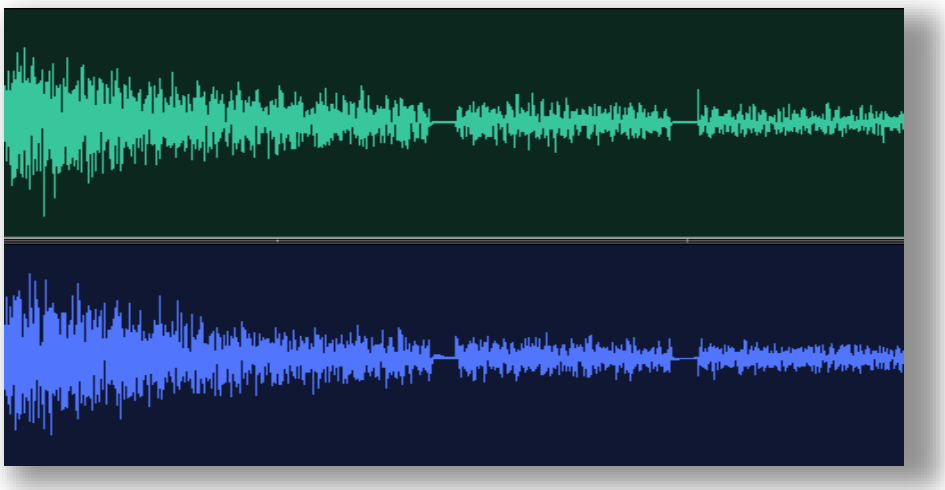

Figure 6.2 Word-clock dropouts

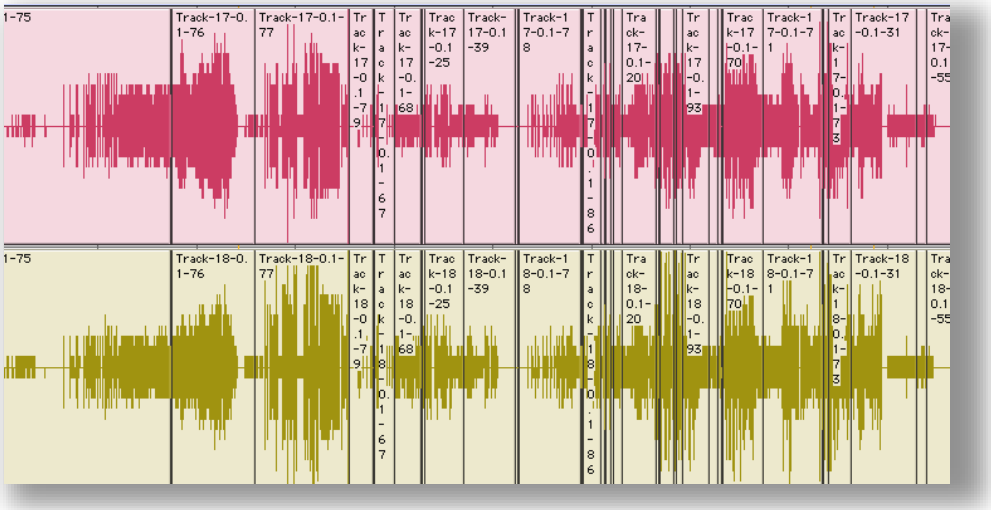

Figure 6.3 The density of word-clock repairs on a section of a single track

6.1.3.4 Delays

The use of delays (echoes) in Free Improvisation is anathema to many practitioners since they might be construed to augment the human performance and detract from the totality of the artists' expression. Despite this, delays were sometimes deployed on this album to add sonority and interest where the 'orchestration' thinned out too much. One potential issue was tempo locking. Where use of delay was considered, a dynamic tempo-map based on transients was created to control the timing, but the result was deemed to be too contrived and was subsequently abandoned. There are however a number of rubato passages (of saxophone and arco bass) where a long unsynchronized echo (1–2 s) is applied to provide a canon on the individual instruments, and further instances where automation sent a single note or phrase for echo e.g. *Collective 3* (3:08). The highlighted track in Figure 6.4 shows the automated delay send for the saxophone. The band had stopped abruptly – almost

sounding like a bad edit, and the delayed note carries through to the next movement.

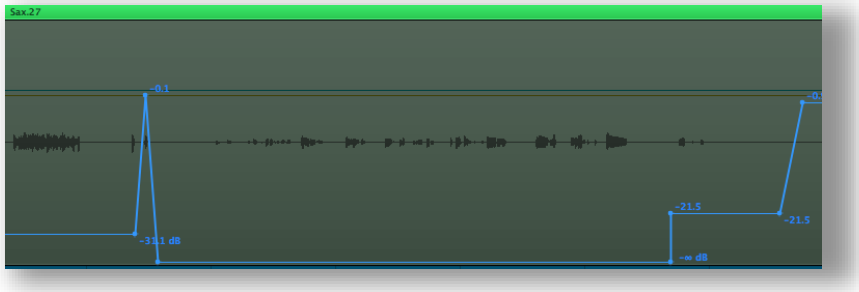

Figure 6.4 Saxophone delay automation – observe the single note that takes the delay on the left

Audio Excerpt 6.7 Delay on a single saxophone note

6.1.3.5 Further Aspects

Although highly synthetic in effect, on occasion extreme compression was applied to the drums. One such is *Collective 2* (14:03 – 15:31), and another is *Collective 3* (whole track). It all such instances the drums and percussion were actually played pianissimo, sometimes even just with fingertips, and aggressive compression and make-up gain altered the timbre to a powerful form, with increased sustain and harmonic content. These passages took new musical function from their placement high in the mix, yet only actually acting as a 'different' drum kit being played forte/fortissimo. Such an approach aligns to the

secondary research focus on subversion of tools[67]. Zagorski-Thomas (2014, p.91) argues that:

> Gaining the stamp of authenticity, or speaking with the voice of authority, often requires the 'tone of that voice' to be exaggerated.

In this case, the converse is also true where the voice of authority disregards authenticity, and further, defies it in the name of creativity.

Crooks (2012) discusses the influence of physical separation on the jazz rhythm section's micro-timing, and it is interesting to note that here, the very physical separation of the bass and drums induced near instantaneous monitoring via close mic'ing and headphones, which can only contribute to a 'tighter' feel for the end-listener. One further and perhaps notable adjustment to ambience came on *Piano Solo*, in which the solo prepared-piano is staged[68] in Chartres Cathedral via convolution reverb, the lengthy tail designed to build polyphonic layers and thickening the naturally sparse performance.

[67] To what degree to producers typically subvert the intended function of their tools and to what effect?

[68] To use the terminology of Moylan (2007).

7 The studio process: *Something Jaggy*

7.1 Album – *Something Jaggy*

I've always thought that art is a lie, an interesting lie. And I'll sort of listen to the 'lie' and try to imagine the world which makes that lie true... what that world must be like, and what would have to happen for us to get from this world to that one.

(Eno, n.d.)

7.1.1 Introduction

This album represents a corpus of self-composed tracks that were created over a number of years. Although the tracks were 'written' at their own point in time, this was in outline form and the concept was to use the originals as vehicles for the development of production techniques en route to their completion. These very techniques then completed the compositions thus forming a creative feedback loop based upon Moorefield's (2010) concept of producer as composer. Many of the tracks originated from different technological backdrops and converged as they moved towards mixing. The production concept was illusion, auteurism and iteraphonic bricolage. Almost nothing that is heard is 'real'. No two performers ever met, and although a few performances were recorded for specific tracks on the album, most were not. Often, machines sound like humans and humans like machines. Every final performance that can be heard was constructed on the desktop, frequently on a note-by-note basis. Source performances were recycled and reconstructed into multiple different ones on different tunes. Occasional motifs have been allowed

to recur in different tunes as homage to their origin and to provide light-hearted links between the tracks.

On most of the tunes, mixing was taken close to the ideal 'in the box' and all tracks were phase-aligned with Sound Radix Pi, before being rendered to audio. Final mixing was performed with one of a number of analogue consoles in different studios for preferred sound quality. This chapter will simply highlight a selection of moments of technical interest in order to illuminate the audio. These will then be reflected upon in Chapter Eight.

7.2 Reflection on process

7.2.1 Election Day

Composed in 1997 using Cubase 2.0 on Atari[73]. This track could be considered seminal to the concept of this album in that it grew through a variety of advancing technologies over many years, embracing each and taking new life from each iteration. It started as a MIDI-based track using only a KORG 05R/W synthesizer module, and an Akai S3000 sampler for audio playback.

7.2.1.1 MIDI programming

MIDI was at the core of this track's instrumentation and many involved techniques were employed even beyond the numerous layers of control changes. One example is the fretless bass, which was played on the keyboard and further had detailed articulations programmed via mouse. In order to get the various glissandi ranges, the pitch-bend range was changed in real time by programming two-byte NRPNs via step-entered data. This low-level approach was consistent with other MIDI 'power users' of the time such as Autechre

[73] See Appendix 11.1.7 for a vignette of the chronology of this track.

(1997), but the postulant developed the technique through employment as a professional MIDI-file creator – a domain that required such a programming style. A search of the Sound On Sound (n.d.) archives – normally a most comprehensive repository of technique that pre-dates the Internet, reveals no reference to programming with NRPNs. This implies that this was an innovative technique and thus in line with the secondary research foci.

Ultimately, tools became available to augment this with performance articulation such as finger noise and harmonics, and these were programmed using a multi-MIDI channel approach, assigning each note of a given articulation to its own channel.

Audio Excerpt 7.1 Dynamic MIDI pitch bend range on the bass

Audio Excerpt 7.2 Articulations on the bass, including x-notes, harmonics and finger noise

7.2.1.2 Beyond MIDI

Originally, the only audio source was the S3000, with which a number of prepared electric guitar[74] phrases were recorded and triggered, as if done linearly. These phrases were then time-corrected and extended through further manipulation in the hardware sampler domain.

Once the track was converted to a DAW host some years later, the trumpet and further guitars were recorded specifically for it. The musicians found the

[74] e.g. using split matches, jammed on the strings acting as tiny self-propelled hammers during performance.

15/16 passages hard to perform accurately, and so multiple takes were heavily edited and composited in order to create accurate final performances.

7.2.1.3 Drums over time

In order to offer a chronological representation of the application of technology, the drums will be considered. The drum part was originally played on pads connected to an analogue brain that was then trigger-to-MIDI converted to input notes into the sequencer. Fragments of ride cymbal phrases were sampled and sequenced alongside these. There were also delays, programmed loops and electronic percussion for an overall synthetic effect.

Audio Excerpt 7.3 The drums as they existed in 1998

Later, in order to include ‘matching’ buzz-roll crescendi, the MIDI snare drums were replaced by bespoke-recorded sampled snares that included both velocity-layered one-shots, clustered phrases of ghost notes, and ‘whole’ rolls. Once audio recording technology became available, a bespoke hi-hat was recorded, and this was tightened in Recycle.

Audio Excerpt 7.4 The drums as they existed in 2003

Superior ROMplers evolved and were deployed in order to offer better sounds. As the arrangement became denser yet more refined, the snare drum again required replacement, but in order to maintain the connection with the human-played ghosts and rolls, only the backbeat was augmented with a sample. The entire part was rendered to audio to save CPU cycles.

Audio Excerpt 7.5 The drums as they existed in 2008

Eventually, as the sound of room microphones was sought, the entire performance was reconstructed by MIDI with one-shots using BFD2, although that had to be rendered into audio one drum at a time due to CPU restrictions, and then have overload-induced clicks removed.

Audio Excerpt 7.6 The drums as they existed in 2011

Audio Excerpt 7.7 The drums in the final version

Thus this one part encapsulates and can relay some 18 years of technological development and demonstrates persistent study throughout this period.

7.2.2 Savage Elevensies

This track was originally composed in 2003 using Cubase VST on a PC. It was created as a working project in order to explore a newly purchased suite of plug-ins. The piece was based around a descending chord sequence played on MIDI tremolo strings.

7.2.2.1 Arpeggios

The Cubase ‘drum map’ facility can translate incoming MIDI notes to different pitches and channels – it is designed to build custom kits from a number of different source VST instruments. Here, a drum map was set up to create algorithmic orchestration, by driving an arpeggiator from the original tremolo string pitches and routing specific notes (over the full range of

arpeggiation) to different destination MIDI channels associated with instruments that played clarinet and cello sounds. The randomization function of the arpeggiator created a pseudo-generative effect such as that described by Eno (1996a). Such an approach could be said to support the inquisitiveness of the secondary research focus on extending functionality[75].

Audio Excerpt 7.8 auto-orchestration in *Savage Elevensies*

In addition, a sample instrument was created that featured timpani (on specific notes aligned to their pitch) and gran casa sounds, each key triggering either velocity-layered one-shots or a number of human-performed rolls. This instrument was also played with an arpeggiator driven by the original chords, thus forming a slightly aleatoric orchestral percussion performance that still aligned harmonically. The resulting sequence can be heard in both the opening and close of the track.

Audio Excerpt 7.9 Pseudo-aleatoric orchestral percussion

7.2.2.2 Drums

There were a number of notable production techniques in the creation of the drum track. The backbone of the rhythm track is created with loops[76], and although these appear to be ostinati, there are subtle rhythmic turnarounds, accents and time-stretch effects to punctuate the arrangement. A snare drum

[75] To what degree do producers typically subvert the intended function of their tools and to what effect, and how are the limitations of functionality probed as was 'traditional' in so-called innovation before the software age?

[76] In a time signature of 11/16.

one-shot audio region was positioned the give emphasis to the backbeat, and (only) its sustain portion time stretched to emphasize the ring of the drum.

Audio Excerpt 7.10 The original ringing snare drum

An overtone was found to be clashing with harmonic centre of the track. Normal practice would be to tune the snare sound (with pitch shifting), but this suffers from the artefact of an overall formant shift. Instead, the snare was opened in Melodyne DNA (Celemony, n.d.) and the principal overtone identified and tuned leaving the remainder of the sound unmediated. Further, a pitch bend was imposed only on this overtone as a special effect. Although a number of lateral uses for Melodyne have since evolved, when this was done in 2010 it could be considered novel.

Audio Excerpt 7.11 The snare drum after Melodyne processing

In order to create an improvised feel with authentic phrasing, a two-bar Apple loop was sliced into sections, each three eighth-notes long. These were then assigned to individual zones on a sampler, and then a longer sequence was performed in the correct time signature on a keyboard, with the irregular note length forcing syncopated phrasing. Such an approach (at least with even eighth-note slices) was common in the Jungle genre in the 1990s, e.g. (Goldie, 1995b), but the application here is unusual.

The result was bounced to audio, and then auto-tuned to a suitable harmonic centre, and the auto-tune attack automated in order to create varied and subtle glissandi.

Audio Excerpt 7.12 The two-bar Apple Loop of tabla that formed the palette for slicing

Audio Excerpt 7.13 The extended improvised part derived from Audio Excerpt 7.12

The last detail of note is in the bridge section, where a glitch-style sequence was created in MIDI, bounced to audio and then stutter and pitch effects were created with a number of time-stretch algorithms, as demonstrated by Paterson (2011b, 2012a, 2015).

Audio Excerpt 7.14 A section of the above, then along with other elements

Figure 7.1 An indication of the arrangement of *Savage Elevensies*

7.2.2.3 Wavelab

In the bridge section is a manipulated bed of audio. To create this section, an earlier part of the tune was processed in Steinberg Wavelab (Steinberg, 2015) – this software is an editor and mastering tool. The entire multi-track data was processed as a whole. It was subjected to a number of transpositions, reversals and volume enveloping in a fashion that could not the performed in a DAW that time. Lastly, it was run through a vinyl emulator to give a monolithic 'sample' quality to the bounced final output. Such creative use of a mastering package could be regarded as innovative.

