A PHENOMENOLOGICAL CASE STUDY OF COMPUTER-BASED MUSICAL CREATIVITIES

JONNY SWAILES

A thesis submitted to the University of Huddersfield in partial fulfillment of the requirements for the degree of Music (MA by Research)

The University of Huddersfield

September 2018

Abstract

This thesis offers a phenomenologically framed exploration of "computer-mediated" (Duignan, 2010) musical "creativities" (Burnard, 2012) and draws upon established creativity models to inform the development of a creativity framework that speaks specifically to the domain of computer-mediated musical practice. It is important to understand that the framework itself is not the focus of this thesis; rather, the aim of this thesis is to disclose transparently a method for developing a personalised understanding of my computer-mediated musical creativities as a template for other practitioners.

Drawing from contemporary literature on creativity from a sociocultural perspective (Amabile, 1996), this study implements a phenomenological (Van Mannen, 2007) approach in order to capture a detailed impression of how my creativity is informed by concrete (computers, technology) and conceptual (socio-cultural background, cognitive processes) contextual resources. More specifically, this research focuses on "little c" (Craft, 2000) creativity, the skills possessed by all individuals as evidenced in learning and development literature (Craft, 2000; Arvaja, 2007; Burnard & Younker, 2010).

This thesis offers a longitudinal case study of the sociological contexts of computer-mediated music creativities by focusing on myself as a subject for this work. Various types of data collection were collected, including: comprehensive written protocol (note-taking), audio excerpts of deconstructed musical materials; and audiovisual screen-capture of real-time creative practices. The creativity stages outlined by Sawyer in Explaining Creativity (2012) and Zig Zag (2013) were used as data sets for template analysis (King, 1998). Data that met these criteria were analysed and represented through structural mapping and analysis of the musical product, methods drawn from Collins (2005).

The findings demonstrate that the chronology and direction of my creative focus between stages is intuitive and context dependent. It was also found that the influence of concrete and conceptual resources can be observed and understood through metacognitive investigation. This guided the development of a framework for the understanding of my computer-mediated musical creativity. This thesis encourages digitally informed musicians to think critically about their own creativity and guides the exploration of sociocultural context as a mediating resource and inspiration.

Contents

Word count: 24,781

1. Introduction

Identifying the Gap

With the growing application of DAWs and other computer-based tools in computer based music production, it could be argued that contemporary tertiary and postgraduate music technology students are most often engaged in recording and production practices with use of the DAW. This study acknowledges literature that explores how technology mediates music composition practice and process amongst established musicians (Eaglestone et al, 2002; Collins, 2005; Clarke et al, 2015) and in an educational setting (Folkestad & Nilsson, 2005; Burnard, 2007; Kirkman, 2010; Jennings, 2005), but posits that there is gap in the evaluation and guidance of creative processes amongst a specific demographic: aspiring composers and producers at tertiary level who are increasingly introduced to music technology through the DAW. Drawing from general creativity models (including Csikszentmihalyi, 1996; Sawyer, 2013; DeBono, 1970) and those catering specifically towards music (Burnard, 2012; Collins, 2005), this thesis details the development of a sociologically informed digital audio creative process framework for my computer-mediated musical creativity. The methods used to develop this framework are explored throughout this thesis and are a template for practitioners within this domain who wish to engage in a self-evaluation of their own personal computer-mediated musical practices.

This thesis also intends to fill gaps left in the research of musical creativity. Pamela Burnard's *Musical Creativities in Practice*, an evaluation of general creativity research (Sawyer, 2012; Amabile, 1996; Gardner, 1993), highlights a lack of research tailored specifically to creativity in music. Burnard argues that a lack of domain-specificity in previous work has led to an incomplete understanding of the subject, and has failed to "address musical creativity with the clarity and relevance that might attract the music specialist, music researcher, composer, songwriter, sound producer, and music educator" (2012, p.4). So, rather than addressing creativity as a singular concept, this thesis is guided by Burnard's concept of "multiple

musical creativities"; a suggestion that musical creativities are task-specific and vary depending on circumstance and practice.

Framework Design

To develop an appropriate framework for the self-evaluation of personal creativities in computer-mediated musical creativity, it is important to determine specifically the situated creativities of this practice. Drawing from creativity models presented in previous research (Csikszentmihalyi, 1996, p.79; Sawyer, 2013, p. 14; Burnard, 2012, p. 230), this research proposes a creativity framework for the specific creativities of computer-mediated music practices.

Previous creativity guides have presented a navigational framework of creativity (Sawyer, 2013; DeBono, 1970), guiding readers through a series of steps; others offer cues that encourage metacognitive thinking, open-mindedness and exploration (Eno & Schmidt, 1975), and others map out the different "creativities" involved within specific realms of music practice (Burnard, 2012). This particular study acknowledges and draws upon these methods of exploring creativity, but puts forward that creativity is personal to the individual and to the specific task. It is further argued in this research that a suitable creativity framework should reflect this. The contribution of this study is to demonstrate a method that enables digitally informed musicians of undergraduate and postgraduate graduate level to develop a metacognitive framework for themselves, in order to explore their own creative practices.

Methodological Aims

The methodology developed by this thesis facilitates the observation of creativity and authorship within a "sociocultural context" as framed by Amabile (1996) and Wolff (1993) and examines how each step in the creative path shapes the subsequent emergence of the resultant musical artifact and its position within the body of work. Where other studies have sought to observe or improve the way technology is used creatively amongst digitally informed musicians (Eaglestone et al, 2002; Clarke, 2015), this thesis adopts a "phenomenological" (Van Mannen, 2007, p. 12) approach in

order to prioritise the in-depth self-exploration of the cognitive and practical creative processes moment-by-moment and over time in my own creative work. This thesis aims to provide a comprehensive case study using myself as the subject for the study, allowing rich insight into how my particular strain of creativity is framed by my specific sociological background and the concrete tools available to me.

Implications

The framework developed in tandem with this thesis will allow me to cultivate my creativity in regards to computer-mediated music practice. Additionally, the intent is for other practitioners of computer-mediated music to approach this thesis as a template, from which they adopt methods in mapping their own computer-mediated musical creativities in a metacognitive investigation. The ontology of this thesis is designed to encourage critical thinking about ones own creativity and encourages the exploration of ones sociocultural background and environment as an inspiration; in the process developing insight and outlook through metacognitive thinking. In developing a framework for this purpose, this work addresses the "universal" (Sawyer, 2013) nature of creativity. Each individual has idiosyncratic creative tendencies and processes and as such, the methods for designing the framework have been created as a flexible resource adaptable to the personalised creative behaviours of each individual who wishes to do something similar.

2. Literature Review

2.1 Introduction

To understand the situated creativities of computer-mediated music practices, it is important to address what is currently implied when we talk about the concept of creativity and what is currently understood about computer-mediated music practice. The cornerstones of theoretical work that ground this research encompass creativity research, creativity in music, musical Human-Computer Interaction (HCI) the influence of the Graphic User Interface (GUI) on creativity, and the influence of imagination and the

"semantic gap" (Eaglestone, 2002) on computer-mediated musical creativity.

Creativity

This thesis draws on the theoretical foundations of creativity with the intended outcome of arriving at a suitable method of researching the creativity of computer-mediated musical practice and its relationship with sociocultural context. In respect of creativity, this study draws on Burnard's modelling of "multiple musical creativities" (2012), which in turn draws from a sociological view of creativity and authorship (Amabile, 1995; Wolf, 1993). Developing a suitable digital audio creativity framework requires investigation of the creative process, which is examined from both a concrete (technological, environmental) and conceptual (cognitive, social, cultural) perspective. To do this, the research draws on creative process models ranging from concrete, problem-solving based frameworks proposed by (Osborn, 1963; DeBono, 1970), to models informed by a more flexible, sociocultural framing of creativity (Sawyer, 2013. p. 14; Burnard, 2012. p. 23; Craft et al, 2006). Sawyer offers a comprehensive consolidation and critique of various branches of creativity research (2006, 2009, 2012, 2013) and a succinct account of its development from an overlooked area of scientific research in the 50s and 60s to current studies conducted from various disciplinary backgrounds.

Computer-Mediated Musical Creativities

For an understanding of computer-mediated music practice, this work refers to studies that observed the creative process and documented findings on the relationship between human and computer in a creative context. The findings of several studies (Collins, 2005; Eaglestone, 2002; Duignan et al, 2010; Clarke et al, 2015; Keller et al, 2014; Gelineck & Serafin, 2012; Folkestad, 1997; Dobson et al, 2011; Dobson & Littleton, 2015; Seddon & O'Neil, 2003) are explored as examples of research that has aimed explicitly to understand how the circumstances, behaviours, tools and context surrounding computer-mediated music practice can shape the creative exchange. These studies help to support the original aim of this thesis, which is to detail the development of a framework for my computer-mediated music practice as a template for other composers and producers wish to

better understand and expand their own creativity in computer-mediated music practise.

2.2 Creativity

Creativity is one of the core concepts of this thesis and arguably the most difficult to define, it is therefore important to establish what creativity means in the context of this work. Through mapping selected fields of creativity, this work summarises how creativity is understood within the context of research design and analysis, and for theoretical contributions to computer-mediated music practices.

In his comprehensive breakdown of its history, Sawyer details three "waves" of creativity research (2012). Following an examination of concepts surrounding individual creativity, this section of literature covers "second-wave" research of the cognitive creative process, and the contextual framing of creativity provided by "third-wave" research.

The Myth of the Creative Genius

In contemporary studies, much research has moved from the idea that creativity is only available to those of "genius" status. Instead, it is now accepted by most research that creativity is not an intrinsic individual ability, but a universally attainable one. Work by K. Anders Ericsson has explained "expert performance as the end result of individuals' prolonged efforts to improve performance while negotiating motivational and external constraints […] Many characteristics once believed to reflect innate talent are actually the result of intense practice extended for a minimum of 10 years" (1993, p. 363). Along a similar line of thought, Malcolm Gladwell book *Outliers* (2008) frequently refers to the '10,000-Hour Rule' which argues that it is the level of time spent with a subject that will give someone mastery over it, as opposed to any perceivably innate ability. Quoting neurologist Daniel Levitin, Gladwell claims that "ten thousand hours of practice is required to achieve the level of mastery associated with being a world-class expert." (2008, p.4).

Sawyer overviews creativity theories in *Explaining Creativity* (2012) and in

Zig Zag (2013) they are presented as a creativity toolkit: 'blocks' offered as steps that can be navigated in order to be and become more creative. "That creative power you find so breathtaking, when you see it tapped by others, lives just as surely within you. You only have to take out those blocks and start playing with them." (2013, p. 1). Drawing from Sawyer's "blocks", this thesis approaches creativity as a universal capacity that can be accessed and influenced by circumstance and technology. This thesis adopts Amabile (1996) and Sawyer's (2012) sociocultural lens to explore the inter-relationship between concrete and conceptual resources within the creative process, and attempts to locate and understand instances of creativity involved within the specific context of computer-mediated musical practice.

The Creative Process

Musical activity is a cognitive process shaped by practices so in understanding musical activity, it is therefore helpful that research of computer-mediated music practice draws upon research that explores cognition in the creative process. Acknowledging current process-based conceptions of creativity is additionally helpful in detailing the development of a new framework designed specifically for computer-mediated musical creativity.

Anecdotal observations of creativity often describe a "eureka" moment; an instantaneous, unconscious event, difficult to describe or define. In creativity research, this arrival at the perfect solution or idea has been termed "the moment of insight" (Sternberg & Davidson, 1995). Drawing on his extensive research of creativity, Sawyer refutes the Western cultural notion of creativity, where insights emerge mysteriously from the unconscious mind. In Zig Zag, Sawyer explains; "No matter what kind of creativity I studied, the process was the same. Creativity did not descend like a bolt of lightning that lit up the world in a single, brilliant flash. It came in tiny steps, bits of insight, and incremental changes." (2013, p. 1). In order to understand which creativities contribute to my own computer-mediated music practice, the process that leads to this "moment of insight" must be addressed and mapped out in consideration of each of these "incremental changes".