Audio Excerpt 7.15 The manipulated bridge

Audio Excerpt 7.16 The manipulated bridge in context with the other layers

7.2.3 Klezm

Originally sketched out in 2003 on Logic Audio 5 (on PC) this track started as a project to learn the DAW, and so included a wide range of available features. The final version of the track uses highly detailed audio manipulation of both pitch and time, and incorporates a number of performances from *The Making Of Quiet Things* (Number, The, 2006).

7.2.3.1 Re-pitching

Although most audio employed in these tracks was re-pitched to some degree, the iteraphonic implementation of both upright bass and trumpet required considerable manipulation of pitch, phrasing, and micro-timing. This was done in a number of phases. Originally in Logic 5, the audio regions were

sliced and driven by melodic/harmonic intentions, the sequences manually rearranged. Crucial notes were imported into a sampler when occasional pitch correction was required. In later versions of Logic on Mac, the musical arrangement was developed considerably using both (proprietary) Elastic Audio and Melodyne. Eventually, the project reached Logic Pro X, and the newly available Flex Pitch employed for further pitch manipulation.

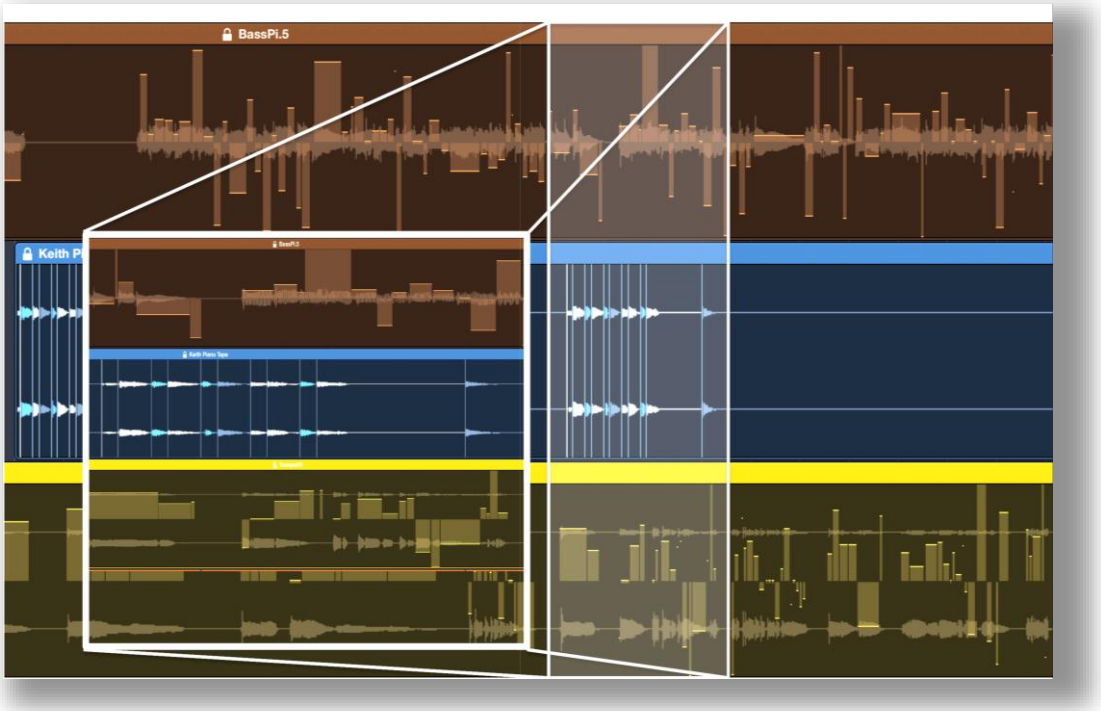

Figure 7.2 An example of the third generation of editing.

Figure 7.2 shows the upper lane of bass, the middle piano and the bottom of trumpet. The vertical bars are the pitch adjustments of individual notes. The inset shows white and blue time-compression/expansion in order to align the piano.

Some of the first-generation edits proved fragile after pitch shifting, incurring split transients, and so they were bounced to audio and then corrected in the spectral domain (they were over the entire duration of the tune).

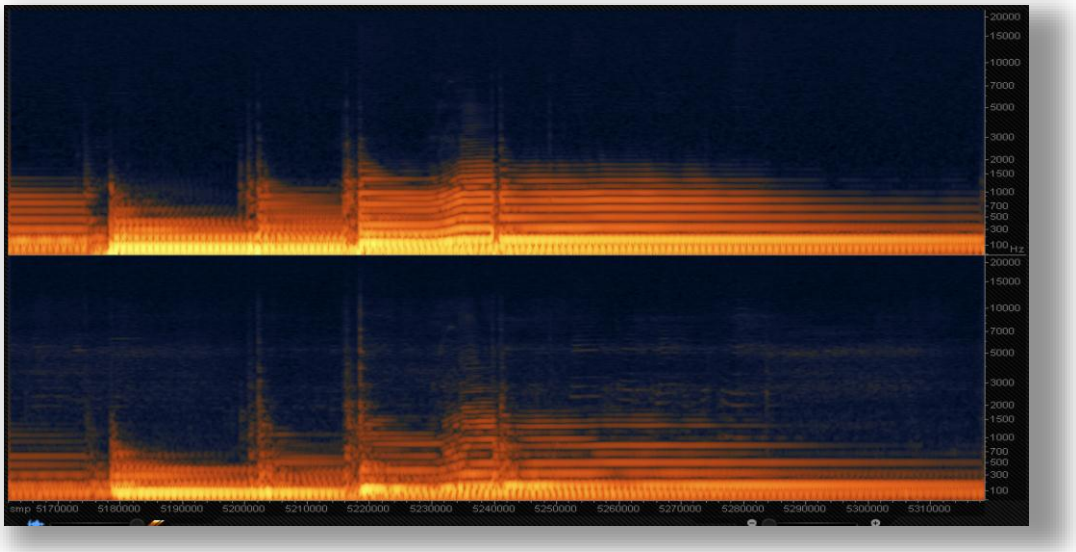

Figure 7.3 The split transients can be seen

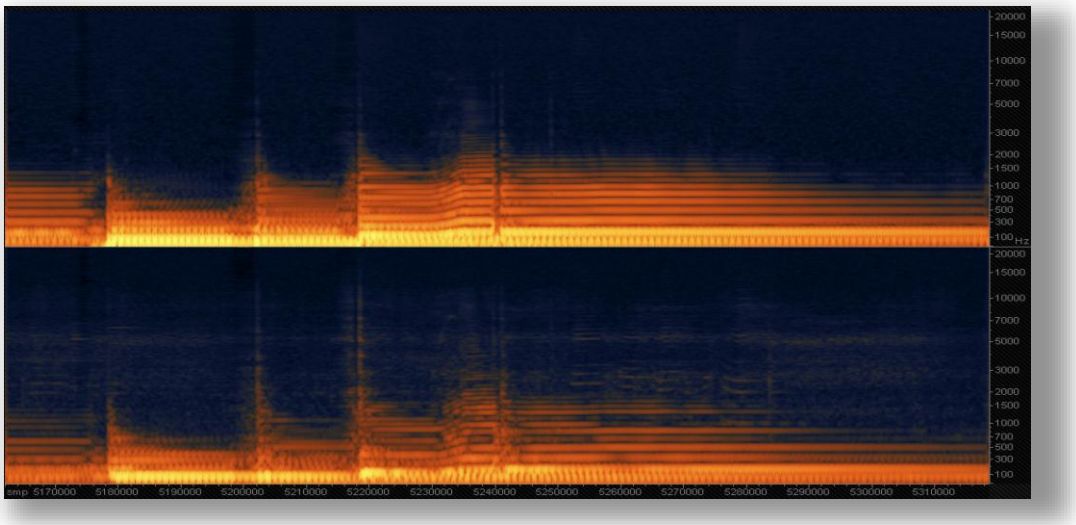

Figure 7.4 The damaged transients once repaired

Audio Excerpt 7.17 The bass with damaged transients

Audio Excerpt 7.18 The bass after the spectral repair

7.2.3.2 Drum plunderphonics

The drums in the middle section are worth some discussion. The original audio came from the drum introduction of *Collective 2* (Number, The, 2006) – simply a stereo file that was yet to be mixed.

.

Audio Excerpt 7.19 The original drum introduction from Collective 2

This performance was then manipulated into the desired tempo and feel, and rephrased using the techniques of Paterson (2011b, 2012a, 2015) to form tutti hits aligned with constructed piano phrases, which were themselves placed according to the initial phrasing of the drums. The drums were then heavily compressed to exaggerate the sustain and overtones. This had the effect of diminishing the impact of the kick drum, and so a copy of the entire part was low-pass filtered to isolate the kick drum, and then a replacement algorithm was used to generate a synchronous MIDI kick. Further MIDI layers of cymbals and toms were added to enhance the groove and tutti accents, and the audio was reflexively adjusted to combine with these.

Audio Excerpt 7.20 This is Audio Excerpt 7.19 after processing

Audio Excerpt 7.21 The drums of Audio Excerpt 7.20 in context with the track

7.2.3.3 Trumpet harmonization

Pitch to MIDI conversion was a commonly employed technique on this album. On this track, it was used to both double and harmonize the trumpet. Whilst the literal doubling effect is quite apparent, what is less obvious is that in

addition, the various pitches were extracted and gathered, then edited to preempt those played by the trumpet in chordal clusters on an electric piano to give the impression of the trumpet being the reactive instrument.

Audio Excerpt 7.22 MIDI notes extracted from the trumpet audio

7.2.3.4 Ensemble stretching

Whilst time stretching pervades this entire album, it took not just a corrective role, but frequently, also a creative one[77] in line with the concept of creative abuse (Keep, 2005) and the secondary research foci on alternative use of tools and subversion of fidelity[78]. One such example involves the use of a section of ensemble playing from *The Making of the Quiet Things* (Number, The, 2006) sessions. Alongside the creation of the album that was released, the band was asked to play along with a number of metronomic backing tracks, both solo and as an ensemble with a view to capturing additional audio material for use in this album. These performances were recorded on (continuously running) DAT alongside any ad-libs and rehearsals. One such excerpt is here:

Audio Excerpt 7.23 An ensemble out-take from *The Making of Quiet Things*

In order to integrate it into the track, rather than just being audio-quantized, the excerpt was subjected to extreme stretches (with different algorithms,

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[77] As has already been alluded to with regard to drums.

[78] What is the worth of pre-DSP 'traditional' production values in the contemporary manipulation-oriented context?

and:

To what degree do producers typically subvert the intended function of their tools and to what effect, and how are the limitations of functionality probed as was 'traditional' in so-called innovation before the software age?

comped together) with an emphasis on resultant timbre rather than temporal alignment. The resulting audio:

Audio Excerpt 7.24 This is Audio Excerpt 7.23 after processing

Audio Excerpt 7.25 The processed ensemble of Audio Excerpt 7.24 in the context of the mix

7.2.3.5 Arrangement

It is perhaps worth noting that when this track was originally conceived of in 2003, and during its early pre-production, it was purely linear on a constant groove, and perhaps held comparison to albums such as *Live – Evil* (Miles Davis, 2010). When the main trumpet line (itself recorded for an unreleased project in 1994) was added in 2014, it became clear that something of an arrangement needed to be constructed, much as Teo Macero had done with the Davis album. The original spirit of improvisation was retained, yet punctuated by phrases that might be 'dropped on cue' by such a live band, but here, the whole is a contrived and programmed construction.

7.2.4 Lord of the Ring

Pre-production commenced on this joint composition in 2004, using Emagic Logic Audio on a Mac. The stimulus for the track was as a lesson in the use of Propellerhead Recycle for co-composer Drew Downing. Recycle was used to create the funk guitar part at around 1' 35"; the rest of the track was developed from that.

7.2.4.1 Granular vocal

At the pre-production stage, an unlicensed sample of an Arabic vocal was used as a quick proof of concept in the arrangement process. Clearly, this had to be replaced in the interests of both ethics and integrity. As a starting point, a new vocal with hints of faux-Arabic was recorded to act simply as an audio palette. The performance was not by 'a singer', and would have been completely unacceptable in its own right, but it was corrected, repeated and developed in Melodyne to form a more agreeable and longer phrase. The phrase was also subjected to various formant, vibrato and pitch-sweep modulations. It was then passed through a granular processor in Reaktor (Native Instruments, 2015a), which had a number of key parameters automated over the duration of the phrase to provide further variation. The end result was deemed acceptable, and offers a catalyst for thought on the research focus[79] regarding 'traditional' production values.

Audio Excerpt 7.26 The raw vocal material that acted as a source for development of the replacement vocal part

Audio Excerpt 7.27 Part of the final extended replacement vocal part

7.2.4.2 Drum room and replacement

At the outset of the development of this track, the drums were all MIDI-programmed with one-shots, bar the hi-hats which were an audio recording. The MIDI parts had been bounced into audio. As the track evolved, it became

[79] What is the worth of pre-DSP 'traditional' production values in the contemporary manipulation-oriented context?

desirable to create a more human ‘live’ effect. Snare drums on the backbeats were isolated (ignoring the ghost notes), and through beat replacement, a more sustained sound was added along with the original as if a human drummer has been playing a rim-shot.

It became clear that the kit needed a virtual room to add to its authenticity, emulating microphone spillage and overall ambience. Anderton’s (2009) approach for room simulation and enhancing early reflections was extended. The individual channels of the components of the drum kit were routed to a buss via sends. This buss fed a convolution reverb channel, which in turn used two post-fade sends to feed to further busses, each of which had a different delay of the few milliseconds. Thus, these busses emulate the early reflections, and the delays and image can be set as suited. Out of phase LFO-driven pitch modulators were also inserted on these busses to add an additional swirl to when their output was summed and added back into the mix. The original drum kit channel send levels could then be balanced to emulate microphone spillage effects.

Audio Excerpt 7.28 The original dry snare part

Audio Excerpt 7.29 The augmented snare part from Audio Excerpt 7.28

Audio Excerpt 7.30 Some of the full kit part using the room simulator technique

7.2.4.3 Guitar solo

The original guitar solo typifies the workflow employed in the construction of this album. The original solo had some excellent phrases, but a number of errors and less appropriate sections. It was heavily edited and reconstructed to be more accurate and sympathetic with the track and project its own line of musical development. Once editing was complete, the part was re-amped.

Audio Excerpt 7.31 The original guitar solo

Audio Excerpt 7.32 The final constructed guitar solo

7.2.4.4 Choir

In 2008, the London College of Music Chamber Choir performed an a capella piece, composed and conducted by Marie Tansley-Scales[80]. The choir were taught a rule set by which they would respond as an ensemble of both individuals and sections to the sight of particular playing cards. The various cards instantiated various vocal sounds, some pitched, some glottal and some verbal. The conductor then drew cards from a pack, and the result was recorded by Tansley-Scales. She then manipulated this aleatoric piece with various DSP procedures. The finished artefact was imported into *Lord of the Ring*, audio-quantized to 'fit', but allowed to run along its natural timeline (bar a couple of edits) with only volume automation to facilitate interplay with the arrangement. It thus provided an aleatoric layer that imposed its original integrity upon the destination track, being only slightly mediated by executive

[80] Permission was granted to incorporate this into the track. See Appendix 11.1.4.1.

control. This might be considered an innovative approach to production in this genre.