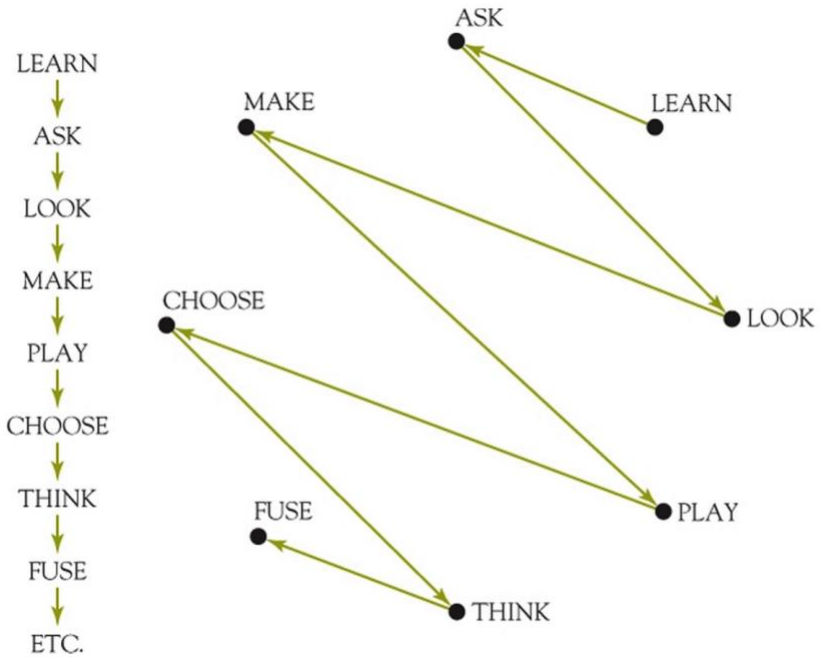
Building on Guilford's concepts of divergent and convergent thinking (1957), research in the 1960s and 70s began to examine creativity and originality by testing subjects on their divergent and convergent thinking abilities. The practical value of these tests is admittedly still under review (Kim, 2002), but they were responsible for capturing and somewhat clarifying the creative act of the individual. In accompaniment of one standardised test, Torrance (1974) defines creativity as "a process of becoming sensitive to problems, deficiencies, gaps in knowledge, missing elements, disharmonies, and so on; identifying the difficulty; searching for solutions, making guesses, or formulating hypotheses about the deficiencies: testing and retesting these hypotheses and possibly modifying and retesting them; and finally communicating the results" (p.8). Models of the supposed creative path routed in principles similar to that of Guilford and Torrance present it as a sequential, step-by-step process akin to problem solving. The six-step Osborn-Parnes Creative Problem Solving Model (1963) for example presents the basic steps of creativity as: "objective finding", "fact finding", "problem finding", "ideal finding", "solution finding" and "acceptance finding" (Lately, 2011). Another model proposed by Wallas (1926) predates most creativity research and presents 5 stages of the creative process, including an "illumination" stage akin to Sternberg and Davidson's "moment of insight" (1995). The above examples do not relate directly to music, however Burnard and Younker's study of the compositional process applies these concepts more specifically the domain of computer-based music practice (2010). These models of the stages of individual creativity arguably present a sequential, linear model of the creative process that remains fundamentally the same regardless of context.

A recurrent criticism of models based on problem solving is that most often in creativity, the problem is either ill-defined or non-existent, in some cases even imagined or brought into fruition by the creator. According to Sawyer for example, "creativity researchers have discovered that exceptional creativity more often results when people work in areas where problems are not specified in advance, where a big part of success is being able to formulate a good question." (2012, p. 91) As a result, many creativity researchers now believe that "creativity involves problem finding as well as

problem solving". (2012, p. 91). Expanding on this, Mayer defines creativity as "producing a novel method of solving a new problem" (1989, p. 203). Drawing from earlier critique on the standardised identification of creativity, my study anticipates difficulty in definitively categorising musical creativity and the creative processes that inform its practice.

Sawyer expands on the idea of the creative path as a series of static, problem-solving steps, introducing the idea of creativity as something that can happen in a more fluid, non-linear way; through retracing ones steps, going back and forth between different stages of the creative path and experimenting without aim or direction. These processes may happen decisively, unconsciously or somewhere in between. According to Sawyer, "You have to follow the zigs and zags. You might not be focused on the right problem because you haven't asked the right question. You might not have the information you need because you haven't learned enough. You might not have explored the spaces and alternatives through the play that generates ideas" (2013, p.6). A model of computer-mediated musical creativity may wish to capture this fluidity in accordance with areas of creative theory.

Fig 1. Sawyer's Zig Zag Model of the Creative Process (2013, p.6)



To summarise, this research focuses on creative processes moment-by-moment and considers how each step in the path contributes to the overall practice. In order to produce a comprehensive, framework specifically for personal musical creativity in computer-mediated music practice, this study addresses past research of the cognitive processes behind creativity. Considering the function of this thesis as a patronal tool for others to follow in the development of their own personal framework, it is important that it acknowledges the variance of cognitive behavior between different people.

Creativity in Context

It should be noted that while concrete and conceptual practices are relevant in defining musical creativity, the creative act should not be abstracted from context. It is therefore important that creativity in the context of this work is presented within a sociocultural frame. According to Amabile, "the main focus of interest is not on introspections about thinking processes […] Rather, the main focus is on the creative persons' reports of social factors that impinged on them and the apparent stimulation or inhibition of their work that followed." (1996, p. 6). Creative research conducted from a perspective that acknowledges the context and domain in which creativity emerges has been termed by Sawyer as "third-wave" research, emerging as a complementary response to the cognitive-based "second-wave" research of the 1970s and 1980s (Sawyer, 2012). To better understand the creative process, this study draws upon "third-wave" creativity research and attempts to anticipate and highlight areas of the creative process in computer-mediated music practice that are influenced by external factors.

Applying Csikszentmihalyi's Systems Model of Creativity (1996) more directly to computer-mediated creativity, Arvaja's analysis of how students discuss a creative task high0lights three contexts; immediate or perceptual context, which describes the available concrete resources, the local context: the collaborative group involved in her study; and sociocultural context: the wider social and cultural events happening outside the collaboration (Arvaja, 2007). Arvaja's model summarises how concrete and conceptual tools collaborate in the mediation of creativity.

The growing influence of concrete tools and how they respond to human interaction within computer-mediated music practice has been documented previously. Blake for example asserts that the creative process in music specifically "has in many cases been displaced from the body to the machine" (2007, p. 67). With the growing application of DAWs and digital technologies in the mediation of music composition and production, this is an important factor that must be acknowledged by this thesis. Arvaja expands on the notion of physical tools as a creative influence, stating: "physical tools are not entirely distinct from psychological tools, because concepts are embodied in physical tools and they make physical tools meaningful for people" (2007, p. 134). Applying this to computer-mediated music practice, it can be concluded that creative practitioners within this domain store knowledge and experience within concrete and conceptual tools alike.

This point of view has been reflected specifically in research of musical creativity; according to Burnard for example; "music arises not simply from individual composers' minds, but in constructions that reflect the tastes and fashions of social groups, social relations, and communities sharing common perspectives." (2012, p. 226). Burnard's argument is supported by Keller, who further points out that alongside the influence of sociocultural context and community, musical creativity is fostered in everyday phenomena and experience, explaining: "A common denominator of embedded-embodied musical creative practices is the close integration of sound processes shaped after natural phenomena with perceptual and/or social factors wrought by everyday experience" (2014, p. 3). A large body of sociocultural research on creativity in music looks specifically at the interaction and discourse of these social groups, relations, communities and personal experience and phenomena. These studies attempt to unlock the role of social and ideological context through documentation of communication between creative collaborators (Dobson & Littleton, 2015; Seddon & O'Neill, 2003). In studies of individual creativity where direct communication during the creative act is absent, records of "inner dialogue" (Wall, 2006) or retrospective explanations (Collins, 2005) and interviews (Eaglestone, 2002) are collected.

Drawing upon these mappings of creativity and authorship, it is important to consider the influence of contextual resources (both concrete and conceptual) on the creative act within computer-mediated musical practice and attempt to define the degree of authorship owed to the computer and to socio-cultural context. This research must ask how creative artifacts are identified and valued, but especially how they are influenced by circumstance, knowledge, personal experience and other sociocultural contexts.

2.3 Computer-Mediated Musical Creativities

In order to successfully examine the "creativities" involved in computer-mediated music practice, it is fundamentally important for this thesis to map out the current research of creativity in human-computer interaction with a specific focus towards the creative exchange of computer-mediated music practice. This section looks at: the field of computer mediated-music practice, human-computer interaction and the computer as a creative partner in computer-mediated music practice. Creative processes away from the computer; and the "semantic gap" (Eaglestone, 2002, p. 31) between mind and software and its influence on computer-mediated musical creativity are also discussed.

Computer-Mediated Music Processes

A wide range of literature explores the various concrete and conceptual processes that accompany the fields of computer-mediated music composition and production. Many practise studies have involved an in-depth mapping of the creative musical processes of individuals (Collins, 2005; Eaglestone, 2002; Gelineck & Serafin, 2012; Folkestad, 1997) and/or groups (Keller; 2014; Seddon & O'Neill, 2003). As a qualitative, long-term study of computer-mediated music process, it is important to address other studies within the same field exploring similar questions and aims.

Previous studies of computer-mediated musical practice have prioritised the observation of concrete creative processes. One such study, by Jennings, explored whether software would enable a child subject to "engage in certain musical processes commonly associated with adult or professional

composers" (p. 1). Jennings approached this research from a concrete perspective, through identifying which "features of the interface" (p. 1) were particularly useful and noting various concrete musical techniques employed by the subject such as "repetition and variation of both melodic units and musical textures" and manipulation of "timbre and dynamics" (p. 13). Jennings concluded that the software had been a vehicle for the subject "to explore musical ideas and concepts which might otherwise have been beyond his reach" (p. 13). Jennings's work demonstrates prioritisation of technological analysis and considers how concrete tools function as a facilitator of computer-mediated musical creativity.

Another study, conducted by Folkestad (1997), involved a three-year examination of 129 computer-based compositions made by 15 to 16 year olds with the aim of identifying and defining different compositional strategies. Two strategies were found through the study and were categorised as "horizontal" and "vertical". Folkestad's study defined "horizontal" methods as the completion of basic overall structure of the composition before expanding the arrangement and instrumentation with use of the computer. "Vertical" composition subsequently took the approach of fully composing, expanding and arranging each section before moving onto the next, which allowed sections to be copied for repetition where appropriate. Folkestad's research exemplifies studies that attempt to understand musical creativity by prioritising the concrete actions taken by music composers and producers, for example how they use the technology and instruments available to them to layer and structure a piece of music. However, the finding that different subjects composed through the two distinct methods identified by the study, despite being given the same tools and technology, points to the relevance of conceptual process as another factor in computer-mediated music practice.

In acknowledgement of factors outside concrete process, multiple studies have explored the importance of sociocultural theory in the foundation of creative musical behaviour and have highlighted the interest in the analysis of music process within this framing. For example, Collins' (2005) study involved following a composer's creative processes over three years. This

allowed the development of a socio-ideologically framed model of the compositional process described by Collins as "richly context-driven solution spaces" as opposed to "problem spaces" (2005, p. 208). Further recognition of the importance of sociocultural context in computer-mediated music practice emerged in an analysis of two composers working in collaboration published by Dobson and Littleton (2015). In the study, composition and production of music is recognised as a "computer-mediated process […] formed through inter-relationships with a composers' historical, social, cultural, physical and conceptual environments." (Dobson & Littleton, 2015, p. 333). In a further exploration of how background mediates creativity, Jason Chi Wai Chen's mapping of compositional strategies sought to understand "how individual students from different backgrounds encounter computer-assisted composition" (Chen, 2012, p.1). The study revealed "different approaches to composing" through analysing the activities of student composers. From this data, Dr Chen presented a series of models that reflect the various compositional techniques and how they relate to sociocultural background and music education.

What this body of work demonstrates is that in research involving computer-mediated music practice, it that technology greatly contributes towards and facilitates creativity, but should not be divorced from conceptual processes. For this reason, the framework developed by this paper views computer-mediated musical creativities from both technological and sociocultural perspectives and explores the relationship of these resources to the cognitive processes behind idea generation and creative thinking. Firstly, this thesis takes a closer look at how concrete processes shape computer-mediated music practice through introducing literature on Human-Computer-Interaction in music technology.