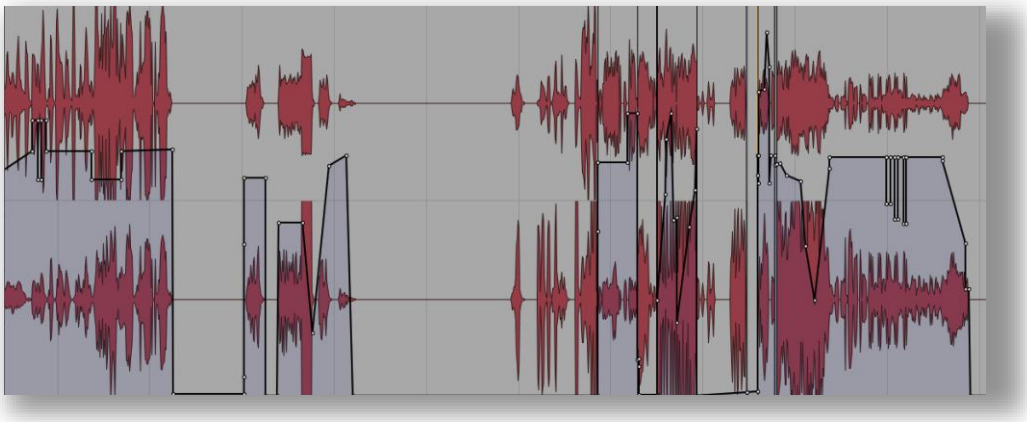


Figure 7.5 The LCM Chamber Choir part and its volume automation

Audio Excerpt 7.33 The London College of Music Chamber Choir after processing

Audio Excerpt 7.34 An excerpt of the choir of Audio Excerpt 7.33 in context with the full track

7.2.4.5 Quantization article

In support of this thesis whilst working on this track, a detailed study of quantization was undertaken. It specifically referred to the rhythmically complex hi-hat part from 2' 50". Initially, this part appeared too involved for typical DAW quantization functions, and so a number of DAWs were studied, compared and appraised. It had been intended to include this study as the basis of a chapter for the submission, but many of the specific features that were analysed have now been updated in the software, and the text feels slightly anachronistic. For this reason it has not been included here, but the interested reader will find the

full multimedia version published in the *Journal on the Art of Record Production* at:

http://arpjournal.com/cutting-tracks-making-cds-a-comparative-study-of-audio-time-correction-techniques-in-the-desktop-age/

(text only version in Appendix 11.1.1)

It is interesting to note that a number of manufacturers appeared to respond to the article when developing their subsequent feature sets.

7.2.5 IZZYSX

Although most of the production work was done in Apple Logic Pro, this track was first started in 2004 using Cubase SX on a PC. It was conceived of as a tutorial to learn that software, and as such consciously drew from as wide a range of (newly) available features as possible.

7.2.5.1 Vocals

Cubase SX offered placement and sizing of audio regions within containers ('parts'), and in order to explore these, a previously recorded vocal performance[81] was sliced in Propellerhead Recycle.

Audio Excerpt 7.35 The original vocal performance that acted as inception to *IZZYSX*

The tempo in Recycle was set as a multiple of the destination tempo, and this caused the vocal to be contracted dramatically, forming a heteroglossic (Bakhtin, 1982)[82] transformation that rendered the lyrical content

[81] See Appendix 11.1.4.4 for permission to use this.

[82] First published in 1934; a metaphor from linguistics.

unrecognizable and simultaneously created a new melody. After import into SX, the now-separate individual syllables were viewed as a palette within the 'part', but manually reordered one at a time (and time-adjusted where necessary) to form a more considered melody, then harmonized. Stutter effects were constructed through audio editing. Timbral detail was added to the identical stutters, for instance by emulating a formant shift linked to tempo in iZotope RX2[83]. This was done by drawing a narrow band attenuation that swept through the harmonics of the vocal as shown in Figure 7.6 – a creative application of restoration software.

Figure 7.6 Emulating a timed format shift: RX2 view superimposed on Pro Tools

Audio Excerpt 7.36 The emulated formant shift can be heard in the fast stutters

Although vocal manipulation was already emergent, this novel approach predated much of the vocal manipulation that has become ubiquitous in current

[83] Now at version four; RX4 (iZotope, 2015).

popular music[84] and could be considered as Keep's (2005) creative abuse, and as such represents the secondary research focus on subversion[85].

7.2.5.2 Drums

For the middle section of the track, it was desired to create a drum performance that emulated a human with highly developed jazz-influenced technique. These drums were MIDI driven, with the actual performance derived from a custom-built Max/MSP patch[86] that was rewired into Logic Pro. The patch was populated with a number of relatively simple MIDI files (created in Ableton Live) that represented a range of performance approaches, much as a human might have in mind when approaching a particular track. Excerpts of these were then multiplexed in real time with instantaneous random access to positions in the component MIDI files according to the time line shown in Figure 7.7, and the performance guided with a videogame controller to form a user-influenced improvisation.

[84] For example the Burial track – *Archangel* (2007).

[85] To what degree do producers typically subvert the intended function of their tools and to what effect, and how are the limitations of functionality probed as was 'traditional' in so-called innovation before the software age?

[86] This was created in version five of the software. It has not been possible to submit this patch since some of the externals (objects of code developed by third parties) on which it was dependent are no longer compatible with current versions of Max/MSP.

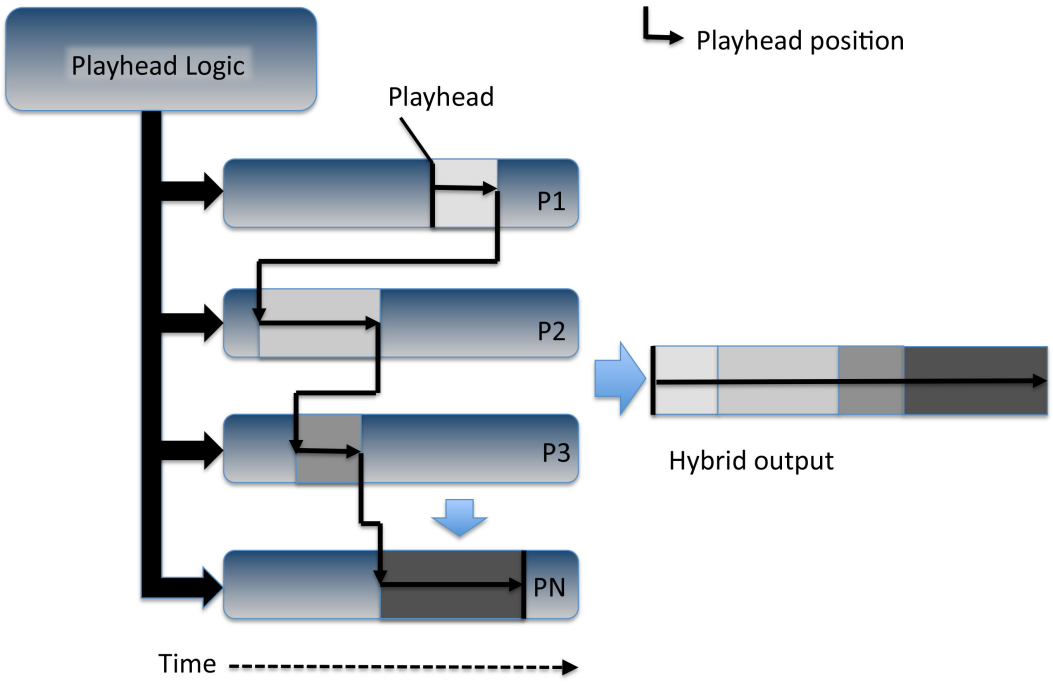


Figure 7.7 The playhead logic

The Playhead logic of Figure 7.7 determines which section of up to N MIDI patterns (P1 ➡ PN) plays at a given time and outputs a sequential and hybridized result. The Playhead logic is algorithmic, but it was this that was influenced by user mediation via the video game controller.

Using MIDI one-shots for this meant that the natural sustain of cymbals and toms etc. were not truncated upon switching pattern as would have been the case if using audio files. Further, the MIDI files also contained control change information that automated certain parameters that were locked relative to the phrasing, for instance softening the attack of a press-roll one-shot when playing a more sustained buzz roll to prevent (or in fact, dynamically adjust) excessive 'machine gunning', as can be seen in Figure 7.8. The phrases themselves could be started at any point within their duration, which meant that the articulation envelopes could effectively be different in their effect for each instantiation of a

given phrase. In Figure 7.8, it can be seen how the automation of the attack of the press roll sound is superimposed on a rapid series of notes (which also had a velocity ramp – not displayed). This allowed different performance nuances to be emulated.

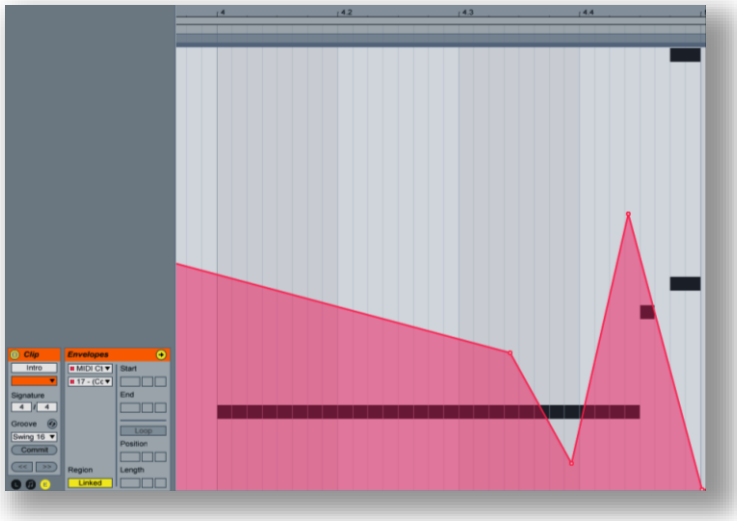


Figure 7.8 The automation of the attack of the press roll sound

The patch created a composite MIDI file of considerable complexity that would have taken a very long time to program manually, and as such demonstrates both innovation and an evolution of production technique pertinent to the title of this thesis. This approach was first demonstrated to the Audio Engineering Society by Paterson (2011b), in the context of swing jazz. Since then, a few commercial tools have emerged with broadly similar functionality (if not quite as sophisticated), for example FXpansion BFD3 and Apple Drummer.

Audio Excerpt 7.37 Some of the auto-improvising drum part

7.2.5.3 Guitar solo

In an experiment in remote studio activity, guitarist Rod Fogg was sent a backing track and given a brief on how to approach playing and recording his own guitar solo[87]. Neither the performance nor the approach were deemed to be ideal, and so in order to maintain the discipline of the greater project a bespoke solo was constructed from the material offered.

Audio Excerpt 7.38 Some of the originally recorded guitar solo

Fogg had found the rhythmic framework[88] difficult to work with and this had affected his natural timing. In order to appraise apprehensive phrases alongside more competent ones, the entire performance was quantized with considerable mediation to maintain its integrity. Excerpts were then rearranged and phrased around the computer-generated drum performance of Section 7.2.5.2. The harmonic content of individual notes were unravelled and exposed in Melodyne DNA. These individual harmonics were then manipulated in a number of ways[89], often producing a highly synthetic texture and sometimes harmonizing with the original notes. An example of a typical process was given in Section 3.3.1.5, but many more variants of that were explored.

Movie 7.1 An excerpt of harmonic manipulation within Melodyne

[87] With an ultra-fast JANET connection, there are now possibilities to record remotely with only a few milliseconds latency, as discussed by Ferguson (2013).

[88] Notionally in 9/8 at a rapid tempo, but with a number of concurrent polymetric layers.

[89] These included manipulation of fine and coarse pitch, formants, pitch, amplitude, placement and duration.

The transients and cross-fades were tempered in RX2, and finally, intricate automation was applied on a note-by-note basis to compensate for induced anomalies and give greater creative effect.

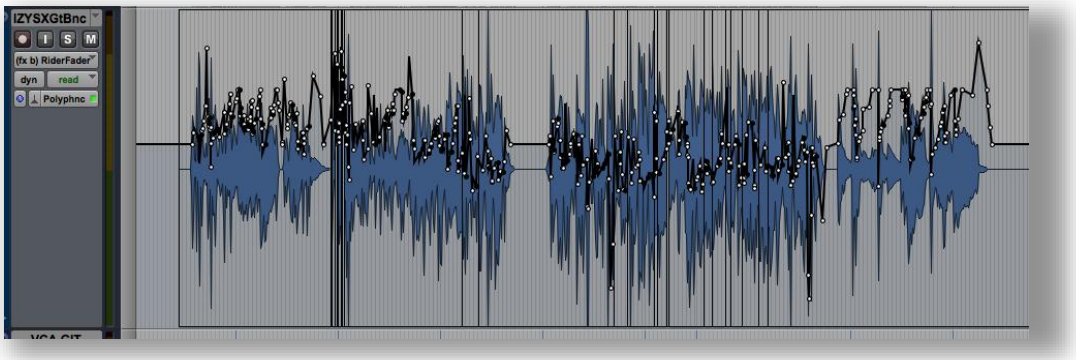


Figure 7.9 The final volume automation on the comped guitar solo

Audio Excerpt 7.39 Some of the guitar solo after manipulation and processing

A review of the literature did not reveal any directly comparable processes, and so again this represents a novel approach and implementation of the available tools to extend typical production technique.

7.2.5.4 Synthesizer lines

Several layers of polymetric synthesizer ostinati (perhaps reminiscent of Steve Reich) were 'manually' performed by the postulant in an attempt to emulate what is more commonly created with a sequencer. Further, a software realization of the Native Instruments Kore (hardware) controller was developed in Liine Lemur software. This software extended the feature set of the original with twin joystick-type controls. This device was used to overdub real time automation of the synthesizers, e.g. on the marimba sound (a physical modelling patch), the virtual construction was modified by modulating the

material and damper positions to give a constantly morphing timbre. The attitude was derived from Sudnow's (1978, p.38) "directionality of purpose", aiming for certain sounds albeit without demanding exactitudes of performance.

Movie 7.2 The emulation of the Kore controller (no audio)

Audio Excerpt 7.40 Polymetric synth riffs with evolving timbre

Audio Excerpt 7.41 The guitar solo in the final mix

7.2.5.5 A selection of other notable techniques

The upright bass was MIDI-programmed with one-shots. A range of articulations were associated with each of eight MIDI channels, and individual notes were assigned to target channels in a step editor to offer performative expression.

Audio Excerpt 7.42 A short passage of MIDI upright bass

An electric guitar harmony to the synth head was constructed from elements of ad lib soloing. When repeated via editing, guitar harmonics were given subtly different tuning envelopes to emulate a live human performance.

Audio Excerpt 7.43 The constructed guitar harmony with harmonics

After mixing it was found that the kick drum did not translate well to laptop speakers. The kick drum part was extracted from the multi-track and filtered

aggressively in RX2 leaving only frequencies above 4 kHz. This part was superimposed onto the mixed stereo master in order to provide a synchronous click and resolve the problem.

The acoustic talking drum part[90] at 3' 56" was given hyper-realism by time stretching with a speed algorithm that affected pitch and exaggerated the performed pitch bends.

Audio Excerpt 7.44 The enhanced talking drum

7.2.6 Anathemaofanenema

First started in 2006 in Logic Pro, this track was initially an experiment in automated harmonization. The track was later migrated to Pro Tools 7.6.1 in 2008 to explore the (then) new Elastic Audio feature.

7.2.6.1 Vocal

As a creative exercise to explore the possibilities of pitch manipulation, a vocal performance was recorded. This performance used glissandi and allowed the notes to 'crack' quite deliberately, with a view to exploiting this using 'live' auto-tune retrospectively, to drag the pitch into a desired scale with a degree of chance whilst maintaining the associated timbral variations. The performance was then rendered and various notes and phrases were reordered along the timeline. A harmonizer effect was inserted on the channel, and various parameters were automated in real time in response to the performance, most specifically the coarse pitch offset, but also fine-tuning and pan position. This allowed freedom from parallel harmony or being tied to a factory scale, as was

[90] Performed by the postulant and recorded by Brian Miller in 1994 for an unreleased track.

the limitation in current commercial systems. After a satisfactory performance had been achieved, the automation curves were edited to optimize it, and the audio bounced again to stabilize it.

Audio Excerpt 7.45 Vocals with an automated harmonizer in *Anathemaofanenema*

This automation process caused a number of pops and also introduced an AC offset that tracked some parametric changes. These were removed in RX2. This irregular application of a harmonizer could be regarded as something of a subversion of its intended function, thus aligning with a desired research outcome[91].

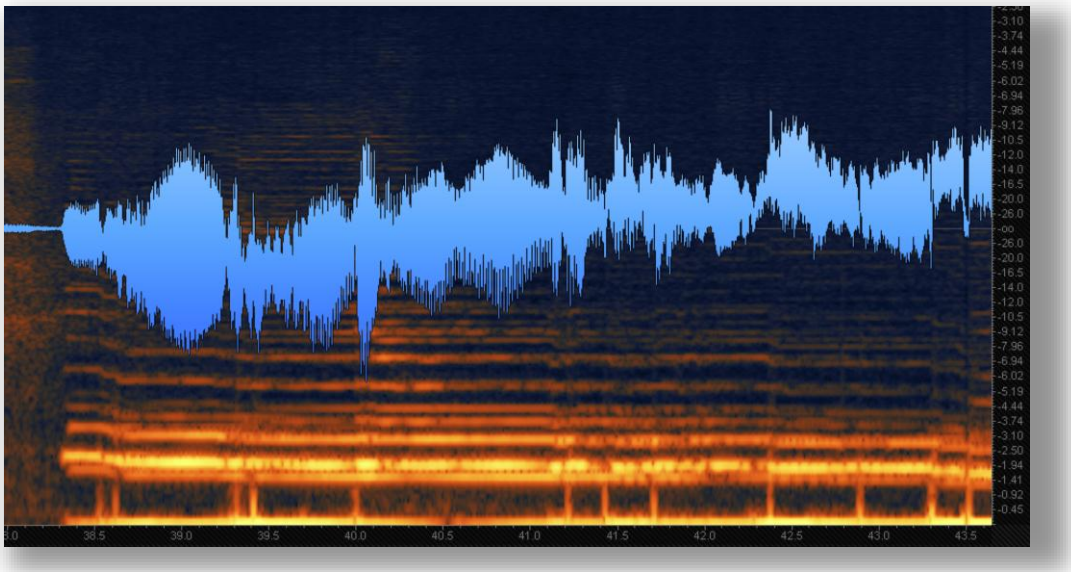


Figure 7.10 The clicks and AC offset introduced by the automated harmonization

[91] To what degree do producers typically subvert the intended function of their tools and to what effect, and how are the limitations of functionality probed as was 'traditional' in so-called innovation before the software age?

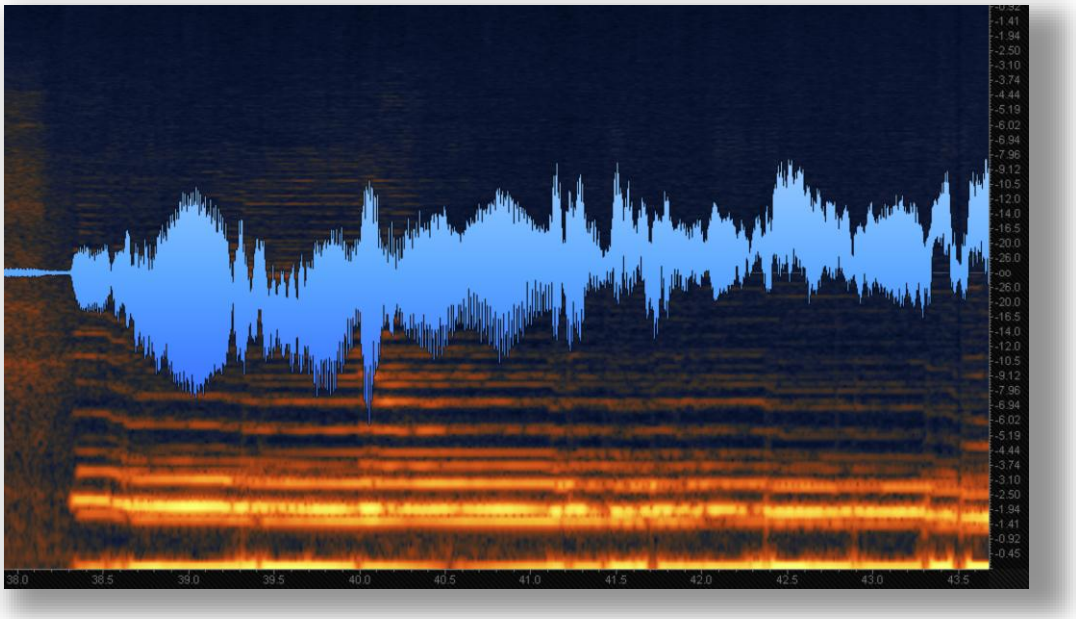


Figure 7.11 The clicks after removal. The AC offset problem meant that they had to be attenuated rather than interpolated

7.2.6.2 Wavefondler

The bespoke Wavefondler software was discussed explicitly in Chapter Six. The device was applied to a number of the tracks in this tune to produce stuttering and glitching effects. In order to explore its potential, its full feature set was applied to a large range of sound sources, however ultimately, it was only appropriate to implement it in a small number of its applications in the interests of overall musicality. It did have a significant impact on the overall sound and demonstrates a development of extant music production techniques in line with the title of this thesis.

Audio Excerpt 7.46 Three examples of the Wavefondler operating on vocals, trumpet and groove

Audio Excerpt 7.47 A section of the final mix featuring Wavefondler manipulation

Audio Excerpt 7.48 The Wavefondler effecting the rhythm track

Audio Excerpt 7.49 The full mix of the section in Audio Excerpt 7.48

7.2.6.3 Other points of note

The prepared piano was taken from Piano Solo (Number, The, 2006) and processed with intense editing, time stretching to align with and form the arrangement, and re-amped to give a distorted effect.

The harmonic shift in the whole track at 9'03" was created retrospectively by applying Zynaptic Pitchmap to the audio of each instrument in turn, controlling them polyphonically via MIDI. Slight differences in the MIDI performances gave an interesting texture to the composite audio.

Audio Excerpt 7.50 The pitch-modulated prepared piano

Audio Excerpt 7.51 The pitch-modulated section of the final mix

In order to control the loudness over the length of the entire piece, automated parallel compression was added. Twin parallel compressors were mixed at a maximum of 50% with the unaffected signal to maintain integrity of the peaks. These gave about 9.5dB of gain boost to the mix beyond the 6dB afforded by a single unit.

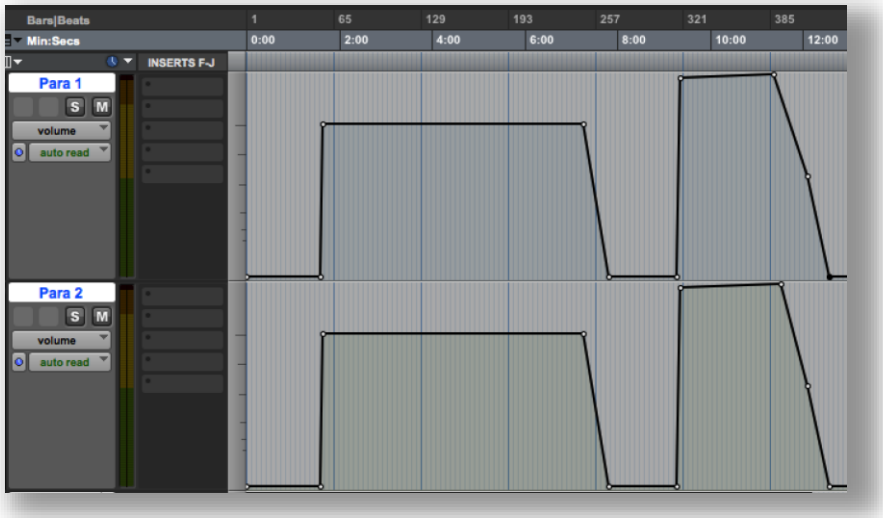


Figure 7.12 The automation of doubled parallel compression over the entire duration of the track

Audio Excerpt 7.52 The parallel compression creating a crescendo as can be seen in the right hand automation curve of Figure 7.12

7.2.7 My Requiem

7.2.7.1 Concept and development

This tune was written in 2008 and was inspired by Paul Ramshaw's "UK Credit Crunch 2008: The sound of the stock market crashing" (Ramshaw, 2008). The latter was a piece created in Ableton Live with an algorithm implemented in Max/MSP whereby the UK FTSE-100 data from the year leading up to the financial credit crunch was converted verbatim into note information.

Audio Excerpt 7.53 Stimulus: *UK Credit Crunch 2008: The sound of the stock market crashing* (Ramshaw, 2008)

Using this as a backing track and in the spirit of Zappa's Xenochrony, edits of Vaughan Williams' *The Lark Ascending* (Vaughan Williams, 1920) the prepared piano from Piano Solo on *The Making of Quiet Things* and the trumpet from *Election Day* were superimposed, and various edits were made. Searching the literature suggests that although remixes of orchestral music are common[92], collage and superimposition are not, although Grant (2011) has since documented aspects of such approaches. It would therefore appear that the technique utilized here extends existing practice and also contributes towards the secondary research foci.

A drum part was then programmed; it utilized algorithmic control of stutter effects such that the pattern never repeated with exactly the same phrasing. Such an approach was novel and in line with the trajectory of this thesis.

Audio Excerpt 7.54 A drum part with LFOs and envelopes controlling the stutter parameters to give an endless number of variations

Audio Excerpt 7.55 The combined layers including the Audio Excerpt 7.54

7.2.7.2 Bass

Live upright bass was recorded in two passes – one arco and the other pizzicato, monitoring from the collage as it stood so far. A Reflexion filter was used in order to capture an intimate sound from the sometimes pianissimo performance and simultaneously offer the most readily editable audio.

[92] Often adding drumbeats to looped excerpts of classics.

The pizzicato bass was then deconstructed on a note-by-note basis, and reconstructed to form a new part more sympathetic to the piano. Three-way editing (of note order, timing and pitch) then reflexively adjusted both piano and trumpet to control rhythmic interaction and occasional polytonality, and meld all three. This was extended to *The Lark Ascending* (Vaughan Williams, 1920), but a tactical decision was taken to ultimately remove this layer in the interests of integrity, copyright and ethics. Some layers of MIDI orchestral percussion were programmed.

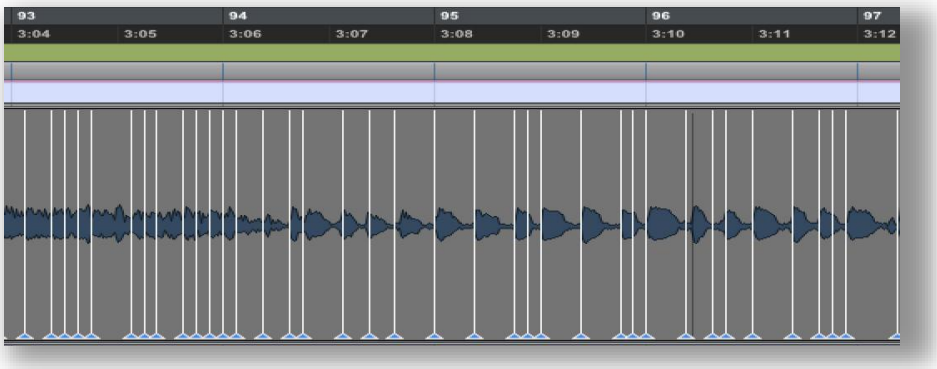


Figure 7.13 Close up of the edit points in four bars of the pizzicato bass

Figure 7.14 The edit points over the duration of the pizzicato bass

Audio Excerpt 7.56 The reconstructed bass with complementary piano and trumpet edits

It was decided to create a double-bass quartet[93] backing through layering. The arco bass take featured very flexible intonation, and so it was passed through Melodyne, and pitches and glissandi were rationalized one at a time; this increased compatibility between the layers. The part was then sliced and arranged canonically in an additional three concurrent tracks, and Pro Tools Elastic Audio was employed to define the rhythmic interaction of the notes, and again pitches were adjusted as required.

Audio Excerpt 7.57 Three layers of arco bass constructions playing in canon

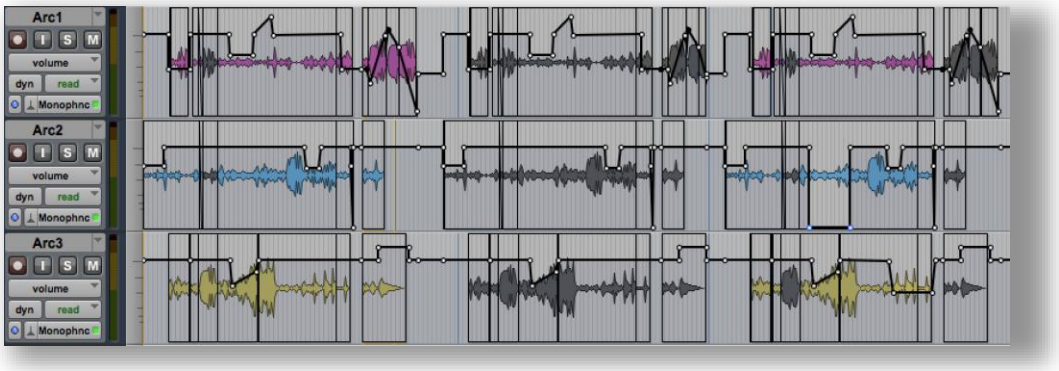


Figure 7.15 The volume automation on the arco bass; the virtual score's dynamic markings

[93] Although there are five simultaneously for a very brief period.

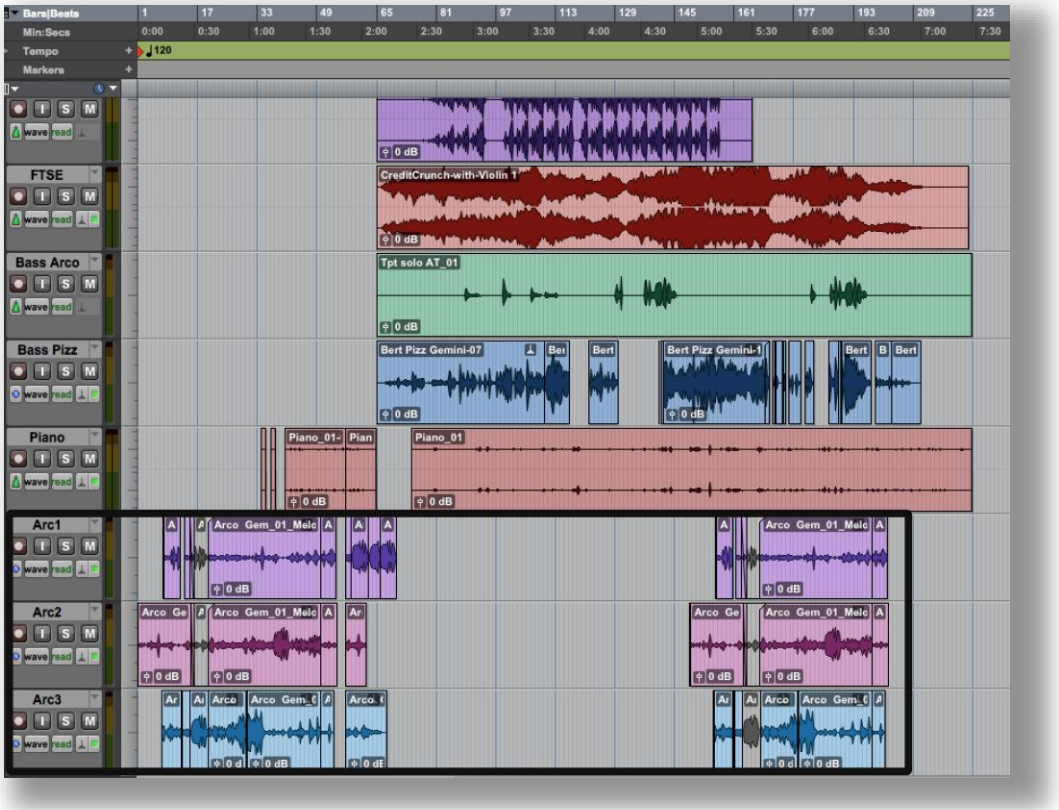


Figure 7.16 The three arco layers (highlighted) increased the duration of the piece to 7'30".