Human-Computer Interaction in Music Technology

Human Computer-Interaction (Card et al, 1983) characterises the use of computer technology, specifically the interface and relationship between users and computers. As a topic of research, it is highly relevant due to the growing importance of computer systems and the Digital Audio Workstation (DAW) in the current climate of music technology. According to SIG

NIME: Music, Technology and Human-Computer Interaction, "advances in digital audio technologies have led to a situation where computers play a significant role in most music production and performance" (Bevilacqua, 2013, p. 2529). Much HCI research aims to propose methods of improving the technological tools involved in computer-mediated music practice, in order to better accommodate user creativity (Bevilacqua, 2013; Duignan, 2010; Eaglestone, 2002). According to Duignan, "human computer interaction (HCI) research has a unique challenge in understanding the activities of professional music producers and in designing DAW user interfaces to support this work." (Duignan et al, 2010, p. 22). "Machine analysis" (Universitat Pompeu Fabra, 2018) has been the primary research aim of studies, often as an examination of technological practices (Clarke et al, 2015) or a suggestion of improvements to the tools of music technology (Duignan, 2010; Eaglestone, 2002).

The 'Requirements Specification for a Composition Tools System' proposed by Eaglestone et al (2002), worked towards "defining a set of requirements for enhanced support for electroacoustic music composers." (p. 2). In Eaglestone's report, the importance of an interface in shaping creativity was reviewed in great detail, and the data gathered was used to propose what improvements could be made to music technologies in order to better stimulate and accommodate creative activity. The report features substantial "machine analysis", exploring the technical processes utilised by the composers in creating material. Equal attention is given to the influence of sociocultural and cognitive resources on the creativity of computer-mediated music composition. The report explores among other factors; "the impact of the visual senses"; the value of diversity in creative methods; and "know-how" as a "resource of the creative artist" (Eaglestone, 2002, p. 35). By framing creativity via the perspective of sociocultural contexts and cognitive processes, Eaglestone's paper produces a comprehensive model of how creativity functions in the specific domain of computer-mediated music composition. He explains: "composition emerges as a process which relies considerably on divergent thought processes, and hence serendipity and randomness are valued. Convergent thought processes are also involved, but these are secondary to the divergent processes, since their role is to elaborate

and refine those creative notions that are the result of inspirational (divergent) thought." The report also concluded, in contrast to motivation for the bulk of "machine analysis" studies of musical human-computer interaction, that there was "no indication that composers need more and new signal processing techniques", instead finding a "high demand for increased knowledge exchange". These findings highlight the importance of sociocultural know-how and background in the stimulation of computer-mediated musical creativity.

In summary, this paper draws on the similar research aims of previous literature (Eaglestone, 2002) in order to propose potential methods of better enabling creativity in musical human-computer interaction. While the reports of these previous studies focus primarily on the creative activities of professional and/or academic composers and producers, the intended demographic for this paper is that of digitally informed musicians of undergraduate and postgraduate graduate level. Furthermore, rather than offer a "machine analysis" study, this research attempts to explore and map out human computer-mediated music practice from a phenomenological perspective as a template for those who wish to better understand and improve their own studio-based creative musical practises. Through detailing in transparency the development of a digital audio framework, this thesis aims to provide users with a method of gaining "know-how" of their personal pool of creative resources and aims to provide a guide as to how these tools can be accessed and optimised.

Computer as a Creative Agent

The influence of technology on creativity is important in the context of this thesis and has been examined in various studies. Human-computer relationship is not a simple one-dimensional interaction, but a dialogue (Suchman, 1987). As Keane argues "the piano, manuscript paper or counterpoint are embodiments of, and stimuli for, profound thinking - and this applies equally to the computer, the synthesizer or the tape recorder." (1986, p. 116). From this perspective, one interesting aspect of computer-mediated music practise is the extent to which authorship is owed to the computer. As Keane points out, defining the point at which human and

computer authorship intersect is difficult, "whether we are considering a hammer or a computer, we see in the tool the embodiment of the *conception* of the task; and yet the very conception of the task is both illuminated and obscured by the nature of the tool." (1986, p. 116). Drawing on prior research of human-computer collaboration as a component of musical creativity, this thesis explores how the computer, and in some cases specifically a DAW, influences creativity in computer-mediated music practice.

In "Abstraction and Activity in Computer-Mediated Music Production" (Duignan et al, 2010), Duignan found that the majority of creative work was being held within the framework of DAW systems in an abstract representational form, and that the participant's ability to manipulate that representation was "entirely mediated by and dependent on the mechanisms provided by these tools". (Duignan, p. 23). Furthermore, Feldman's metaphor of the "composerly hand" (cited in Friedman, 2000) summarises a general trend toward reliance on "extra-musical processes (computational tools, environmental sounds, extra-musical media, audience participation" (Keller, 2014, p.1), implying that musical creative processes can no longer be thought as isolated cognitive work.

In order to develop a framework for understanding my computer-mediated music creativities, it is important to identify how the computer collaborates in the generation of ideas and creative processes. Drawing from the literature highlighted in the above chapter, it can be concluded that a study of computer-mediated musical creativity must have a deep routing in how technology is used and how it can influence the creative process.

Digital Audio Workstations (DAWs), Graphical User Interfaces (GUI) and the influence of visual stimuli on computer-mediated music practice

Having covered Human-Computer-Interaction broadly, this part of the literature review focuses more specifically on two aspects of computer-based music practice that are relevant to this thesis: the DAW and the GUI. Visual tools and aids such as EQ graphs, waveforms and audio meters are examples of GUI often implemented in music technology devices which feature as a

manner of providing users with information that would not be accessible without visual representation. With the growth of digital plug-ins and DAWs, the GUI has become an increasingly important aspect of computer-mediated music practice. As a fundamental aspect of DAWs, understanding how the GUI and visual tools contribute towards computer-based music practice is an important part of this thesis and a way of understanding how computer-based music creativity is changing as the DAW becomes increasingly central to music technology.

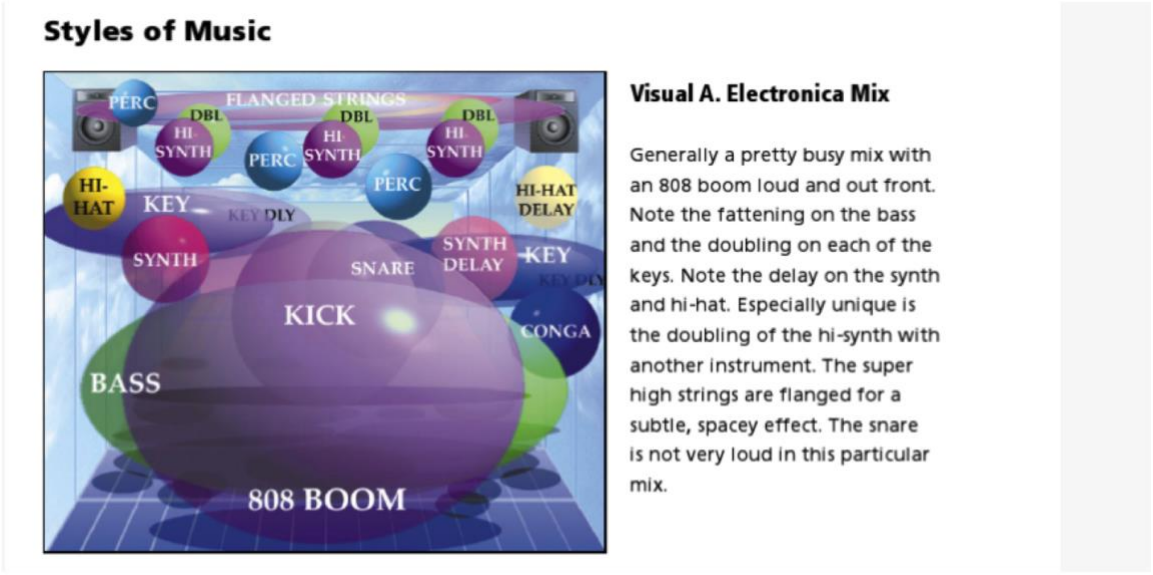
In a study I conducted as an undergraduate, I found that amongst novice music producers mixing "in the box" using a DAW, visual tools and techniques play a vital role in their understanding of how sonic material is behaving, as a representation of complex audio concepts (see Appendix). Eaglestone, who explains that visualisations are a dominant factor in the creativity of computer-mediated music practice, further supports this argument. According to Eaglestone: "A key interface issue is the importance and impact, both positive and negative, of the visualization of sounds." (2002, p. 44). To ask exactly how the graphic interfaces of DAWs shape musical creativity, this study firstly explores potential explanations behind the influence of GUIs in modern music technology.

The influence of GUIs in modern music technology can be linked to the intrinsic, cognitive relationship between human hearing and sight. According to Ladan Shams, our visual and auditory senses work in tandem; "hearing and sight are deeply intertwined, to the degree that even when sound is completely irrelevant to the task, it still influences the way we see the world" (Menon & Wolpert, 2011) and this visual-spatial relationship with sound has been noted in creative research. In order for this thesis to scrutinise computer-mediated musical creativities, it is important to investigate whether this phenomenon extends to music production and DAWs.

Throughout the history of audio production, especially prior to a reliance on visual tools, professional music producers and mix engineers have used visual metaphors to express the localisation of sounds in relation to other sounds or the individual themselves; in front, behind, above and below for

example. The Art of Mixing (Gibson, 2005 p. 28) for example features several diagrams representing spatialisation, identified as 'Visual Representations of Imaging' (see Fig 2). In some cases, discussions of sound using visual metaphors may also extend to the implication of trajectory, colour and texture. For example, Michael Stavrou's "Mixing With Your Mind", relies heavily on visual metaphors to organise and explain relationships between sounds in lieu of simply describing the sounds themselves (Stavrou, 2003). On the point of visualisation in musical practice, Eaglestone's study suggests that in some instances, "composers are often led more by visual cues than by auditory ones." (2002, p. 31). It could be anticipated that the use of visualization as a key tool in the separation and creative cataloguing of sounds and layers within a mix raises implications for research interested in exploring creativity in the studio.

Fig. 2 Spatialisation representation (Gibson, 2005, p.28)



In exploring the influence of technological resources on creativity, this thesis analyses emergent data that highlights how the interface contributes towards my practice. The aim of this is to investigate the extent to which visual tools impact on creativity. In consideration of the relationship between sight and the perception of sound, it is important that research investigating visual stimuli as an influence on computer-mediated musical creativities looks past the obvious use of visual feedback as a tool and prioritises analysis of ways

in which various visual tools might be shaping auditory perception. In detailing the development of a framework for other composers to adapt to their own practices, it is useful to ask how composers can be conscious of how visual tools influence their musical practices. This thesis asks whether, as suggested by Eaglestone (2002), there can be negative implications to relying so heavily on visual tools in certain tasks of musical creativity.

Imagination in Computer-Mediated Music Practice

A successful response to the central aim of this paper involves an understanding of how instances of computer-mediated musical creativity are influenced in absence of technology, where the creative processes taking place are purely cognitive and may include sonic imagination and the semantic gap. Arguably, the mental work behind computer-mediated music practice is equally as important as the influence of technology and it is therefore important for this research to analyse creativity in respect to the cognitive work that takes place in absence and in use of technology. Izhaki proposes that "it is not equipment, time spent or magic tricks that made these two mixes so dissimilar it is simply the different sonic visions of Vig and Wallace" in discussion of Butch Vig and Andy Wallace's alternate mixes of 'Smells Like Teen Spirit', (2013. p. 6). Izhaki's point corresponds to the contemporary view of creativity as an act to be viewed within sociocultural context, through reflection on how and why an individual or group arrived at the ideas behind their creativity.

Eaglestone's study observed a variety of creative activity happening in absence of technology, a lot of which occurred as composers took breaks from the computer (2002). His paper recorded amongst others, a composer who "made lists of tasks they were to perform on the computer" (2002, p. 32), and another who "regularly spends a day listening to his pool of sounds" (2002, p. 32) in order to make note of their potential relationship in the formation of a new piece. The imagining of hypothetical interactions with technology as observed in Eaglestone's research arguably exemplifies Craft's concept of "possibility thinking" (2007, p. 1) defined as "the means by which questions are posed or puzzles surfaced – through multiple ways of generating the question 'what if?'" In this setting, imagination is used both

as a resource which shapes immediate activities with or without technology but also includes the imagined, future use of technology.