The interaction between the named tracks can roughly be seen in Figure 7.16. 'FTSE' is Ramshaw's (2008) stimulus tune.

7.2.7.3 Violin

In order for the tune to gain autonomy, both of the pre-composed tracks were deleted, and a violin was recorded[94] to replace them. The player was briefed in a number of melodies to allude to, but allowed to improvise, with broad stylistic direction from the producer (the postulant). The violin was recorded simultaneously with a AKG C-414 and a Beyer-Dynamic M160. Upon reflection, only the latter was utilized for its warmer ribbon sound. In addition, a

[94] In a small recording booth.

pair of DPA 4011 microphones were set up in ORTF purely to act as a true stereo effect send – a technique that makes a considerable difference to imaging when sending to a convolution reverb of a large space. The M160 and the ORTF were grouped in Pro Tools for every take, and then two definitive parts were created through editing.[95] A number of spectral edits were performed on the results in order to control bow noise, remove breaths, alter the harmonic balance creatively and tidy the occasional temporal edit from earlier.

Audio Excerpt 7.58 An unedited take of the violin playing along with the track

With the final melody in place, it was now possible to commit to creative editing decisions in the rest of the instrumentation in order to best complement the melody and develop the arrangement, and further ornamental parts were added. The pitch of the melody was extracted with Melodyne, and this was used to drive some background MIDI textures and harmonize with the original. Occasional phrases were processed in the spectral domain and/or effected to create special effects and punctuate the piece. Overall, the aesthetic of the string processes might be considered reminiscent of Skelton (2013, 2010).

Audio Excerpt 7.59 An example of how a violin trill was manipulated. This phrase also fed a modulated delay via an automated send to create a tumbling cascade effect.

[95] It is perhaps worth noting that much time went into correcting the intonation of the violin, however almost all of this was abandoned in the end in favour of the character of the natural performance.

Audio Excerpt 7.60 A legato violin part was harmonized with parallel 4ths up and 5ths down, and stereoized to create a pad-like effect.

Another layer of automation was then added to several of them to finely control the interactions between instruments. The most problematic aspect of final mixing was controlling the volume of the bass due to the nature of the hyper-edited end performance, which rapidly traversed the entire length of the neck. Izhaki's (2011) serial compression was used, with an analogue dbx 160 doing most of the level balancing

8 Discussion

What turns me on about the digital age, what excited me personally, is that you have closed the gap between dreaming and doing.

Bono, in (Luppicini and Haghi, 2012, p.1)

8.1.1 The Making of Quiet Things

Although only a selection of significant aspects were presented in Chapter Six, this study revealed a number of areas that do not appear to be documented elsewhere. According to available literature, within the genre, such a recording and more especially the subsequent processing and mixing remains unusual if not unique, and the publication of the associated text[96] underpins this. Retrospective analysis of a finished stereo master could not have offered equivalent insight into the practice.

8.1.1.1 Future practice

It is not likely in the near future that many other producers will engage in such time-consuming mediation in this genre; it is just not cost-efficient, and would require something like an academic or personal context to justify it. Further, even at the highest levels in the genre, many bands do not have anyone designated as ‘producer’. Currently however, there are a growing number of laptop musicians performing alongside former traditionalists, and it is highly likely that if a suitable studio venue could be secured, this avant-garde will bring further DAW approaches to Free Improvisation. Even without such a studio, the laptops are often manipulating sub-mixes of the acoustic

[96] By the AES (Paterson, 2013b). The original publication has since been augmented to form what is presented here.

instruments, and thus even live recordings (and performances) can sound increasingly processed, and this will in turn become more accepted. Since this observation was originally published, the trend has been reinforced by artists such as Polar Bear (2014) with Leafcutter John. Although not strictly dwelling within Free Improvisation, Polar Bear have flirted within the genre, and here adopted the multi-room Livingston studios (Tingen, 2014) for total acoustic separation. They differ in that their more mainstream repertoire carries a larger recording budget, and it remains likely that Free Improvisation will (as a whole) remain out with this environment.

Due to a number of factors referred to in Chapter Six, from the producer's perspective, there were many areas that could be bettered, and the aesthetic aspired to for this album was not fully realized, as is the case with many productions. One example of this is the saxophone spillage into the piano microphones – an insurmountable function of the recording facilities – which necessitated the level of the saxophone being overly loud in order to balance against its own reverb. With the mercurial evolution of technology since the recording was performed, numerous powerful tools are now available that could have improved things considerably. For example:

- The reverberation spillage issues might now be ameliorated[97] with bespoke tools such as Zynaptic Unveil (Zynaptiq, 2015) (and/or a lateral application of Sound Radix Drum Leveller (Sound Radix, 2015)), although this would likely be less transparent if used on the

[97] Although this very issue led the postulant to subsequently develop a method of dereverberation (Paterson, 2006), not included in this submission.

more exposed duo performances, and it is unknown how effective this could be.

- The piano clicks could be swiftly repaired[98] with interpolation using iZotope RX4 (iZotope, 2015).
- More modern DAWs typically offer phase-locked time stretching of grouped tracks would have offered more options for correcting the drum kit performance, however the copy and paste approach taken did make a musical contribution to the flow of the performance.

8.1.1.2 A brief personal reflection

In such a discussion, it is appropriate to include a (first-person) personal reflection on the experience surrounding this project.

The creation of this album was challenging and precipitated much self-development. The album was conceived of as an academic project that would also become a commercial release in order to underpin the robustness of the work. Project management on this scale was new to me, and soliciting, developing this album, securing its release and directing a team of five people required further skills to be developed linked to the greater role of the producer[99]*. Although I had a level of experience in music production, I had never recorded and produced an entire band playing live before and this required much to be learnt and many obstacles to be overcome under time pressure. The technical issues and the politics were particularly taxing, and with hindsight provided a most valuable experience.*

[98] This was successfully tested for feasibility.

[99] as described by Burgess (2002).

The desktop aspects of the production were less challenging since they were aligned more closely to the core of my previous experience, yet the context provided a demanding environment for this experience to now operate within. My goal was to contribute something to the finished sound of the album without excessive mediation that might push against the aspiration of the musicians, since their musical direction was always paramount. Ironically, if I were to re-record this now, I could do it very much better – a function of the experience of having done it once already.

8.1.1.3 A sonic signature

Duets apart, each track on the album featured a particular production aesthetic that could be regarded as a metaphor for a musical 'hook'. Such an approach is not novel and can be traced back to examples such as the Beach Boys' *Caroline, No* (1966) – in which:

> The whole song was sped up to raise it by a semitone in order to make Brian's voice sound younger and sweeter than it really is. (Butler, 2012, p.228)

Here, examples include the extreme compression on the drums in *Collective 2*, or of the cathedral reverberation on *Piano Solo*. This approach aligns with what Zagorski-Thomas (2014) has subsequently dubbed Sonic Cartoons, where particular features of the production are emphasized to the point of exaggeration – a metaphor for cartoon schematics.

8.1.1.4 The studio artefact versus the live band

If other practitioners were to follow this approach, there is little doubt that Free Improvisation would benefit. Sales of recordings have always been minimal, with fans preferring to engage with live performance. Whilst there is no doubt that such performance is powerful and represents the focus of the

musicians' intentions, perhaps studio technology could make the recorded performance more autonomous and (current industry trends notwithstanding) reach out to a larger audience. This would represent a transition across Zagorski-Thomas' (2010) modes of functional staging, where the music is repurposed for a different type of listening. It could be argued that this album does in fact make a step towards that transition.

8.1.1.5 Relationship to the research foci

The link between innovation and context was explored in Section 4.1. As was alluded to in Section 6.1 the techniques employed cannot be claimed as novel in themselves – it is the unfamiliar context of this album's construction that validates a claim that the production work is innovative. Whilst aspiring to the word 'true' in the secondary research focus[100] is audacious and is not claimed here, accepting the context-innovation link allows the album to align to this focus. Section 6.1 also noted aspects aligning to the secondary research focus[101] on the lateral application of tools, and again, it is the context that offers some novelty.

8.1.1.6 Presentation or representation

Whilst the techniques and concept are a most familiar mode in popular music production, there can be little doubt that their application in this context challenged the norm. The musicians themselves were all hugely experienced in their field and despite being primed to expect it, they expressed considerable

[100] What constitutes innovation in music production, and to what extent can true innovation in production be demonstrated?

[101] To what degree do producers typically subvert the intended function of their tools and to what effect.

cynicism about the approaches. As Theberge (1997, p.216) observes: “sound recording allows the musicians to distance themselves from the act of performance and to create ‘impossible music’ ”. For the musicians here, any such distancing was anathema, and further, the capabilities of the studio are so synonymous with the genres in which they are typically applied, that the band felt that any such mediation was actually an attempt to commercialize their art form in some way. They sought reproduction, not production (Theberge, 1997). Despite this, upon hearing the end result they were universally pleased, with Keith Tippett declaring it one of his best sounding albums, and Mark Sanders inviting the producer to work with him on his next project. Sanders also went so far as to apologize for his earlier reservations[102]. Furthermore, the album was also well received by critics, and a short selection of reviews can be seen in Appendix 11.1.6.

Listeners tend to understand jazz recordings as representations of performances, and it is only with hindsight or knowledge that any phonographic illusions are exposed (Tackley, 2010). It is highly improbable that Jazz listeners in the 1950s were aware of the diagonal tape splicing techniques of Rudy Van Gelder (Skea, 2001), and whilst such illusions could potentially be obvious, Van Gelder strove to develop techniques to make them transparent. Here, both approaches have been employed quite consciously. The avid listener will notice the ostentatiously synthetic effects such as delay, but will be less aware of

[102] He had been particularly irritated by the request to purchase new drum heads before the recording, saying “don’t my drums sound alright then?” The request was only rooted in common practice in pursuit of the best possible sound in rock recording. Sanders later declared the final drum sound to be one of the best he had ever had.

splicing. Regardless, a text such as this is required to form an exegesis that offers a more complete view of one of Butterfield's (2002) 'Musical Objects'[103] where the 'autonomy' is further asserted by an exposé of the production.

8.1.2 The Wavefondler

Whilst it would be quite possible to have formed a critique with a backdrop of Human Computer Interaction (HCI), this would quickly move beyond the music-production-focused scope of this DMus submission. Instead, a reflection upon use and functionality will be presented.

8.1.2.1 Proprioception and dexterity

One problem that was encountered when using two iPads was the lack of proprioceptive control. When using a traditional hardware interface, the user can typically operate a fader or knob without looking at it, using a combination of proprioception and aural feedback to exert control. Since a touchscreen offers no such (hybrid) feedback at present and the eyes can only accurately guide the hands in a relatively small target area i.e. a single iPad, the use of two iPads did not literally give double the functionality of one. However, it was found possible to visually multiplex between the two quite rapidly, and in addition a limited degree of control was possible even with eyes averted from a given iPad.

Whilst there are systems under development which remove the need for such visually directed control (for example, Ahmaniemi and Lantz (2009) discuss navigation devices for pointing to objects of interest with the user's own arm) it is

[103] Introduced in Section 6.1.1.

not conceivable at present how these could operate with sufficient accuracy for the type of control necessary in this context. Doubtless, suitable control will emerge in the future. There were further issues around dexterity when using two iPads, since a two-handed approach had already been developed during software creation on a single iPad, however specific practice could negate this.

Johnson (1999) asserts that as the complexity of an interface design increases, the user experience becomes more of the interface and less of its effect. For this reason, a multi-page interface was implemented keeping each page relatively simple. Mycroft and Paterson (2011) stated:

> There is a balance between a visualization that aids, reinforces and expands our innate aural abilities, and one in which the instrumentation translates all other aspects into visible results.

It is hoped that this device aligned with the former category.

Despite this, the real time updating of the visualization imposes a pressure on the user to constantly interact and consequently 'overplay' – a pressure that had to be consciously resisted when actually recording a performance on *Anathemaofanenema*.

8.1.2.2 Novelty

As can be seen in the demonstration video, the Wavefondler is a most intuitive and tactile device; however, it must be considered how it aligns to the second part of the secondary research focus on innovation[104]. As discussed in Sections 5.3 and 6.2, direct multi-touch interaction with a waveform is still unusual, but as argued in Chapter Four, there cannot be many seminal moments in the evolution of the application of a new technology such as multi-

[104] What constitutes innovation in music production,
and to what extent can true innovation in production be demonstrated?

touch. Having said that, innovation in this context can be demonstrated through incremental developments, simply by facilitating something that was not previously possible. The Wavefondler demonstrates novel interaction with the audio on a host computer, in the 'familiar comfort' of a DAW environment if preferred, doing away with the tedious Internet-based file transfer often associated with other current audio apps, and crucially integrating with the greater multi-track environment. Although its sonic manipulation functionality is based on established DSP techniques and at present oriented towards a glitch-type genre, it could be developed or modified to carry out many other functions through a similar interface and gestural control. These gestures are of course not novel, now becoming commonplace in a variety of apps, but here, they serve to demonstrate that they can be applied as control of a host, and "a new activity – particularly a new engagement with a 'tool' – allows, or perhaps forces, us to think in a new way" (Zagorski-Thomas, 2014, p.147). Although not implemented in this version, it would be ideal to transfer all gestural information to a host sequencer for potential retrospective editing as automation.

Another aspect to consider is the secondary research focus on limits of functionality[105]. It could be argued that here, in opposition to the trends of 'equipment complacency' alluded to in Sections 4.1.8 and 5.1, but in alignment with contemporary DIY-coding, making and hacking culture, the notion of developing a tool with a unique function is representative of 'probing the limits of functionality'. Further, the device represents a reaction to the lure of the

[105] To what degree do producers typically subvert the intended function of their tools and to what effect, and how are the limitations of functionality probed as was 'traditional' in so-called innovation before the software age?

'preset mentality' discussed in Section 5.1, and demonstrates the same curiosity towards innovation as those who wished to subvert the original intended function of their tools. The Wavefondler presets were extended by the implementation of dynamic and algorithmic modes, ones in which a basic category was user-selected (e.g. of filtering and stuttering) and the effect then changed according to predefined parametric ranges, in real time. In testing, the functionality appeared accessible to novices, but as dexterity increased through familiarity, the device offered increasing levels of control and playability akin to a musical instrument. Whereas Section 5.1 concludes by highlighting the tension between the expectations of novice and professional, and suggests an ongoing trajectory, the Wavefondler appears to offer a satisfying accessibility to a broad spectrum of users.

8.1.2.3 A further brief personal reflection

This was by far the most complex piece of software that I have designed. I had to extend my existing capabilities with Max/MSP by an order of magnitude, and since the software is not designed to support complex graphical user interfaces, many tricks had to be devised in order to implement a workspace that in software terms is many layers deep. There was quite a bit of functionality that was not consolidated to the point of full integration and stability since the device had to be completed in order to publish at the Innovation in Music conference in 2013, but the Wavefondler still has a large range of functions and modes of operation.

It was very flattering that Cycling '74 selected this patch as their featured project in the quarterly newsletter, which implies that they felt that knowledge of

the device would be beneficial to other coders. The feature and interview can be seen here:

https://cycling74.com/project/wavefondler/

Indeed, the design process was a conscious learning journey; a self-imposed tutorial in DSP, HCI, functional augmentation and system design. Curiously, it was not possible to anticipate the user experience before the device had already evolved to a high level of functionality and committed to those modes. Doubtless, the device could have been streamlined further with the advantage of a reflexive feedback loop that allowed greater design refinements in response to functional testing. As is increasingly understood in emergent research paradigms such as that of Research Objects in computing (Bechhofer *et al.*, 2010)[106], this research could not have been revealed without design, demonstration and textual augmentation.

8.1.3 Something Jaggy

In contrast to the previous album, this one featured hugely greater levels of mediation. In Chapter Seven, a number of notable production features were highlighted in order to offer insight into the creative process and assert alignment with the various research foci and the conceptual backdrop. The stated features were of course only indicative, and the reader is invited to speculate on the full range of production techniques whilst listening to the finished mixes.

[106] See Section 3.1.

8.1.3.1 Bricolage

The iteraphonic bricolage proved to be an intriguing discipline. Beyond its purest form of superimposition, along with the spectral mediation and four modes of editing referred to in Section 3.3.1.3, the approach became a powerful compositional toolset to create symbiotic layers, especially when augmented with bespoke MIDI-sequenced parts. This methodology occasionally produced delightful moments of serendipity, but more often than not offered hints of a direction that required extensive interaction to consolidate; however, responding to this situation in itself also helped to force the parallel driver of auteurism and offered compositional direction.

To draw further metaphors from visual arts, the actual implementation of the bricolage could be regarded as parallel to collage or montage. It could be argued that:

> With so many precedents in the world of the visual arts, … it does seem surprising that it took so long for there to be similar developments in the world of music. (Cutler, 2004, p.145)

Perhaps, but this can draw criticism – conversely, Theberge (1997, p.206) states that: “the artistic practices of collage, assemblage and montage used in popular music virtually destroy the organic integrity of ‘the work’ ”. He is speaking specifically of popular music, and clearly does not hold that aspect of it in high regard. Of course, the semantics of "organic integrity" might be analysed; surely such a statement must be a reaction to the singer-songwriter or the paper-based composer. It is interesting that in the intervening years since that was written, both modes of composer have increasingly turned to computer assistance to empower their craft. Crucially however, if integrity is placed within these practices from the outset, then they cannot be viewed as invasive to a

self-aware art form, especially when composition is subservient to a principal driver of production.

One major obstacle that the approach consistently presented was that of EQ. In a normal overdub environment, whilst recording, great care is taken to achieve specific tonal qualities that will complement the existing material (Toulson, 2008). This is not possible when selecting audio from a pre-existing palette, thus this orthodoxy was subverted. Consequently, many of the final mixes were hindered by contrived and remedial EQ[107], and although in many cases this was transparent, it is an affliction that is prevalent throughout the final album.

8.1.3.2 Placing the approach

As was the case with the first album, it seems unlikely that this mode of creation would be undertaken in the commercial world. Working in this way took several hundred hours per track. A considerable part of this involved learning and applying new systems, and this was exacerbated by the extended timeline, which offered many technological developments over its duration, with these consciously being allowed to influence the artistic direction – something that Zagorski-Thomas (2014) relates to as residing within the actor-network theory (ANT) of social theory. Whilst symphonic and operatic opuses have been known to have greater incubation times, the grandeur and sophistication of these surely justify it. The aesthetic result of this album does not reveal the endeavour behind its creation, and most listeners would assume that it could

[107] The bass in My Requiem being one example that was commented upon in Chapter Seven.

just as easily have been made in a fraction of the time with a more pragmatic and conventional approach.

Having said that, its purpose was as an academic project, and as such it was necessary to be meticulous and disregard any such pragmatism in order to 'discover' the end result and justify such studio inquiry – without taking this approach and forming the associated contextual backdrop, the inquiry could not be conclusive. Unlike the first album, the context of the practice is less novel, but in response to the title of this thesis, *Something Jaggy* performs a robust exploration and development of the *interaction* of an unusually large range of desktop techniques.

Chapter Seven provided a selection of examples through which the secondary research foci were explored, and Chapters Four and Five provided a range of contextual backdrops and case studies of particular salient concepts. Whilst stopping short of forming a holistic praxis, these do serve the frame the practice herein.

8.1.3.2.A **Time stretching and editing**

As discussed in Section 8.1.3.1 above, time stretching and editing[108] were techniques that exerted great influence on the final results. Section 5.2 argues how the audio processes that were employed formed Cagean transitions, presented timbral creation as an acousmatic process and embraced the artefacts that might be created. Such an approach even extends Zagorski-Thomas' (2014, p.206) view that:

> This microlevel editing of audio to manipulate performance can also be used in a more creative manner.

[108] Of both MIDI and audio.

Of course, it must be reiterated that these things are not always discretely audible, but the manifesto of their implementation was always a constructive force. The fastidious MIDI editing, although often highly involved, deserves less reflection here since its practice is more widely understood. Sections 5.2.2.1 and 4.1.5 frame the relevance of tape techniques and provide an historical metaphor for this work.

8.1.3.2.B **Timeline**

As has been alluded to above and in Chapter Seven, the material on this album has often straddled many technologies over many years, and there has persistently been a conscious effort to respond to the availability of this technology and indeed develop innovative and lateral uses for it. This has precipitated many different versions of the tracks, and required assimilation of a very large range of tools. This could be regarded as a worthy ethos, since as Skea notes:

> …that the quality of Van Gelder's output rests not necessarily on technical innovation but on determination to master successive waves of state-of-the-art technology available to him and a legendary degree of perfectionism. (Skea, 2015, p.1)

Perhaps unsurprisingly, it also caused a great many problems ranging from system compatibility and format conversion to a fluxive development of personal expectations and aspirations; however, it could be said to have presented an interesting context for an academic study such as this.

8.1.3.2.C **Relationship to traditional production values**

Any production that involves such extreme mediation is bound to undermine many of the traditional production values that are often more prioritized, and this is no exception. These have been discussed in Section 4.2

to form a contextual framework for this practical work. As with Section 8.1.3.1 above, and of course in response in the methodology of Chapter Three, this album has been designed to challenge such values. To its advantage, it is not burdened with attempting to convey an unmediated acoustic instrument representation of reality as discussed by Händel in Section 4.2.3. As producer Martyn Phillips observes, “music production has been creating a meta-reality, an increasingly abstract artifice with relative values.” (Phillips M., Interviewed by: J. L. Paterson, 2012)

8.1.3.2.D **Density**

As was mentioned in Section 3.3.1.4, the album featured musically dense arrangements that consciously presented a challenge to the mixing process, especially given the EQ issues described in Section 8.1.3.1. In general, these issues were addressed using EQ and automation, with additional techniques such as parallel processing and side chaining. Panning was also used, but with reflection this was an underexploited tool. The tunes typically featured a very high proportion of stereo tracks, and these were often left with their own image. This meant that the sonic energy was often spread across the panorama and tended to cause frequency cancellations, leading to ‘muddiness’. The pre-existing stereo was sacrificed to some degree, and so-called three-point mixing[109] was employed more extensively on the last two tracks that were mixed, *Election Day* and *Klezm*. With hindsight, this should have been done much more extensively, since of course it offers new modes of clarity.

[109] Where the only pan positions that are used our full left, full right, and centre.

8.1.3.3 Auteurism

It should be evident from the preceding text that auteurism pervaded all of this musical material. Whilst such a discipline is immersive and could be said to offer the ultimate control to the producer, of course it brings its own disadvantages to bear. The music becomes entirely constrained by the subjectivity, stylistic preferences and most importantly limitations of the individual. The approach taken also meant that performances were all too easily sterilized, and whilst every effort was taken to reinvigorate them in their new contexts, this was only achieved with varying degrees of success.

> It's not surprising that far from removing "sacred cow auteurs," modern technology has simply shifted the metaphor from exceptional accomplishment on paper by "composers" to exceptional accomplishment on hard disk by "producers." (Moorefield, 2010, p.111)

Of course, Moorefield's "exceptional accomplishment" refers to a global perspective, and naturally that is not claimed here; however, the discipline was embraced and the above transition actioned.

8.1.3.4 Another brief personal reflection

This album turned into something of a magnum opus. It is curious that long before registration on this doctorate several of the tracks started life as self-tutorials in order to learn various systems. I could never have imagined what formidable tutorials they were to become as the systems were superseded and augmented multiple times. The learning journey has been enormous and rewarding, although naturally there have been many traumatic frustrations en route.

The self-imposed disciplines associated with this project were equally bipolar, and I acquired many skills not explicitly documented in this text, for

instance, data management (there is 120 GB of audio data), perseverance and artistic aspiration. This of course is on top of the enormous self-development around the core themes.

8.1.4 Summary

The three practical artefacts in the submission all have very different natures. Collectively, they represent a range of production values and approaches that respond and contribute to the various research foci whilst maintaining the autonomy required of a practice-led project. Whilst a track-by-track evaluation could offer further insight, this could tend towards subjectivity and so has been avoided. Instead the focus has generally remained discursive, albeit centred within the practice. The following chapter will offer some conclusions and briefly reconsider the research foci, and form a transition from specific to general.

9 Conclusion

We must break out of this limited circle of sounds.

(Russolo, 2004, p.11)

9.1 Reiteration: the pertinence and significance of the project

Clearly, the intention is that this submission be regarded as research. Being a practice-led DMus, it has utilized Haseman's (2007) performative research paradigm in that the artefacts are accompanied by a text that contextualizes the methodology and details a selection of aspects of the studio process, thus validating it as an inquiry.

In reviewing the literature, no academic texts were found that do this, although consumer periodicals do offer detailed procedural breakdowns in their own context. The paradigm is rapidly expanding at present, and it is anticipated to be an increasingly popular mode of enquiry, as indeed is the adoption of the format of Enhanced Publication from the world of software. The implementation of Supanova (2015) for Australian creative research submissions to the ERA[110], embedding text and artefact together in an online repository indicates increasing formal acceptance.

This submission carries value to the international research community. This is demonstrated through the peer-reviewed publication of a significant portion of the text[111]. Beyond its published textual discussion, the software artefact was deemed to carry interest to the Max/MSP community as testified by its inclusion

[110] The Australian equivalent of REF.

[111] The original publications can be viewed in Appendix 11.1.2.

on the manufacturer's website. The music albums have been released commercially and received positive critical reviews. It is claimed that much of the practical work has extended and clarified current professional practice.

9.2 Implications and extrapolations

The two albums in this submission are very different, but are united by their uncharacteristic modes of production. Both modes were time-consuming, far beyond the norm in their respective genres. At present, although it is unlikely that these modes will be applied commercially, the question might be asked as to how beneficial the processes undertaken were to the final aesthetic of the artefacts. The answer is of course subjective, and likely more so without the insight offered by this text; however, as long as the prime motivation is understood to be an academic study of production with an ontological perspective, then the aesthetic is to some degree irrelevant. It is *not* the intention to argue that this should be the case in another context.

If any of the processed parts can be held to be musically or sonically worthy, then once contextualized chronologically, in the future, the human effort involved in realizing such an end result might only have been an interim issue. Bespoke technologies could be developed to further automate or rationalize the approaches. Such things have been alluded to in Sections 5.1.6.3, 5.2.5, 8.1.2 and elsewhere.

Aside from those already highlighted, a couple of specific further examples might be offered here to extend the imagination:

- Reiss and his associates have been working on autonomous mixing[112] for a number of years, as encapsulated by De Man and Reiss (2013). Once this technology matures, cheapens and becomes implemented ubiquitously, fringe genres such as Free Improvisation are bound to benefit, and undoubtedly dynamic presets will be available to impose sonic signatures from other genres upon the mix.
- With regard to the time stretching, it is currently quite possible to develop an audio quantization engine that would use Music Information Retrieval (MIR) to analyse pitch and transients on multiple tracks, automatically align transients according to parameters such as amplitude and harmonic relationship, and thus create machine-controlled inter-track musical relationships. Such a system has already been proposed and has a patent pending (Paterson and Toulson, 2015)[113], an endeavour that was partly inspired by this submission.

It is inevitable that further new and surprising tool sets will evolve and apply artificial intelligence to many of the processes, extending Moorefield's (2010, p.xiii) reality of illusion. Perhaps the trajectory of illusion can be illustrated even more clearly if parallels to other art forms are made. Whereas once, audiences were amazed by ghostly projections of actors onto pieces of glass on the theatre stage, we currently have markerless facial motion tracking (Faceshift, 2015) in cinema and games, and this technology is still in its naissance. The

[112] Whereby a significant proportion of 'standard' mix decisions (starting EQ, panning, compression) are made and implemented by an algorithm.
[113] It is not part of this submission.

physical characteristics of an actor are now irrelevant, and further, the very performance can be retrospectively adjusted.

It takes little imagination to translate this into an equivalent form of sonic control, as is already being demonstrated by the augmented performance capabilities of Zoundio (2015), where lesser-skilled performers can deliver virtuosic performances, yet still control the artistic direction; Guitar Hero for real instruments might yet become the norm in the future, with long-honed traditional dexterity as obsolete as touch typing in the current voice recognition era.

Reverting to the present, should it prove successful, this study might offer a pedagogical template for a future DMus in Music Production[114]. Whilst every doctoral study is unique, the format, methodology and approach might provide some broad guidance for others undertaking this endeavour.

9.3 Limitations of the research process

Ultimately, this work is subjective – it is driven by the aspirations and limitations of an individual. Having said this, in other musical disciplines such as performance or composition, this trait would also apply. It must be accepted that this will be the case, yet hoped that sufficient context and cohesion is presented to maintain its validity regardless.

Spontaneity and momentum are normal drivers in the creative process, and both the lengthy techniques that were employed and the act of documentation could impede this process. Further, the extended duration of this project meant

[114] Google does not reveal any others completed at the point of writing, although it seems to be a burgeoning qualification in Finland with a number of current postulants.

that expectations and aspirations shifted over time, and this also led to perhaps unnecessary iterations of Reflective Practice cycles.

The process was led by the methodology, which in turn imposed a number of guiding strictures. Had the process been freed from these, some of the work might have found a more natural trajectory towards completion. The tools were allowed to guide the creativity, and this approach could be said to counter natural artistic integrity, and perhaps even freedom. It is however quite easy to form a metaphor in response to this. When a chisel with a finer tip is invented, should a sculptor not be permitted to learn, then employ it to create finer detail? Few would argue with that, except of course in cases where self-imposed discipline precludes it. Of course, ultimately the test is of how well the tool was applied, and those beholding the final artefact are (very likely and rightly) ignorant of the available tool set. Any tool is just an actor in its own network; casting any tool in the lead role is a legitimate decision.

9.4 The Research Foci

In order to facilitate a transition from the specific to the more general, each of the research foci will now be considered in a broader sense.

9.4.1 What constitutes innovation in music production, and to what extent can true innovation in production be demonstrated?