To better understand how imaginative processes shape our perception of sound and music, the research considers the concept of "auditory imagery" as presented by Reisberg (2014) and Lacey and Lawson (2013). "Auditory imagery" is a term used to describe sounds imagined in the "mind's ear" (Adolphe, 2013). This can refer to anything from the creation of sounds we have imagined from scratch to an imagined manipulation of an existing mix or sound environment. The study asks how I use technology to represent the tonality, timbres and textures of these "auditory images" (Reisberg, 2014; Lacey & Lawson; 2013), and what problems are encountered in attempting to do so.

From the highlighted body of work, it can be concluded that imagination driven processes are an important resource in the creativity of computer-mediated music practice. The use of note taking to represent ideas in favour of using compositional software found in Eaglestone's observations (2002) arguably highlights the importance of imagination driven processes and the cataloguing of creative musical ideas in the absence of technology. In order to develop an appropriate creativity framework for computer-mediated musical practice, it is important to explore the influence of imagination-driven creative processes away from the computer. The thesis asks how imagination driven-processes can be driven by technology (Eaglestone; 2002) and how they can be influenced by sociocultural background (Izhaki, 2013).

The Semantic Gap between Mind and Software

One interesting complexity of computer-mediated music practice is that it relies on technology in order to bring "auditory imagery" into fruition. In the process of realising "auditory imagery", for example through the recording or performance of an imagined melody on an instrument or computer, it is common for some element of the musical idea as it appeared in the "mind's ear" to be essentially lost in translation. This was observed in studies conducted by Eaglestone (2002), who refers to the problem as the "semantic

gap" "between conceptualisation (in the mind) and realisation (in the software)" (p. 31). In other words, "the semantic gap" is a term used to describe the difficulty in bringing sounds we have imagined into reality.

In his research on the influence of technology in how ideas are translated from the "mind's ear" into realisation, Eaglestone's findings "contradicted the notion that the semantic gap between conceptualisation and realisation may be a major impediment to creativity" (2002, p.14), concluding that many instances of creativity are born from the limited ability of software to accurately recreate sonic ideas.

In understanding the influence of the technological resources on computer-mediated music practice, I attempt to explore how my own creative ideas evolve while attempting to bridge the semantic gap and how they are influenced by the technological resources I am using at the time in order to do this.

This thesis explores how the semantic gap effects the creative exchange of computer-mediated music practice and investigates the areas in which the GUI limits the semantic gap, or alternatively, contributes towards it. Furthermore, I evaluate the ways my experience correspond with Eaglestone's notion that the semantic gap and software limitations can have a positive effect on creativity (2002).

3. Research Aims and Questions

3.1 Research Aims

Drawing on Burnard's theory of creativity as an inter-relationship of multiple "creativities" (2012) rather than a singular concept, this study attempts to understand overlapping creativities and sub-creativities involved in human-computer interaction and searches for patterns and characteristics within my own computer mediated musical creativity in the development of a framework for self-investigation. Drawing from the findings of this research and from models presented in previous creativity work (Burnard, 2012; Csikszentmihalyi, 1996; Sawyer, 2013; Osborn, 1963; De Bono, 1970), the aim of this paper is to detail the development of a framework designed specifically for the understanding of my computer-mediated musical creativities.

In order to develop a framework for the self-evaluation of personal creativities in computer-mediated music practice, it is important for this research to explore what mediates and informs these creativities and the creative processes. This study identifies and maps out each concrete and conceptual step in my own creative process, focusing on the processes moment-by-moment and considering how each step in the path contributes to the creative artifact and its position in context. This offers a deep, data rich resource for personal investigation. The method for developing this framework is detailed with as much transparency as possible and acts as a template for others to follow similar metacognitive investigation of their own computer-mediated musical creativities.

Drawing from the review of literature, the creativities involved in my particular exchange of computer-mediated musical practice are outlined and investigated as to whether they appear in a consistent and linear fashion (Osborn, 1963; Wallas, 1926) or in a more intuitive and lateral fashion (Sawyer, 2013). Considerations are made to the fact that my particular strand of creativity and my creative behaviours may differ to those of others.

The study asks how my creativities are influenced by human-computer collaboration (Lubart, 2005), sociocultural contexts and resources (Amabile, 1996; Wolff, 1993), the "semantic gap" (Eaglestone et al, 2002) and by the imagination-driven practices and "inner dialogue" (Wall, 2006) that happens away from the active creative process and equipment. It asks how these factors can be harnessed and understood in computer-mediated music practice.

3.2 Research Questions

In order to successfully respond to build a suitable framework for the self-evaluation of computer-mediated musical creativities, the data collected from the investigation is analysed and discussed in the context of the following research questions:

1. How do I define the creativities and creative process involved in my personal computer-mediated music practice?
2. What concrete and conceptual resources are involved in the mediation of my computer-based musical creativity?
3. What kind of salient concerns and focus should be afforded to a framework for computer-mediated musical creativities?

4. Methodology

If I were to tell you where my greatest feeling, my universal feeling, the bliss of my earthly existence has been, I would have to confess: It has always, here and there, been in this kind of in-seeing, in the indescribably swift, deep, timeless moments of this divine seeing into the heart of things. (Rilke, 1987)

4.1 Introduction

This chapter details the methods used to collect and analyse the data recorded in this study, for the purpose of answering the research questions. It explains the ontological framing and covers the literature that was drawn from in order to formulate my approach.

This research follows a mixed-method longitudinal process of data collection drawn from "multi-dimensional in-depth long-term case studies (MILCs)" (Schneiderman & Plaisant, 2006, p. 1), with data provided through phenomenological observations (Van Mannen, 2007). The findings of this data are researched through "template analysis" (King, 1998), an approach that anticipates a pattern of results, which in this case of this study are the creative stages as outlined in previous literature (Sawyer, 2012; Sawyer, 2013). Using template analysis offers a template that helps retain analytic focus on key areas of interest.

In capturing the influence of "perceptual and/or social factors wrought by everyday experience" (Keller, 2014, p. 3) and the creative feedback involved in human-computer interaction (Eaglestone, 2002; Blake, 2007; Duignan, 2010; Lubart, 2005), the key methodological issue is the implementation of a methodology that does not disrupt creative "flow" (Csikszentmihalyi, 1996) in a natural setting, while simultaneously allowing for reliable and relevant data collection of computer-mediated musical creativity.

4.2 Ontological Framing and Phenomenological Design

The expanding definitions of creativity led researchers across many disciplines to advocate fundamental change in the way creativity is viewed and researched. The notion of the creative genius has been challenged since the 1950s, with sociocultural-based creativity research pointing towards the existence of creativity outside of traditional, academic definitions. For example, Perleth, Sierwald, and Heller "found differences between students who demonstrated creative/productive as opposed to traditional academic giftedness." (Renzulli & Reis, 2010) and, referring to attempts to produce a standardised assessment akin to an IQ test, Treffinger termed general measures of creativity the "creativity quotient fallacy" (1986, p. 15). By the 1980s, psychologists had given up attempting to research the creative personality (Sawyer, 2006, p.55). In critique of creativity research that emphasises intellectual and academic giftedness, Renzulli and Reis ask; "Is giftedness or creativity a static concept (i.e., you have or you don't have it) or is it a dynamic concept (i.e., it varies within persons, cultures, and among learning/performance situations)?" (2010, p. 326). In order to fully analyse creativity, it must be accepted that it does not develop solely from ones self, but instead evolves from the concrete and conceptual factors involved within and outside of the creative process.

In order to capture a detailed impression of how creativity is informed by context, one method of understanding the conceptual processes involved in creativity is to self-study. According to Van Mannen, who paraphrases Rilke's poem, "The reward phenomenology offers are the moments of seeing-meaning or "in-seeing" into "the heart of things" (2007, p. 12). Self-study allows a deep, situated and qualitative understanding of the sources and contexts of moment-by-moment creativities, including insights around personal motivation, action and response towards meaning. Observing this in individual creative practice can be facilitated through capturing the "inner dialogue" (Wall, 2006, p. 7) that accompanies creative practice. As Van Mannen puts it, "the phenomenologist directs the gaze toward the regions where meaning originates" (p. 13).

A phenomenological approach allows situated data to provide a deep and nuanced understanding of how creativity is mediated by the self, and also how the processes behind creativity link together and influence each other: "A phenomenology of practice aims to open up possibilities for creating formative relations between being and acting, between who we are and how we act, between thoughtfulness and tact" (Van Mannen, 2007, p. 13). This phenomenological approach therefore offers qualitative data, which is necessary in order to record and analyse the creative practices as they happen naturally and over varying periods of time. The methodology prioritises moment-by-moment analysis to observe the generation and development of creative ideas during computer-mediated music practices as it happens naturally.

A study of the self is inherently messy; as Van Mannen explains, "the practicality of a phenomenology of practice should not be sought in instrumental action, efficiency or technical efficacy" (p. 13). However, a philosophical ontology does have a practical value. In support of auto-ethnography, a similar research method to phenomenology, Duncan argues that self-study is a scientifically valid process that "does more than just tell stories. It provides reports that are scholarly and justifiable interpretations . . . [that] do not consist solely of the researcher's opinions but are also supported by other data that can confirm or triangulate those opinions." (2004, p. 5). While it is important to engage with criticism towards phenomenology's scientific validity, systematic reflection on personal processes and behaviours can provide valuable insight. As Heidegger puts it, "even if we can't do anything with it, may not philosophy in the end do something with us, provided that we engage ourselves with it?" (2000, p. 13). This notion is at the core of the present research; the aim of the framework developed by this paper is to provide inspiration to practitioners of computer-mediated music who wish to look inwardly into their own creativity; a means of understanding how their creative processes behave and how this can be optimised. It is important to acknowledge that the framework developed by this research is not intended to be a universal tool; instead, the intention is that the idea and development of the framework acts

as inspiration and guidance for others to be in-seeing in their own computer-mediated music practice.

Previous research advocates phenomenology as a methodology for researching individual creativity since, in some cases, the external evaluation of a creative individual can interfere with the reliability of the findings as it introduces another factor along with the concrete and conceptual factors already present. Rogers concluded that an environment where "external evaluation is absent" (1954) is less obstructive towards a natural creative process. Furthermore, it has also been noted that self-study "can assist in answering otherwise unanswerable questions" (Wall, 2006, p. 7), specifically through the observation and in-depth explanation of personal motivations, feelings and meanings.

However, one issue of using phenomenology in this thesis is that the review of creativity literature conducted prior to data collection must guide findings. The very process of self-evaluation has inarguably shaped the preconceptions and assumptions of my creative process during this study, resulting in an influence on my creative practice and subsequently the data.

4.3 Research Setting and Timeline

Myself as subject and my music

As a subject, I am typical of someone who began music production as a visual learner in that I was introduced to the practice with DAWs. For this reason, the phenomenological approach of this study was also a way of determining how deep an influence the interface has on learning to communicate with technological tools creatively.

As I started this thesis I was engaged in various creative projects, which formed the basis of my research. Some projects were in an early stage of creation whereas others only needed final work in the mixing stage. A comprehensive breakdown of the developmental stages of this material is presented in Table 2 (see page 35). The flexibility of working on projects at various stages enabled the exploration of a range of computer-mediated

musical activity from composition to final mixing touches. This allowed me to capture a range of creativities and creative processes at different stages of the overall creative process. Another beneficial characteristic of the work chosen for research was that it would eventually be presented as an EP. The development of this EP is investigated as a longitudinal aspect of creativity; in other words, considering how creative choices are made in the context of how they collaborate as elements of a larger work.

I chose to create an EP alongside this research for a number of reasons: I have made a number of EPs in the past and it is therefore something I already have habits and potentially "flow" in. Furthermore, through experience I recognise various creativities evidenced in the literature review and as I am interested in the interrelationships and emergence of creativities, the creation of an EP seemed like a logical way of observing the various creative processes and behaviours required in the various stages of studio-based composition, mixing and recording. The EP was produced in tandem with this thesis and while it isn't the subject of examination, the materials are available in the appendix. The four Projects that were selected for analysis for this thesis are: Project #1 (Temporary Slang), Project #2 (Xanadu), Project #3 (Music 2 My Eyes) and Project #4 (Blindness).