In music production, innovation is often driven by technology in that periodically, it is emergent technologies that facilitate new modes of production and corresponding new sounds. These moments can be distilled into a number of seminal ones, or indeed into a much greater number of smaller increments, which may or may not be harder to quantify. It is common for early adopters of

these technologies to be the first to disseminate their application, and therefore be associated with such innovation as practitioners, and as such there is a case to accept this work as innovative simply because it lacks precedent.

The secondary research focus above, questions: "the extent that true innovation … can be demonstrated". Although “true” is a bold word and most likely aligns with the seminal technology developments, if the above contexts are accepted, then not only can the various technologies and techniques highlighted in Chapters Four and Five be regarded as "innovations", but the practical work presented in this submission can also qualify through both its context and developmental aspects as well as Von Hippel’s (1986) User Innovation.

9.4.2 What is the worth of pre-DSP ‘traditional’ production values in the contemporary manipulation-oriented context?

" ‘Traditional’ production values" are not in question. These have been at the heart of the perception of ‘quality’ in music recordings since the inception of such artefacts; however, they are fluxive and therefore by definition temporally subjective. It is hard for successive generations of listeners and producers to imagine how the current state-of-the-art might develop every couple of decades, but history has proved that music production does seem to have its own metaphor of a Moore’s Law-type curve. It would appear from tracing the chronology of music production that the emergence (then prevalence) of DSP processing placed a step on that curve, whilst also causing it to steepen dramatically towards the future.

The research focus seeks to attribute worth in the face of DSP manipulation. If a degree of authenticity (of an acoustic instrument recording)

needs to be maintained, then the best sounding recording will give the best result. As the degree of processing increases however, there will be a tipping point after which this recording is transformed beyond the point at which it is easy to tell much about the original quality of the source – this is assuming that the processing is still resulting in a useful sonic texture. If processing is not linear over the timeline – as is the case with different degrees of time and pitch adjustment to specific notes in a given performance, then the result will alternate between two poles of mutation (none to maximum), but the holistic result will be one of mediation.

In such a case the listener might choose or be led to perceive an 'authentic' performance that has been interfered with, or a mediated performance that sometimes sounds quite 'authentic'. It is claimed that beyond such hybrids, the full spectrum of such parts is presented in this submission, and that a corresponding range of perceptions will ensue.

9.4.3 To what degree do producers typically subvert the intended function of their tools and to what effect, and how are the limitations of functionality probed as was 'traditional' in so-called innovation before the software age?

The motivation to go beyond the intended functionality of a given piece of equipment is guided by need, available options, experience and curiosity. As Phillips pointed out in Section 4.2.4, having only a single tool forces the user to develop more flexibility with it. In the (analogue) hardware era, a greater proportion of users tended to covet their equipment, which naturally led to experimentation, hence subversion. The more equipment in a given user's

domain and the more sophisticated it was, then the less time there was available to engage with a single piece in that fashion, the more manuals that needed to be read and the less-likely lateral functionality was to be extended. Of course, the professional user might still typically find time for all of this, but such a pattern might impact more on the amateur.

Such a paradigm is not just a function of a physical hardware tool, since a parameter-light vintage compressor will impact upon such situations in a different way from a complex Eventide harmonizer. Perhaps it is the presence of the embedded software operating system that makes the difference in this example. Such operating systems became increasingly ubiquitous in the sampler/workstation era, simultaneously vastly increasing potential functionality, but also making its intended boundaries more arcane. The prevalence of user-installed software on a computer greatly multiplied the complexities that were typically dealt with, multiplied again by the transition from sequencer to DAW plus third party systems, and ever more time was spent reading manuals and solving problems just to stay abreast of expected operation.

As the palette of functionality continued to multiply exponentially, the depth of engagement with the tools typically diminished, a simple function of time available versus the need to complete certain tasks. To some, this was amplified as both the intrinsic and financial value of software decreased.

Expert users might tend to shy away from preset parameter sets in equipment with which they are very comfortable, yet still employ them in the interests of pragmatism with less familiar systems. The range of options available with such presets is increasingly unfathomable, yet the range of their functionality is increasingly flexible and exotic. Manufacturers are starting to

respond with more intelligent preset options that simplify user engagement or standardize parameter sets across a range of equipment. Naturally, there are still a great many practitioners who actively pursue the novel and there are ever-larger opportunities to implement this[115].

[115] As for instance has been discussed in the time stretching case study of Section 5.2.

9.4.4 A study, exploration and development of the interaction of music production techniques in a contemporary desktop setting

Many music production techniques ranging through recording, sequencing, manipulation and bespoke software design have converged in the creation of this submission. The two albums are clearly contrasting both in their approach and aesthetic, and the tools that have been employed in their creation range from the now-vintage – at the inception of the older tracks' demo recordings to the current state-of-the-art, with many other systems in between. The accompanying text has offered a methodological, chronologically contextualized and explanatory breakdown of the artefacts and their associated applied-methodology and techniques, thus forming an exegesis that offers additional insight into the before, within and after, an insight that could not have been gained by retrospective analysis of the artefacts alone.

The project has proved hugely demanding, and the postulant has grown enormously from its pursuit. The music has been released commercially, and the software plus much of this text has passed academic peer-review. "A study, exploration and development of the interaction of music production techniques in a contemporary desktop setting" has been completed. The producer was an auteur and the illusion sustained.

10 Appendices

NB — Clicking the links will open PDFs of the full papers in a new window

10.1.1 Additional publication

10.1.1.1 Cutting Tracks, Making CDs: A Comparative Study Of Audio Time-Correction Techniques In The Desktop Age.

Paterson, J. L. (2008). Cutting Tracks, Making CDs: A comparative study of audio time-correction techniques in the desktop age. Journal on the Art of Record Production, (4). [Online]. Available at: http://arpjournal.com/761/cutting-tracks-making-cds-a-comparative-study-of-audio-time-correction-techniques-in-the-desktop-age/ [Accessed: 17 February 2014].

Click here

NB the full text exists as a multimedia publication at the above URL. The interested reader is strongly recommended to consult that version, since the text linked from the button has no media content.

10.1.2 Publications included in the main body of the submission

10.1.2.1 Creative Abuse in Time Stretching

Paterson, J. L. (2011a). Creative abuse in time stretching. In: *Proceedings of the 130th Audio Engineering Society Convention*, May 2011, London, UK. [Online]. Available at: http://www.aes.org/e-lib/browse.cfm?elib=16567 [Accessed: 19 March 2013].

Click here

10.1.2.2 The preset is dead; long live the preset

Paterson, J. L. (2011b). The preset is dead; long live the preset. In: *Proceedings of* the 130th Audio Engineering Society Convention, May 2011, London, UK. [Online]. Available at: http://www.aes.org/e-lib/browse.cfm?elib=16569 [Accessed: 19 March 2013].

Click here

10.1.2.3 What constitutes innovation in music production?

Paterson, J. L. (2011c). What constitutes innovation in music production? In: Proceedings of the 131st Audio Engineering Society Convention, October 2011, New York City, USA. [Online]. Available at: http://www.aes.org/e-lib/browse.cfm?elib=16575 [Accessed: 19 March 2013].

Click here

10.1.2.4 What Is the worth of pre-DSP 'traditional' production values in the contemporary manipulation-oriented context?

Paterson, J. L. (2012). What Is the worth of pre-DSP 'traditional' production values in the contemporary manipulation-oriented context? In: *Proceedings of the 132nd Audio Engineering Society Convention*, April 2012, Budapest, Hungary. [Online]. Available at: http://www.aes.org/e-lib/browse.cfm?elib=16596 [Accessed: 19 March 2013].

Click here

10.1.2.5 Free Improv — the hard way

Paterson, J. L. (2013a). Free Improv — the hard way. In: *Proceedings of the 134th Audio Engineering Society Convention*, May 2013, Rome, Italy. [Online]. Available at: http://www.aes.org/e-lib/browse.cfm?elib=16695 [Accessed: 3 June 2013].

Click here

10.1.2.6 Wavefondler — a multi-touch interface for iPad to control audio on a host computer via a visualization of the waveform

Paterson, J. L. (2013b). Wavefondler — a multi-touch interface for iPad to control audio on a host computer via a visualization of the waveform. In: *Innovation in Music 2013*, December 2013, York, UK.

Click here

10.1.3 Contract from The Number to sample their performances

FROM: [Justin Paterson]

("Producer")

TO: [Gary Curson]

[John Edwards]

[Mark Sanders]

[Keith Tippett]

("Musicians")

19th July 2005

Dear [Justin Paterson]

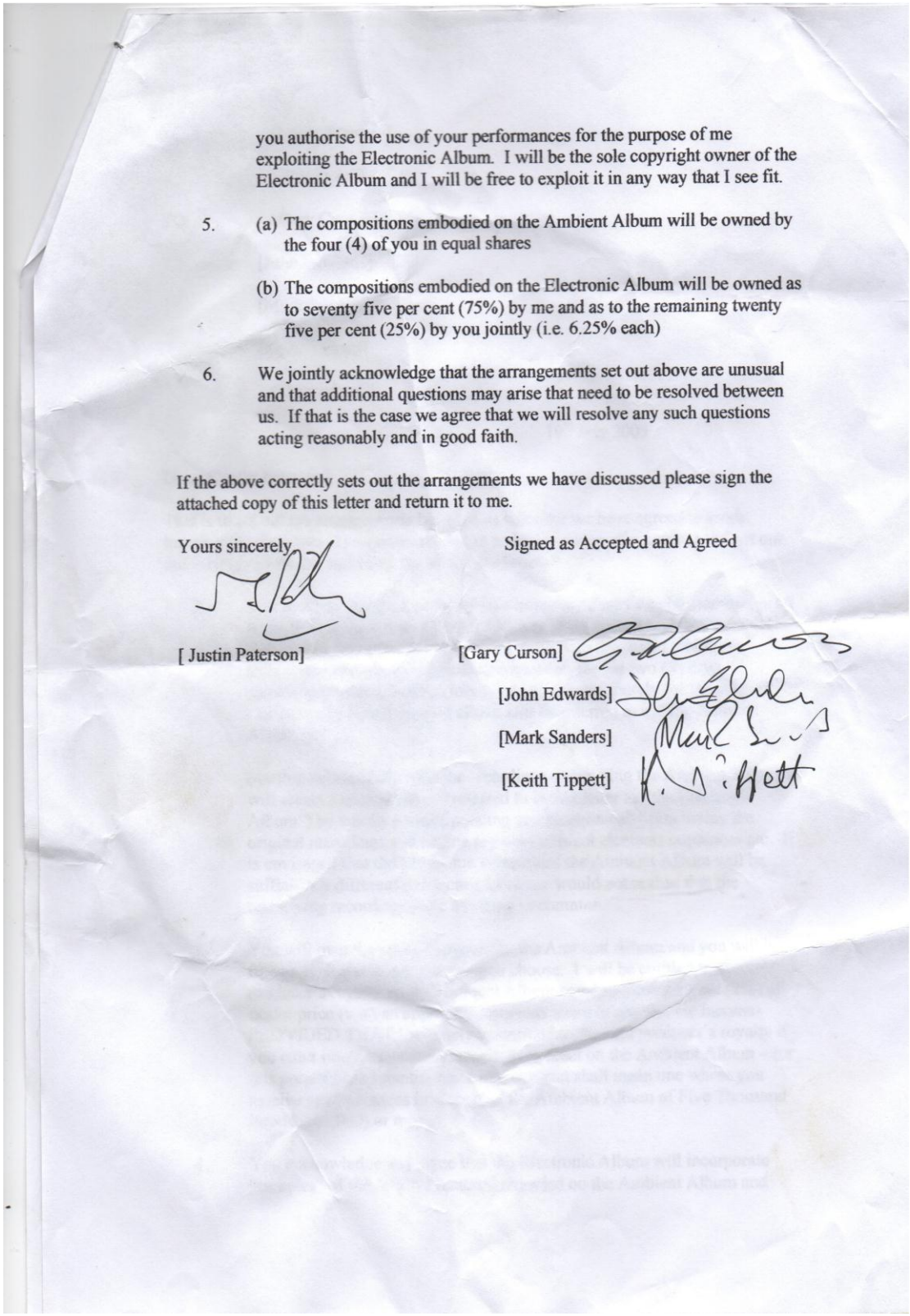
This is to set out the arrangements between us whereby we have agreed to work together to create two (2) separate albums in a single session of recording and set out our arrangements for exploiting the albums as follows:-

1. You agree to make an album of free-improvised music to be recorded in an ambient live session on 19th and 20th July 2005 at Vestry Hall Studios. I will provide my production services along with the studio facilities technicians and photographic documentation for the two (2) days recording plus any finished mixdown master and (purely for the sake of clarity in this letter) the first album will be referred to as "the Ambient Album").

2. Starting substantially with the recordings comprising the Ambient Album I will create a second album (referred to in this letter as "the Electronic Album") by wholly re-manipulating and electronically processing the original recordings and adding my own musical elements sequences etc. It is envisaged that the Electronic Album and the Ambient Album will be sufficiently different that a casual listener would not realise that the underlying recordings have anything in common.

3. You will own the entire copyright in the Ambient Album and you will be free to exploit it in any manner you choose. I will be entitled to a producer's royalty on the Ambient Album equal to three per cent (3%) of dealer price (with an appropriate pro-rata share of any flat fee income) PROVIDED THAT I will only be entitled to the said producer's royalty if you enter into a substantial recording contract on the Ambient Album – for this purpose a substantial recording contract shall mean one where you receive total advances in respect of the Ambient Album of Five Thousand Pounds (£5,000) or more.

4. You acknowledge and agree that the Electronic Album will incorporate "samples" of the original material recorded on the Ambient Album and



you authorise the use of your performances for the purpose of me exploiting the Electronic Album. I will be the sole copyright owner of the Electronic Album and I will be free to exploit it in any way that I see fit.

5. (a) The compositions embodied on the Ambient Album will be owned by the four (4) of you in equal shares

(b) The compositions embodied on the Electronic Album will be owned as to seventy five per cent (75%) by me and as to the remaining twenty five per cent (25%) by you jointly (i.e. 6.25% each)

6. We jointly acknowledge that the arrangements set out above are unusual and that additional questions may arise that need to be resolved between us. If that is the case we agree that we will resolve any such questions acting reasonably and in good faith.

If the above correctly sets out the arrangements we have discussed please sign the attached copy of this letter and return it to me.

Yours sincerely

[Justin Paterson]

Signed as Accepted and Agreed

[Gary Curson]

[John Edwards]

[Mark Sanders]

[Keith Tippett]

10.1.4 Emails

10.1.4.1 Permission to use the LCM Choir: from Marie Tansley-Scales

The edits remove personal correspondence.

Begin forwarded message:
From: marie Tansley-Scales <squig_squig@hotmail.com>
Subject: RE: Experimental Sound- Marie Tansley-Scales 20004372
Date: 16 February 2008 10:00:49 GMT
To: Justin Paterson <justin.paterson@googlemail.com>

Hi Justin,

[EDIT]

That was really weird that you were listening to my tracks when I emailed. ooooh spooky! and YES! of course you may use my audio for your remixes. you have my blessing. I am flattered that you would want to use it. John Cage would absolutely be "most satisfied!" One of the main purposes of the music I like to create is to inspire and it's a great feeling when you achieve that. I would love to hear your remixes when they are finished. They sound extremely intriguing.

[EDIT]

I look forward to hearing your work and I hope to hear from you soon,

Marie

10.1.4.2 UWL authorization to omit optimized session files from the submission: from Prof David Osbon

From: David Osbon <David.Osbon@uwl.ac.uk>
Subject: RE: Session files
Date: 11 August 2014 10:02:40 BST
To: Justin Paterson <Justin.Paterson@uwl.ac.uk>, John Howard <John.Howard@uwl.ac.uk>, Jonathan Stockdale <Jonathan.Stockdale@uwl.ac.uk>, Francis Pott <Francis.Pott@uwl.ac.uk>

Hi Justin

I think that you have come up with a good solution and would be happy for you to progress in this way.

All the best

David

From: Justin Paterson **Sent:** 24 July 2014 10:31 **To:** John Howard; Jonathan Stockdale; David Osbon; Francis Pott **Subject:** Fwd: Session files

[resend to include John; sorry]

Begin forwarded message:

From: Justin Paterson <Justin.Paterson@uwl.ac.uk>
Subject: Session files
Date: 24 July 2014 08:43:56 BST
To: Jonathan Stockdale <Jonathan.Stockdale@uwl.ac.uk>, Francis Pott <Francis.Pott@uwl.ac.uk>, David Osbon <David.Osbon@uwl.ac.uk>
Cc: Maria Pennells <Maria.Pennells@uwl.ac.uk>

Hi Professors,

I am in the process of pushing towards the end of my DMus. One requirement stated in the MSG is to submit optimized session files, where each component of the mixing session is rendered into audio thus bypassing any 'live' studio-dependent effects and allowing an examiner to audition individual parts of a piece of music. This is in *addition* to the final track of course. Optimised sessions are a standard submission format in the industry, and are used to create retrospective remixes etc.

I imagine the purpose here is to allow the examiner scrutiny beyond the stereo masters.

I have just realised that a significant proportion of my audio was completed before my transfer to the DMus (the DMA had a different submission regime), and therefore it will not be possible for me to create and submit such optimized sessions. It has always been my intention however, to submit a large number of audio excerpts of individual components that trace the chronological development of my productions, and naturally I am still in a position to do this. The rationale is that it will give the reader infinitely more detailed insight into the development and evolution of the productions than simply a time-stamp of the final components at the point of mixing as would an optimized session. I believe that these would give the examiner an even more detailed tool with which to scrutinise my work.

So, my question is despite going against the written grain of the MSG, would you consider such a submission to be an acceptable alternative in this case?

Cheers,
Justin

Justin Paterson

Course Leader
MA Advanced Music Technology

LCM Offices — N108
North Building
University of West London
St. Mary's Rd.
Ealing

London

W5 5RF

https://lcm.uwl.ac.uk/

10.1.4.3 Permission to bypass formal ethics approval: from Maria Pennels

From: Francis Pott <Francis.Pott@uwl.ac.uk>
Subject: FW: Ethics query from Justin
Date: 29 April 2015 15:39:58 BST
To: "Justin Paterson (justin.paterson@gmail.com)" <justin.paterson@gmail.com>
Cc: Justin Paterson <Justin.Paterson@uwl.ac.uk>

Hi Justin,

Here is Maria's response. Hope this helps but do keep me posted if you need me to follow it further.

Atvb,

F

-----Original Message-----
From: Maria Pennells
Sent: 29 April 2015 15:25
To: Francis Pott
Subject: RE: Ethics query from Justin

Dear Francis,

The current process is that all students have to complete the ethics application form, which can be found at https://adobeformscentral.com/?f=lHvCwVzIBBktZ5%2AtS5tK1w#. These forms are then sent to the School for approval, in the case of LCM, to Jonathan Stockdale. However, this was not the case when Justin first started, so I think it is fine for Justin to simply write a short passage on ethics in research and how it applies to his work, as per his email below.

All the best,
Maria

-----Original Message-----
From: Francis Pott
Sent: 29 April 2015 12:45

To: Maria Pennells
Subject: FW: Ethics query from Justin

Dear Maria,

The answer to the question below is no, in so far as any such thing is subsumed into the University-wide approach to ethics. I confess I've lost track of where the current formulation of this can be accessed as a file. Justin appears to be wishing merely to ensure he doesn't transgress anything, rather than trying to cite the documentation directly in anything he's writing. Please could you advise? Sorry to add to your load!

All best,

Francis.

-----Original Message-----
From: Justin Paterson
Sent: 29 April 2015 11:33
To: Francis Pott
Subject: Ethics

Hi Francis,
How are you? It has been a while. I hope that you are well and keeping your head above water.

I have a question. Traditionally, LCM did not have a formal ethics in research policy. When I was commencing my doctorate I investigated all this, and that was the conclusion. I am currently at the point of writing up (hurrah!), and I just thought that I should check with you in case any such thing has crept in over the lifespan of my doctorate without my spotting it.

It is still my intention to write a short passage on ethics in research and how this applies to my work, but I just need to check that I am not meant to be referring to any specific policy such as they have in Health.

Cheers,
Justin

10.1.4.4 Permission to use Izzy Davies' vocal performance: from Isobel Davies

Izzy Davies (vocals, *IZZYSX*) was recorded by the postulant in 1999 for an unrelated project. Her vocal was manipulated in an experiment at the time, although contact was subsequently lost. The track IZZYSX was built around this performance, before being adopted for this submission. In 2015, after

considerable efforts contact was eventually made with her via the place of her mother's employment in the 1990s. She consented to the use of her performance.

Response:

Begin forwarded message:
From: Isobel Davies <fluttertongue@googlemail.com>
Subject: Fwd: Your voice wanted!
Date: 6 October 2014 17:59:53 BST
To: Justin Paterson <Justin.Paterson@uwl.ac.uk>

Hi Justin,

How flattering! You may use anything you like from those recordings.

I live in America now - a city in Upstate New York called Rochester. There's a lot of musical life here, mostly because of the Eastman School of Music and a big jazz festival every year. I work as a choir director and accompanist, among things. Still writing songs, but just for my own amusement. Here's a very badly recorded one... https://www.youtube.com/watch?v=q-Amlf9mzmk

Hope your life is treating you well :)

Izzie.

---------- Forwarded message ----------
From: **Debbie Debbie** <debsadavies@gmail.com>
Date: Mon, Oct 6, 2014 at 12:06 PM
Subject: Your voice wanted!
To: isobel davies <fluttertongue@googlemail.com>

Hi Iz Random email - can you reply, or I will if you like! Xxx

---------- Forwarded message ----------
From: "Justin Paterson" <Justin.Paterson@uwl.ac.uk>
Date: Oct 6, 2014 10:04 AM
Subject: Re: Old Greycourt
To: "Debbie Debbie" <debsadavies@gmail.com>

Hi Debbie,
Fantastic! Great to hear from you and thanks for getting back to me.

I hope that you are well. Are you still in Barnes? I know that you are no longer in Grey Court… I moved from Sheen to Thames Ditton in 2000, and left RUTC for

Uni in 2004 (I am now a researcher), so life is all very different.

Actually, it is Izzy that I am trying to track down. I had little luck on the internet, so I eventually though of you! I made a demo recording for Izzy many years ago, and I wanted to ask her permission to use a sample of her voice in a track that I wrote. I would be very grateful if you could put us in touch so that I might do this.

Best regards,
Justin

10.1.4.5 Un-cleared performance: from Brian Miller

There is a soprano saxophone part on the track *Anathemaofanenema*. It was played by a saxophone player known to the postulant only as Jed, and was recorded in the mid-1990s. The original recording was for one of the postulant's tracks, co-written with Brian Miller. Jed gave his permission for the performance to be used however it was wished at the time. Despite considerable efforts to track him down in order to gain explicit permission for use in this track, this has not been possible.

Legal advice was sought and it was suggested that providing a witness statement to this arrangement and registering the performance with PPL was an ethically appropriate approach. This has been done. Should contact ever be re-established, a session fee should be offered at today's rate of £150 for a three-hour session[116].

Statement:

Begin forwarded message:
From: "brian miller" <bmiller3@supanet.com>
Subject: Re: email requested
Date: 21 July 2015 10:09:58 BST
To: "Justin Paterson" <justin.paterson@gmail.com>

[116] Source: http://www.musiciansunion.org.uk/Home/News/2015/Apr/Rises-agreed-in-Recording-Broadcasting-rates.

Hi Justin

To whom it may concern,

I , Brian Miller, am verifying that Justin Paterson and myself did record the saxophone player known only as Jed. This session took place in the mid-1990's. He did give verbal permission for us to use and edit his recorded performance in any way we wanted.

Brian Miller

Brian

10.1.5 Request for additional DMus submission format

Request for additional DMus submission format: Justin Paterson

The research degree regulations state in section 10.15:

Commentaries shall normally be in A4 format; the University Research Degrees Sub- Committee may give permission for a thesis to be submitted in another format where it is satisfied that the contents of the thesis can be better expressed in that format.

The named postulant is due to submit by 15th September 2015. The nature of the DMus pathway requires submission of some two hours of audio accompanied by a commentary. The commentary will contain many references to precise moments in the music. It will be extremely cumbersome for examiners and other future readers to navigate these excerpts using a CD player or a native media player on a computer.

Adobe InDesign offers an alternative solution by embedding audio in Adobe PDF files, and transport controls can be located in the main body text, allowing for swift auditioning of the relevant excerpt. Multiple transport controls can index to different positions in the same audio file, which negates the need for separate excerpts and will be efficient to prepare, store and transfer. It will also

be convenient to audition and compare differing excerpts when placed adjacently in the text.

For this reason it is requested that the URDSC grant permission for submission of the commentary and audio in *addition* to the prescribed textual form. There is no prescribed form of audio or mixed media submission, and so it is proposed that two Red Book CDs represent the 'prescribed' submission, and are accompanied by a number of CDRs or other media containing excerpts.

Response:

Begin forwarded message:
From: Maria Pennells <Maria.Pennells@uwl.ac.uk>
Subject: DMus submission format
Date: 22 May 2015 18:15:06 BST
To: Justin Paterson <Justin.Paterson@uwl.ac.uk>

Hi Justin,

This is to confirm that Anthony Woodman has approved your DMus submission format as requested, on behalf of the University Research Degrees Sub-Committee.

I look forward to receiving the full submission in September.

Best,
Maria

…….
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10.1.6 Selected reviews of *The Making of Quiet Things*

- "Album-title notwithstanding, this is magnificent, incandescent, full on free Improv with a strong melodic element" Andy Hamilton, The Wire
- "The clamorous quartet 'The Number' is an excellent example of the London style" Cosimo Parisi, Musicboom (Italy)
- "Raw and adventurous, intensely emotional. Free jazz at its most viscerally affecting" Chris Parker, The Vortex
- "Another GREAT disc! Man, Tippett, et.al. sound excellent" Laurence Donohue-Greene, All About Jazz (USA)

10.1.7 Credits

10.1.7.1 The Making of Quiet Things

Alto sax – Gary Curson

Piano – Keith Tippett

Bass – John Edwards

Drums – Mark Sanders

Produced by Justin Paterson

Engineered by Paul Borg

Assistant engineers: Simon Lowry, Andy Johnson

Mixed by Justin Paterson and Paul Borg

Mastered by Justin Paterson

Compostion

- *Collective 1* – Curson, Edwards, Sanders, Tippett
- Bass & piano duet – Edwards, Tippett
- Collective 3 – Curson, Edwards, Sanders, Tippett
- *Bass & Sax duet* – Edwards, Curson

- *Collective 1* – Curson, Edwards, Sanders, Tippett
- *Piano solo* – Tippett

Thanks to Iain Hodge for technical support

10.1.7.2 Something Jaggy

IZZYSX

Vocals – Izzy Davies

Guitar – Drew Downing

Guitar solo – Rod Fogg

Drums, percussion, keyboards, programming – Justin Paterson

Engineers – Justin Paterson, Rod Fogg

Klezm

Trumpet – Max Wynter

Drums, percussion, keyboards, programming – Justin Paterson

Additional Drums – Mark Sanders

Guitar – Brian Miller, Drew Downing

Bass – Julia Doyle

Prepared Piano – Keith Tippett

Alto Sax – Gary Curson

Vocals – Justin Paterson

Additional Bass – John Edwards

Engineers – Justin Paterson, Paul Borg, Brian Miller

Savage Elevensies

Trumpet – Max Wynter

Drums, percussion, keyboards, programming – Justin Paterson

Bass – Julia Doyle

Violin – Tracey Renwick

Engineers – Justin Paterson, Brian Miller

Lord of the Ring

Trumpet – Max Wynter

Drums, percussion, keyboards, programming – Justin Paterson

Guitar – Drew Downing, Martin Glover

Manipulated Vocals – The London College of Music Choir, arranged and conducted by Marie Tansley-Scales

Additional Vocals – Justin Paterson

Guitar solo – Mo Nazam, Brian Miller

Arco Bass – Roberto Bellatella

Additional Keyboards – Drew Downing

Engineers – Justin Paterson, Drew Downing, Marie Tansley-Scales, Brian Miller

Election Day

Trumpet – Max Wynter

Drums, percussion, keyboards, programming – Justin Paterson

Guitar – Brian Miller

Prepared Guitar – Rod Fogg

Engineers – Justin Paterson, Brian Miller

Anathemaofanenema

Trumpet – Max Wynter

Percussion, keyboards, programming – Justin Paterson

Arco Bass – Roberto Bellatella

Vocals – Justin Paterson

Prepared Piano – Keith Tippett

Additional Bass – John Edwards

Soprano Sax – Jed

Guitar – Drew Downing

Engineers – Justin Paterson, Brian Miller, Paul Borg

My Requiem

Trumpet – Max Wynter

Violin – Joe Townsend

Percussion, keyboards, programming – Justin Paterson

Bass – Roberto Bellatella

Prepared Piano – Keith Tippett

Engineers – Justin Paterson, Darren Jennings, Paul Borg

All tracks composed, arranged, produced and mixed by Justin Paterson, except:

Lord of the Ring – composed by Justin Paterson and Drew Downing.

Mastered by Bryan Martin at Sonosphere and Justin Paterson

Thanks go to Russ Hepworth-Sawyer at Motto-Sound for post production thoughts, and Andy East for legal advice.

My Requiem inspired by: “UK Credit Crunch 2008: The sound of the stock market crashing” by Paul Ramshaw

10.1.8 Vignette: *Election Day* timeline

One further aspect that might be worth highlighting concerns the tune Election Day, which was originally composed on the 1st May 1997 using only a non-velocity-sensitive MIDI keyboard, a Simmons SDS5 analogue drum kit triggering MIDI through an Alesis D4, an Akai sampler recording short bursts of audio and an Atari 1040STE computer running Cubase 2.0. Extensive MIDI editing was implemented via mouse to add expressivity. Two years later, the track was recreated on Macintosh Power PC, now with Cubase VST that could record audio parts, and a number of available hardware synth modules. One year later, a more powerful PC-based system became available again with Cubase VST and the software sampler Halion, which was capable of recreating the original sounds. The MIDI files were transferrable, but the sampler instruments had to be reconstructed by recording the root notes as audio and building from scratch. Cubase SX 2 later became available in 2004, and featured a better sounding audio engine and Time Warping, which allowed the audio recordings to be more easily tightened, and so the tune was moved to this system, and such processes applied, yet it remained unfinished. The postulant decided to recreate it for submission in this DMus in 2009, and so it was then transferred to Logic via OMF on a Mac Powerbook, although the MIDI files now had to be reconstructed, as did the sampler instruments. In subsequent years, there were three attempts to mix it in different studios, although all were unsatisfactory for different reasons, and the mix submitted was performed ‘in the box’ in 2015 as remedial action.

Purely through tradition and whether the track was currently in active evolution or not, it was ritualistically developed (even in a very small way) on

every Election Day, local or general until the 7th May 2015. On this date, since the track was already complete, the earliest rough mixes were reviewed for this submission.

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