Location

To ensure a natural environment for the phenomenological study of creativities, I have chosen a methodology for data collection that should have minimal influence on the creative process. For example, if an idea were to suddenly formulate away from a studio, it would have been impractical to be required to relocate to a studio and book out audiovisual recording equipment in order to document the creative instance. Such a methodology would have disrupted the creative "flow" (Cziszentmihalyi, 1996). It was necessary therefore for the research setting of this study to be flexible. This also created a more natural study environment than confining myself to one location to work on creative ideas, something I would not normally do anyway. With some exceptions, the locations in which the creative activity occurs are my home studio and the University recording studio, EMS suites and practice rooms.

Software

As my normal method of composing and producing musical material is through use of the Digital Audio Workstation Logic Pro X, I opted to use this software throughout the entire study. The use of Logic Pro X as the chosen DAW of this case study should be considered an example or template that can be applied to creative research or use of other DAWs.

Timeline

This work adopts a longitudinal perspective, which allows the collection of data corresponding to a range of creative activities taking place over varying periods of time. According to Keller, long-term studies provide "detailed information on creative methods. A long-term creative project may provide insights on aspects of creative practice that have not been addressed from an embedded-embodied perspective." (Keller et al, p.4, 2014). Furthermore, a long-term study of creativity is useful in understanding how choices are made in the context of how they collaborate as elements of a larger work. The tables on the following two pages are the Research Plan and Timeline. Table 1 details the timetable of research and illustrates the breakdown of the methodology, including preliminary organisation, data collection, analysis and the conclusion and evaluations abstracted from the findings.

TABLE 1 – Research Timeline				
	Early Feb	**Late Feb - May**	**May - July**	**July- Sept**
OVERVIEW	Gathering ideas. Preliminary Data Collection based around one Logic Project.	Data Collection.	Data Analysis and further Data Collection	Findings Conclusion Evaluation
CONTENT	Made notes, potential tracklists for the EP, organised Spotify playlists of reference tracks, began to think about aims and inspirations.	Began to work and collect data on more than one Logic Project. Collected notes, audio, video and screenshots relating to my practice.	Began categorising the episodes and data according to a criteria. Continued collecting data on one further Logic Project.	Looked for patterns of results in the analysis, reflected on what they said about my practice and how they helped answer the research questions
		See TABLE 2, which shows the various stages of development of each Project.	Annotated episodes and defined the functions of the interactions, the contextual resources used and defined the creativities/stages of the creative process present.	Reflected on the successes and failures of the study. Reflection on how the study may be useful to others.

TABLE 2: Timeline of compositional and production development captured through this research

	Definition and early composition	General composition	MIDI Demos	Demo recordings (live instruments)	Full Recording	Early Mixing	Finished Recording	Finished Mixing
Project #1 (Temporary Slang)								
Project #2 (Xanadu)								
Project #3 (Music 2 My Eyes)								
Project #4 (Blindness)								

4.4 Methodology Literature Review

Mixed-method approach

In a response to the changing way creativity is framed theoretically, the way it is researched has also evolved. While early creativity research was conducted largely on the basis of scientific principles and psychological theory (Guilford, 1957), contributors to contemporary research encompass a broader range of disciplines, from historians and sociologists to anthropologists and many others (Sawyer, 2012). Despite this however, there is a limited overlap between research fields, an issue termed as "parochial isolation" by Czikszentmihalyi (et al, 1991, p. 270). In view of this problem, in the late 1990s Sternberg suggested that "were it the case that an understanding of creativity required a multidisciplinary approach, the result of a unidisciplinary approach might be that we would view a part of the whole as the whole, but at the same time, have an incomplete explanation of the phenomenon we are seeking to explain" (1999, p. 9). Drawing on comments made by Sternberg, Sawyer explains that: "this lack of multidisciplinarity [has] blocked our understanding of creativity" (2012, p.4). My research attempts to navigate this concern by appropriating research methods and materials from multiple disciplines, avoiding a narrow, single-dimensional approach unsuited to a complex and dynamic subject such as creativity.

According to Eaglestone, a naturalistic and holistic approach is "particularly appropriate to the investigation of problems and phenomena which are not clearly understood and do not benefit from a large body of existing theory." (2002, p. 18). Investigation into speculatively understood conceptual concepts such as creativity has been termed by Olaisen as "sensitising" (1991, p. 254) as opposed to "definitive" concepts, a process that allows a flexible approach in a "shifting, empirical world to 'feel out' and 'pick one's way in an unknown terrain." A mixed-method, qualitative approach is therefore used in researching my own computer-mediated musical practice in order to capture in detail the concrete and conceptual (Amabile, 1996) resources that contribute towards my own creativity in a naturalistic setting. Through investigating my creativity in this way, the aim is to connect the

data collection and analysis with reality.

A qualitative, mixed-method study of computer-mediated music practice facilitates the observation of the various creative processes and behaviours engaged in by a subject who works in various modes - composition, mixing and recording for example. An appropriate methodology to draw from in a long-term mixed-mode study is a research method termed as "multi-dimensional in-depth long-term case studies (MILCs)" (Schneiderman & Plaisant, 2006, p. 1). MILCs are a suitable template for data collection methods as they prioritise "situated strategies that emphasize ethnographically-oriented and longititudinal participant observation." (2006, p. 1). MILCs are "well adapted to study the creative activities that users of information visualisation systems engage in" and are therefore a particularly appropriate resource for a study of computer-mediated music practice in which the DAW can be seen as an "information visualisation system".

In this research, the mixed-method approach is guided by Collins's synthesis process model of creative thinking in music composition (2005), a three-year case study tracking the development of one composer. Data collected in Collins's study included "digital MIDI save-as files, analogue audio files, semi-structured interviews, immediately retrospective verbal accounts and verification sessions between composer and researcher" (2005, p. 199). While Collins's research involved an external observer, phenomenology allows a rich, retrospective analysis of conceptual processes that may only be known to the creative practitioner. Therefore, participant as researcher is a relevant, plausible mode of investigating creative process in depth.

In this phenomenological research setting, a mixed methodology allows the method of data collection to be adapted to suit the nature of the creative activity, ensuring that creative "flow" is not obstructed and that creative practice can be engaged in as normal. In a study of creativity and flow in musical composition by MacDonald, Byrne and Carlton, it was found that "increased levels of flow are indeed related to increased levels of creativity" (MacDonald et al, 2006, p. 300). This perspective was developed by Csikszentmihalyi's work on the psychology of flow, creativity and

happiness (Csikszentmihalyi, 1992). Alongside flow, physical and sociocultural environments of creativity are of crucial influence to creativity. According to Hennesey and Amabile, people are most creative "when they feel motivated primarily by the interest, enjoyment, satisfaction and challenge of the work itself – not by external pressures" (1988, p.11). Considering this perspective, it is important that the research setting of this study does not become an "external pressure" so as to not upset the flow of the creative work as it takes place.

Methods of Capturing Creative Process

A range of methods have been used to document creative process and music composition practice, the salient and most relevant appear to methods that incorporate situated activity as it emerges. For example this may include written protocol (note-taking) and audio-visual documentation. As discussed earlier, Collins (2005), Folkestad (1997), Eaglestone (2002) are examples of multi-model studies of computer-mediated music practice, these studies are drawn on as valuable resources in that they have approached a similar topic to this research with similar aims.

Written protocol

Numerous studies of computer-mediated music practice have mapped the development of ideas through keeping a log of "verbal protocol" (Eaglestone et al, 2002; Collins, 2005; Sawyer & DuZutter, 2009), "dialogic activity" (Keller, 2014, p. 5) or think-alouds (Ericsson & Simon, 1993; Reitman, 1965; Burnard & Younker, 2002) in other words the verbalisation of thoughts during the creative process. A phenomenological study is largely non-communicative and without an external observer or dialogue transcripts to record the generation, abandonment or recycling of ideas, tracking their conceptual development was an especially difficult obstacle to overcome. One method of alleviating this problem is to document the "inner dialogue" (Wall, 2006) of the creative process using diaries and note taking as a form of auxiliary data[1] that accompanies the main data collection. The thoughts and personal experiences that contribute towards practices are a highly

[1] "Auxiliary data" is a term referring to data from an "external source[…]used to supplement" data collected by the study (Cross Cultural Survey Guidelines, 2018).

important part of the creative process; in a phenomenological study, it would be difficult to capture these processes without taking notes. The research draws on Murchison, who finds three types of note taking that appear in well-balanced ethnographic research:

"(1) notes on participant-observation; (2) notes associated with interviews; and (3) personal reflections." (2009, p. 78)

It is important to state that my own research should not be considered ethnographic but the study does take influence from ethnographic principles and practices, particularly the documentation of thoughts and experiences as formulators of method and meaning. According to Murchison, ethnographers often choose to leave personal reflections out of their analysis and writing in an effort to "separate personal thoughts and experiences from research and data" (2009, p. 78). Other ethnographers "argue that this distinction is somewhat artificial." (2009, p. 78). In a self-study, the documentation of personal thoughts and experiences is especially important as the emergent creative activity is framed by a chronology of actions that are socially and culturally situated.

In place of verbal protocol, this study makes use of "written protocol" as a record of the "inner dialogue" (Wall, 2006) that parallels physical creative work to be captured through real-time audiovisual recordings and retrospective audio extracts. This approach is validated by Shneiderman and Plaisant (2006, p. 6), who suggest a "log book" as a record of subject experiences and by Keller's use of "text messages and pictures" (2014, p. 5) as data items in the study of collaborative musical creativity. The decision by Keller to analyse text messages and pictures sent between a group engaged in creativity is an acknowledgement of the way text can be used in the expression and generation of musical ideas away from any direct engagement with music technology. Capturing written protocol of this nature is therefore highly important in the study of computer-mediated musical practice.

It is important in research involving written protocol for notes to be taken at

an appropriate time. As pointed out by Gelineck and Serafin, regarding the "think-aloud" method, taking notes immediately may be "too distracting from the musical interaction preventing the user from being naturally immersed in the musical context." (2012, p. 261). At the same time, recording written protocol too late may also be problematic. Gelineck and Serafin found in their study that retrospective interviews could mean they "lose the very immediate and spontaneous thoughts of the subjects as they interact with the system." (2012, p. 261). Relying solely on an immediate capture of written protocol could be distracting, and relying on a retrospective approach misses the immediate perceptual responses and real-time thoughts and responses. It is therefore important to use a balanced approach in recording written protocol.

Audio-visual recordings

Another accepted method of data collection in long-term studies of computer-mediated music practice is the use of audiovisual recordings. This method of collection allows the preservation of data in close to its original form. According to Mehan; "videotape serves as an external memory that allows researchers to examine materials extensively and repeatedly" (1979, p.19). Use of video and audio capture in the documentation of creative musical practice is drawn from Eaglestone's "Requirements Specification for a Compositional Tools System" (Eaglestone et al, 2002). Eaglestone and his research team recorded subjects to gain insight into their compositional processes, with the central aim being the proposal of an improved interface system that better allowed creativity amongst electroacoustic composers.

The Musical Product

In parallel to the recording of creative practice, previous literature on creativity in music technology has also considered the relevance of the creative product under development. A systematic collection of "MIDI save-as files" in research conducted by Folkestad (1997) for example provided valuable insight into the temporal generation of ideas amongst children across various creative stages. According to Collins (2005, p. 198), the approach "allowed a more accurate degree of mapping compositional processes, as each 'save-as' could be accompanied by a date and time stamp

within the file, rather than erasing previous work." Later studies by Burnard and Younker (2002) and Seddon and O'Neill (2003) also involved the tracking of computer-based compositional strategies through examination of musical products. In the case of Burnard and Younker, musical products were recorded using a MIDI keyboard and Apple computer and Seddon and O'Neill systematically collected MIDI save-as files at the end of scheduled composition sessions (Collins, 2005, p. 198). Systematically documenting the progress of the musical product allows the creative processes involved in the development of a work or multiple works to be viewed from a moment-by-moment and longitudinal perspective, a useful standpoint for a study routed in sociological creativity theory (Amabile, 1996).

Methods of Analysing Creative Process

In a mixed-method study where data is collected in a naturalistic setting, selecting a method for analysing the data can be difficult. In a longitudinal evaluation of integrating digital instruments into existing compositional work, Gelineck and Serafin offer a disclaimer regarding their analysis, stating that: "one must be aware that there is no truly objective way of analysing this kind of qualitative subjective data" (p. 266). In another example, the holistic approach and rich data set sought by Eaglestone meant that there was an absence of a clearly defined hypothesis prior to data collection. Eaglestone explains that in his naturalistic mode of inquiry "there is no predefined goal how to analyse the data, but data collection and data analysis are an interactive process, and in an ideal situation, theory will emerge from the data alone." (2002, p. 18). While the aim of my methodology is to provide a similarly rich set of data through collection alone, this thesis also considers systematic analysis methods used by previous literature within the domain of computer-mediated music research. In comparison to Eaglestone, other researchers such as Collins for example have triangulated the holistic setting of their studies with more predetermined analysis methods. Collins' study focused on the analysis of MIDI files, "graphical representation of ongoing work" (via screenshots) and "text (acquired through a verbal protocol, interviews, and verification sessions)." (2005, p. 201).

Through engagement with the data, Collins established three methods of "mapping" (2005, p. 198): "Real-time mapping" involved the examination of MIDI save-as files as a longitudinal "diary" (2005, p. 202) of the compositional process, cross-correlating the content of these files with extracts from interviews; "structural mapping" involved a graphical representation of the events of the creative musical processes, as an illustration of "how the composer manipulated the emerging composition both in small-scale and global terms."; and "thematic mapping" involved transcribing verbal protocol (interviews, talk-alouds etc) in order to identify broad categories (Collins, 2005, p. 202). This study draws on Collins' three mapping techniques as suitable analysis methods, it also looks at the way other research has implemented these three methods.

Template analysis

Typically in long-term mixed-method studies, a substantial amount of data is recorded and it is not practical to analyse the entire body of recorded data. Sawyer and DeZutter faced this problem in their study of collaborative creativity in theatre improvisation (2009). Their data collection involved the recording of 12 rehearsals and 5 performances, which was too great an amount of data to analyse fully. In scenarios where a lot of data may be recorded, such as audio-visual recordings, it is necessary to develop a criterion in order to narrow down the scope of the material. In Sawyer and DeZutter's work, the contents of their recordings were logged and categorised before being narrowed down to selected episodes of determined importance. Rather than an attempt to superficially cover all of the recorded data, a study of creativity in computer-mediated music practice may narrow its material down to key themes for an in-depth analysis.

In the event of a vast data collection, previous literature proposes an approach of selecting key episodes of for analysis according to key themes as identified by the researcher. The analysis methods involved in a study of studio based collaborative composition conducted by Dobson and Littleton (2011) for example involved the identification of "recurrent creating points" discussed most often in the collaborative setting. These points were identified as "structure, concepts and aesthetics, space in performance and

audiovisual relationship". Picking out key themes facilitated an understanding of sociocultural discourse framed collaborative musical creativity.

Another study involving Dobson incorporated thematic analysis of discourse, a method that consisted of analysing transcripts of conversations during collaborative creativity that showed "collaborative emergence, distributed contributions" (Dobson et al, 2011, p. 3) and development of knowledge. The work of Dobson and Littleton follows a trend in music composition research since Reitman (1965) which prioritises the analysis of verbal protocol, a method also followed by Collins in his documentation of a composer thinking aloud while composing and compiling elements of a piece (2005). In Eaglestone's work, analysis of verbal protocol is also prioritised, arguably further than the physical recording of the creative interaction with technology. Eaglestone draws on the approach of Collins (2001), stating: "videotaping should be regarded as a complementary method to the verbal interaction protocol." (2002, p. 22). In my own research, more emphasis is placed on the thematic analysis of audio-visual screen-capture; the reasoning behind this is that while the written protocol that acts as a substitute for the any verbal protocol is valuable, in a self-study it is apparent that the thematic content of written protocol will be influenced by my existing preconceptions relating to computer-mediated musical creativity, as discussed earlier. The audio-visual recordings present events as they actually happen for subsequent analysis and won't therefore be filtered by memory.

Much of Keller's research prioritised an analysis of "resource transfers"; file-transfers between three creative collaborators consisting of "textual, visual and sonic materials" (2014, p. 4). The resource transfers selected for analysis were again narrowed down to those that fit any of three criteria: "(1) proposals concepts and materials that were not previously explicitly stated within the domain of the creative work; (2) commitments – explicit approval of proposals ensuing incorporation of new procedures or products; (3) rejections explicit exclusion of proposals from the creative epistemic space." (2014, p.4) Similarly, the transcription of verbal protocol in the work of

Gelineck and Serafin "underwent a filtering process where statements/actions were first coded and then recoded. The codings used were partly derived from initial areas of interest but also from revisiting notes taken during the interviews" (2012, p. 266). This method of coding (according to recurrent patterns in the data or elements deemed relevant by the author) resembles a qualitative data analysis method termed "template analysis" (King, 1998).

"Template analysis", an analytic method offered by Nigel King (1998), which involves "the development of a coding 'template', summarises themes identified by the researcher(s) as important in a data set, and organizes them in a meaningful and useful manner". In a study (such as Sawyer and DeZutter's (2009)), where there may be an abundance of collected data, template analysis offers a tool for sharpening the focus of the research through highlighting the key patterns and elements of the data. Another relevant proposal that relates to the thematic mapping methods of previous literature (Collins, 2005; Gelineck & Serafin, 2012, Dobson & Littleton, 2011) is Erlandson's "emergent category designation", a concept he proposes as a tool in naturalistic inquiry. Emergent category designation involves "taking all the units of data and sorting them into categories of ideas. This allows categories of thought characteristic of a particular setting to emerge intuitively as the researcher's own background and latent theory interact with these data". Importantly, Erlandson understands that "the researcher must understand that the construction that emerges through this practice is but one of many possible constructions of reality." (1993, p. 118). To allow for this, it could therefore be proposed that even in a holistic approach, an appropriate analysis should still involve some systematic methods. As pointed out by Gelineck and Serafin, "by following a rigorously structured data analysis method it is possible to reduce the impact that predispositions of the researcher has on the interpretations of the data." (2012, p. 266). This is especially important in navigating the issues of phenomenology, as no external observer is present and therefore any objective reflection on qualitative subjective data is problematic.

This thesis implements template analysis (King, 1998) as the analytical method for coding the emerging data, drawing on the fact that similar

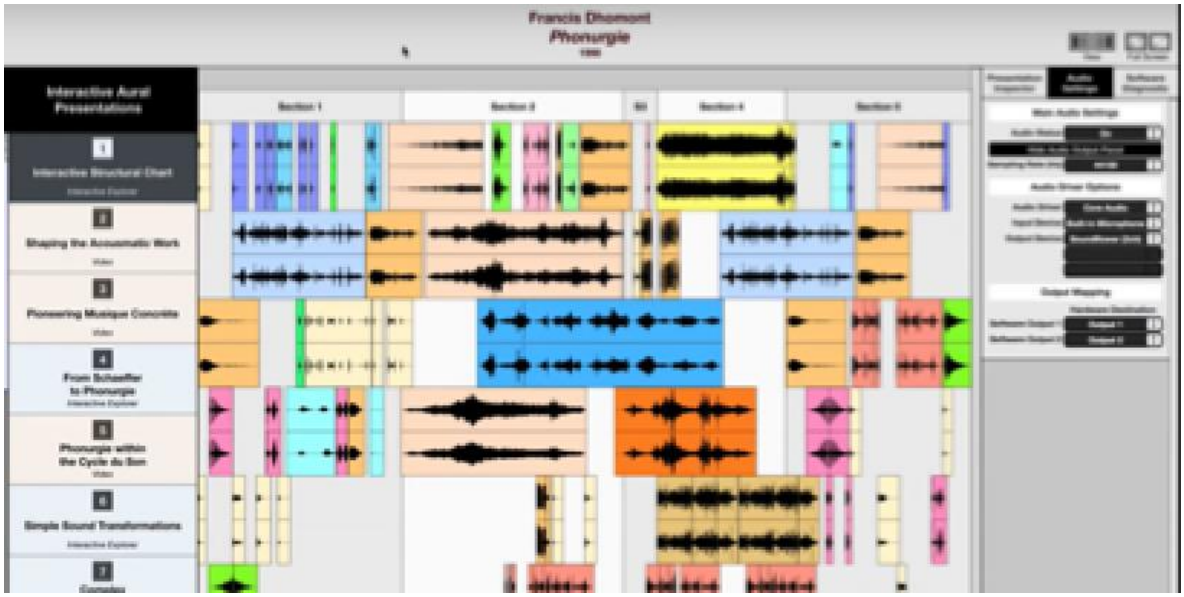
methods such as thematic mapping (Collins, 2005), thematic analysis (Gelineck & Serafin, 2012, Dobson & Littleton, 2015) and emergent category designation (Erlandson, 1993) have all been used previously and are appropriate for research of computer-mediated musical creativity.

Mapping the musical product

Computer-mediated music practice is a dynamic, temporal process and any exploration of the process should reflect this accordingly. One method of tracing longitudinal creative music progress is the analysis of systematically extracted audio or music data (Folkestad, 1997; Collins, 2005) to allow "the time-based mapping of compositional processes over substantial periods of time" (Collins, 2005, p. 199) This allows research to pinpoint stages of the creative musical process, such as idea generation and combination (Sawyer, 2012). According to Collins, the analysis of musical products allowed Burnard and Younker (2002) to observe "'eureka' moments of illumination when, for example, a student might grasp a holistic understanding of the, as yet incomplete, piece." (2005, p. 198). Furthermore, by analysing extracts of the musical product that demonstrate development over time, it is possible to observe whether the processes used fit a linear or recursive model.

In a study of the compositional methods of electroacoustic composers, the TaCEM research project involved a series of case studies each focusing on a single work by an established composer. Each case study involved "the detailed investigation of a particular work, looking at the technical means employed in its creation, analysing its musical structure and examining the place of the work within the composer's oeuvre and the broader historical context." (TaCEM, 2012-15) TaCEM's analysis of Francis Dhomont's "Phonurgie" (Dufeu & Clarke, 2015) for example graphically represented the composition process through the development of interactive software that was used to deconstruct the individual elements that made up the full piece (see Fig 3 on next page). In this present study of computer-mediated music practice, the ability to analyse audio extracts rather than MIDI save-as files facilitates the detailed deconstruction of a finished work element by element. In a study of computer-mediated musical creativity, this is a useful method of illustrating the technical and creative processes that led to the completion of the musical product.

Fig 3. TaCEM's analytic mapping of the elements that make up Francis Dhumont's *Phonurgie*



Structural mapping

In some studies, the practice of creating structural representations of the musical product can be extended to chronological representations of moment-by-moment and longitudinal creative production process. Collins terms his use of this tool as "structural mapping" and this is how it shall be referred to throughout the course of this research.

Structural mapping is often used in conjunction with thematic analysis. For example, rather than simply transcribe dialogue and pick out thematic content in a study of interdisciplinary creative collaboration within music technology, Dobson opted to represent the content of the dialogue graphically, producing visual maps using Microsoft Excel (2012, p.92). In Fig 4. (next page), the x axis is used to show time in passing minutes from left to right, and the y axis is divided into different focuses of creative and collaborative discussion (shown as blue strips and red strips respectively). Dobson used charts such as this as analytical tools to not only show the breakdown of discursive focus that was subsequently coded and catalogued, but additionally to reveal how subject focus shifts between different topics and activities over time (2012).

In his study of creative collaboration, Keller (2014) also used structural mapping to represent breakdown of dialogic activity (Fig 5). Rather than adopting Dobson's method of focusing on specific "episodes" for thematic analysis, Keller's study shows how the thematic content of dialogue shifted over the course of a year. Structural mapping facilitates the tracking of shifts in creative focus and inter-relationships between creativities over time, an analytical resource not offered by relying on thematic mapping alone.

Fig 4. Dobson's chronological representation of flow between different creative activity (2012)

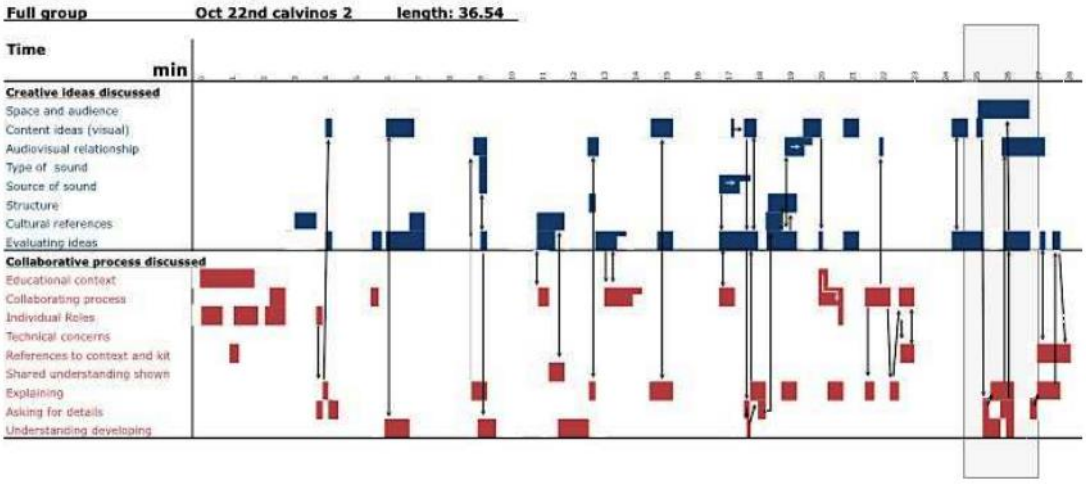
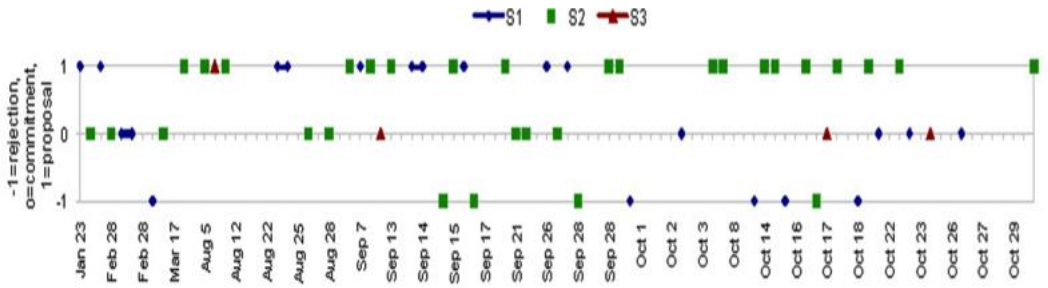


Fig 5. Keller's chronological representation of creative behaviour over several months (2014)



Gelineck and Serafin also use structural mapping, but rather than a breakdown of dialogue, it focuses on a breakdown of creative activity.

Specifically, their structural mapping illustrates how time has been used by three subjects in the learning of digital music instruments known as PHOXES (2012). The subjects engaged in both free exploration and task-based composition exercises over the course of several weeks. The content of the subjects' engagements are represented and compared via structural mapping (see Fig 6 on next page). To compare creative behaviour between subjects as it developed over time, Gelineck and Serafin used structural mapping. Gelineck and Serafin also used structural mapping to visualise recursive steps taken by the subjects as they progressed (see Fig 7 on page 50).

Visual maps are also used by Collins in his analysis (Fig 8), but rather than a chronological thematic analysis over time as exemplified by previously discussed structural mapping (Dobson, 2012; Gelineck & Serafin, 2012; and Keller; 2014), Collins opts for flow charts to break down the subjects compositional processes and to illustrate the path used in solving differing compositional problems at different stages of the creative process. Collins describes this as a "graphically presented overview of events". In Collins' work, interviews were conducted prior to and after compositional activity in order to help analyse the emerging data from the structural mapping. Collins' structural mapping was used in combination with analysis of MIDI save-as files and verbal protocol in order to build a hypothetical model of the compositional process.

Where some of Dobson's charts (Fig 4 for example) offer a moment-by-moment overview of an isolated episode of data recorded in real-time (2012), other charts (Keller, 2014, Collins, 2005, Gelineck & Serafin, 2012) have outlined the work of the various avenues explored over the longitudinal creative process. For a study that aims to capture both moment-by-moment creativities and the longitudinal interactions between them, a useful analytical method would be to blend elements both strategies in order to analyse and represent data at both micro and macro level.

Fig 6. Gelineck and Serafin's structural comparison between the creative processes of two subjects (2012)

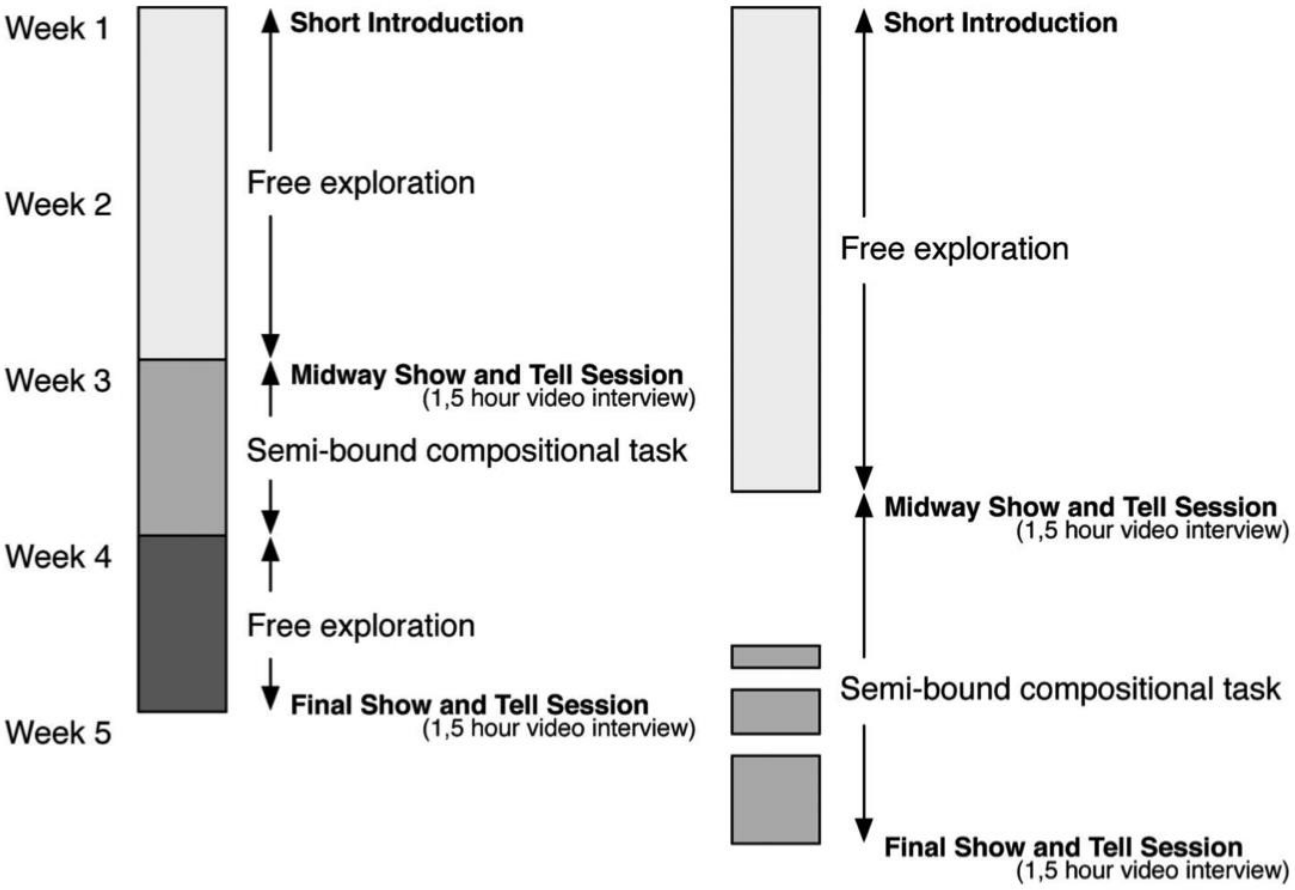


Fig 7. Gelineck and Serafin's structural representation of recursive creative activity (2012)

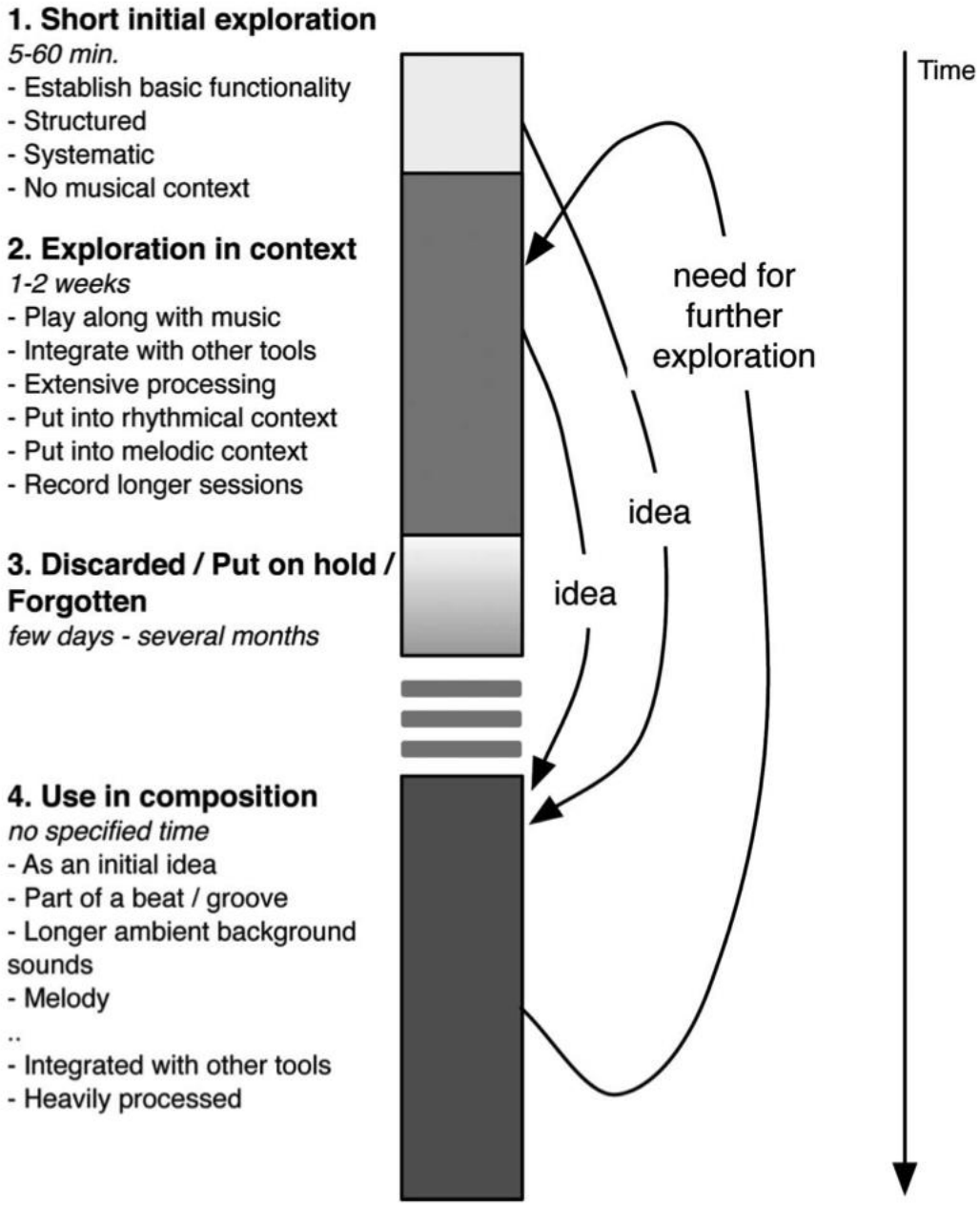
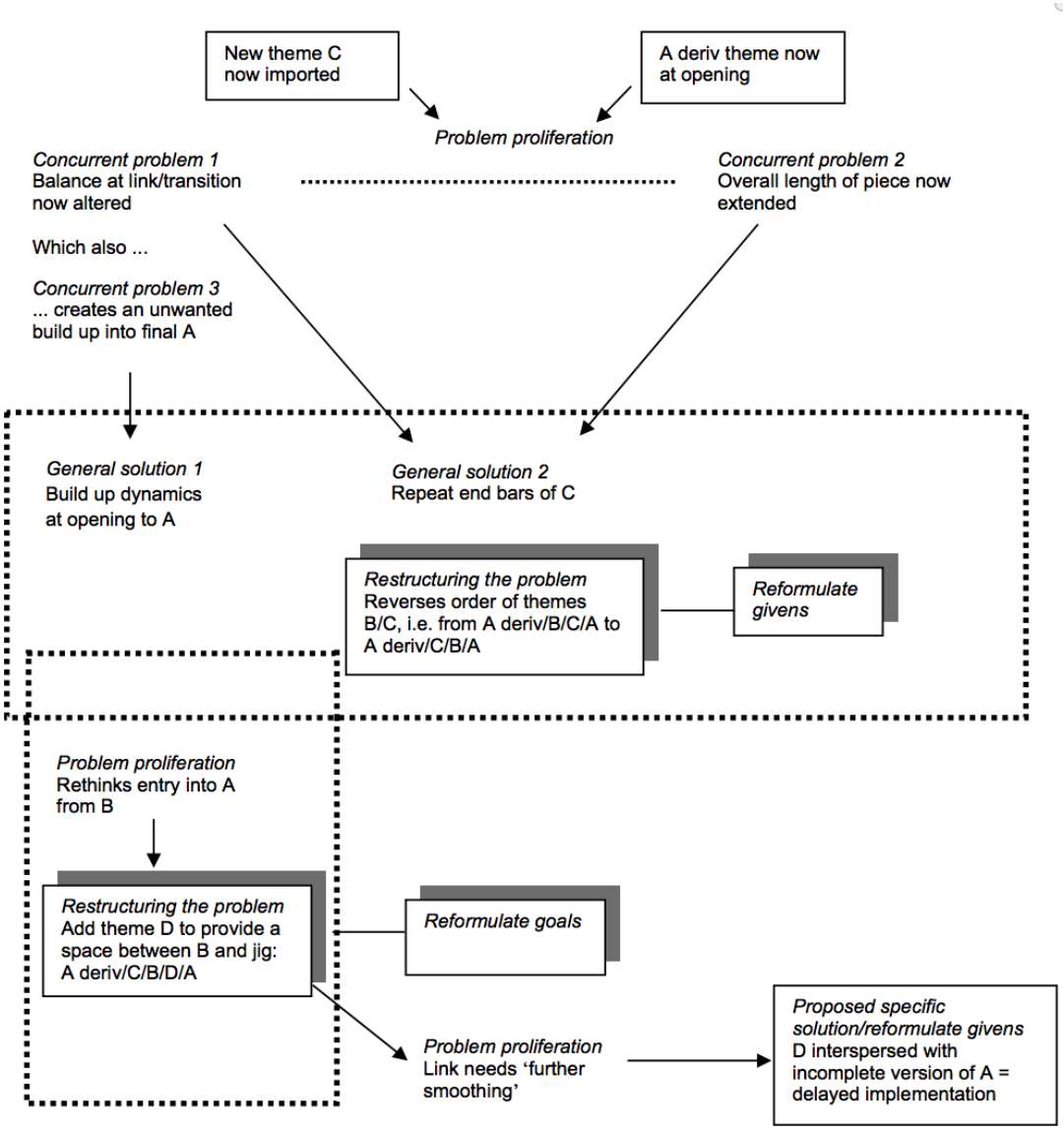


Fig 8. Collins structural mapping of the overall creative process (2005)



5. Data Collection

5.1 Overview

Based on literature encouraging multi-disciplinary approaches to creativity research (Sternberg, 1999, p. 9; Sawyer, 2012, p.4; Collins, 2005; Shneiderman & Plaisant, 2006), it was determined that in order to collect a rich amount of data over moment-by-moment and longitudinal periods of time, it was important to utilise a variety of data collection methods. Using a mixed-method approach allowed me to more effectively answer the research questions. For example, the most practical method of understanding how my creativity is framed via social, cultural and concrete context is through keeping written protocol on creative processes, documenting ideas as they happen in order to catalogue the conceptual processes and documenting personal experiences that happen in parallel to concrete creative activity. On the other hand, to understand the influence of concrete factors on computer-mediated music practice (visual tools and interfaces for example) an audiovisual document of creative processes involving real-time interactions with technology was useful.

In this work, audiovisual recordings capture the moment-by-moment processes of interactions through methods such as screen capture and/or video link, while the systematic collection of audio extracts demonstrate the longitudinal development of the material. Written protocol is used to provide further qualitative information in accompaniment of these data collection methods. The types of data captured throughout this research fall into the categories summarised below and are referred to throughout this paper as ‘data type(s) (a) through (c)’:

a) **Written protocol:** Personal reflection on the creative processes as they happen (i.e. influences, ideas decisions, thoughts) and notes that are taken as a natural part of conceptual creative processes.
b) **Audio-visual recordings and audio recordings**: Real-time screen-capture or audio recordings of concrete creative work being

undertaken, i.e. interacting with the DAW interface or a musical instrument.

c) **Audio Extracts:** Individual elements or sections of music or the musical product in its entirety exported as .mp3 files at various stages of development.

5.2 Timeline

Fig 9. Timeline of Data Collection methods for each Project. The numbers inside each cell correspond to the date of the month

		Timeline																											
	Month	*Feb*				*Mar*				*Apr*				*May*				*Jun*				*Jul*				*Aug*			
	Week	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Data type	Written protocol	3rd 6th		15th 17th 15th	30th 24th	7th	9th 11th 8th	15th 21st 21st			9th 8th		25th 25th	1st 5th	9th 9th 11th 13th	16th		2nd 3rd 4th	10th 8th 9th	19th			9th							
	Audio-visual recording	2nd				6th 7th							30th 30th	1st	12th 13th			7th	14th 8th 9th	19th 20th									
	Audio extract	3rd 1st 3rd 6th 7th	10th 8th 9th 14th	15th 16th 19th 20th	22d 23rd	7th 7th	8th 9th 12th	21st					27th 30th	3rd	13th	16th	25th	3rd 5th 7th	8th 9th	21st 22d 21st	26th	3rd	9th							

Project #1 (Temporary Slang)
Project #2 (Xanadu)
Project #3 (Music 2 My Eyes)
Project #4 (Untitled)

Figure 9 on the above page illustrates the breakdown of the Data Collection. Data was also collected for several additional tracks, with the aim of capturing as much as possible about the situation for multi-modal data analysis before omitting potentially valuable parts of the process. It was ultimately decided that 4 projects (Projects #1 through #4) featured the most substantial amount of collected data. Projects #1 through #4 also represented the greatest range of composition and production methods and it was therefore considered that focusing on these materials would allow for the analysis of a broad spectrum of computer-mediated musical creativities.

Data collection took place over a 7-month period between February and August. During the first 3 weeks, the decision was made to focus on Project #3 (Music 2 My Eyes) as a preliminary collection of audio extracts. Carrying out this preliminary data collection helped to focus research questions and narrow down methodologies. Rather than the systematic collection methods used in previous literature, it was decided to bounce audio extracts at the end of composition and production sessions as they happened, in order to maintain a naturalistic approach where time of work was flexible. The table below represents the quantity of data collection between each project.

Fig 10. Data type per project

	Project				
	#1	#2	#3	#4	
Written protocol	14	10	4	5	Quantity of data items recorded
Audio-visual recording	6	5	1	2	
Audio extract	17	15	17	9	

The methods used in collecting data types (a) through (c) are outlined throughout the following section.

5.3 Data type (a): Written protocol (*memos* and *part-of-practice*)

The recording of written protocol contributes towards two aspects of data collection: The first aspect is the documentation of *memos* (see Fig. 11 and Fig. 12) as mode of direct data collection. Memos record the "inner dialogue" (Wall, 2006) accompanying creative practice, in an attempt to track the conceptual work involved in computer-mediated music practice. In some cases, memos are also used to directly accompany other collected materials such as audiovisual capture, where it may be useful to have text-based explanations of complex processes that cannot be understood by simply observing a screen-capture or video recording.

Fig 11. Memos recording conceptual process

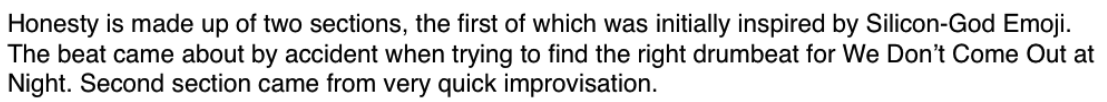
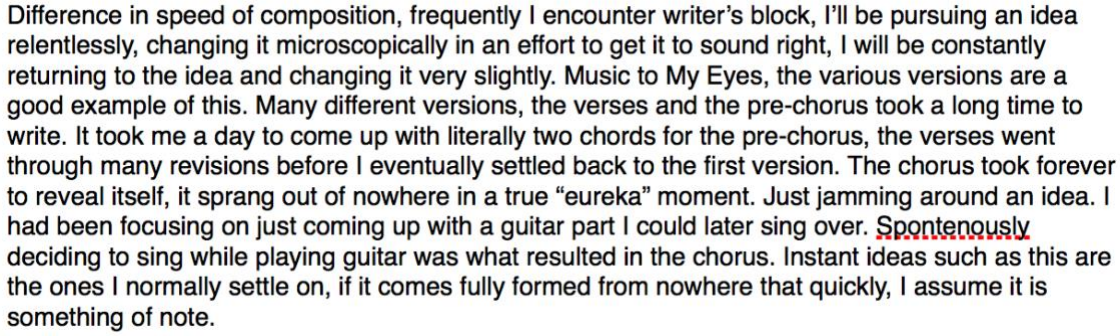

Honesty is made up of two sections, the first of which was initially inspired by Silicon-God Emoji. The beat came about by accident when trying to find the right drumbeat for We Don't Come Out at Night. Second section came from very quick improvisation.

Fig 12. Memos recording conceptual process


Difference in speed of composition, frequently I encounter writer's block, I'll be pursuing an idea relentlessly, changing it microscopically in an effort to get it to sound right, I will be constantly returning to the idea and changing it very slightly. Music to My Eyes, the various versions are a good example of this. Many different versions, the verses and the pre-chorus took a long time to write. It took me a day to come up with literally two chords for the pre-chorus, the verses went through many revisions before I eventually settled back to the first version. The chorus took forever to reveal itself, it sprang out of nowhere in a true "eureka" moment. Just jamming around an idea. I had been focusing on just coming up with a guitar part I could later sing over. Spontenously deciding to sing while playing guitar was what resulted in the chorus. Instant ideas such as this are the ones I normally settle on, if it comes fully formed from nowhere that quickly, I assume it is something of note.

The second aspect of written protocol is note taking that already happens naturally as part of the creative process itself, i.e. written protocol to help decide how a certain piece should be structured or what the overall

intent/meaning is. This form of written protocol was analysed in a separate context from the memos, as a record of creative activity in absence of music technology and in some cases to track conceptual and sociocultural influences. This form of written protocol is referred to as *part-of-practice* note taking (see Fig 13, Fig 14 & Fig 15).

Fig 13. Note taken on pages document as natural part of practice

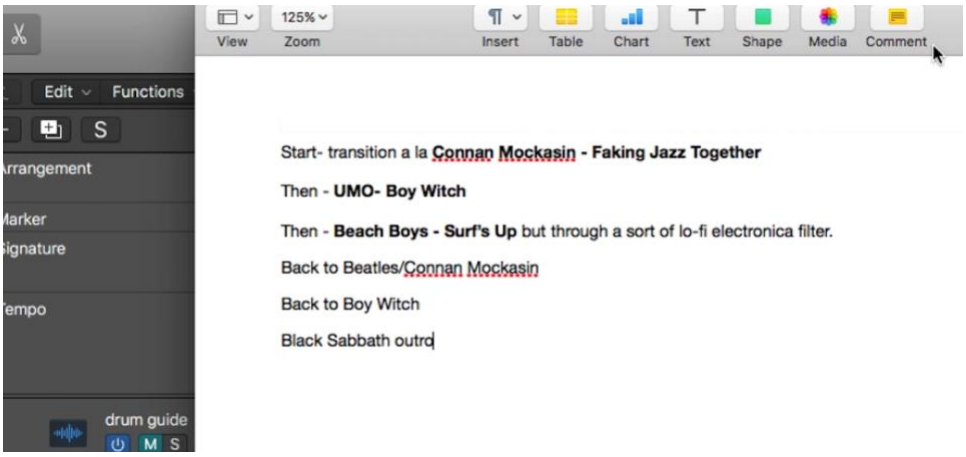


Fig 14. Written protocol made on phone app as natural part of practice

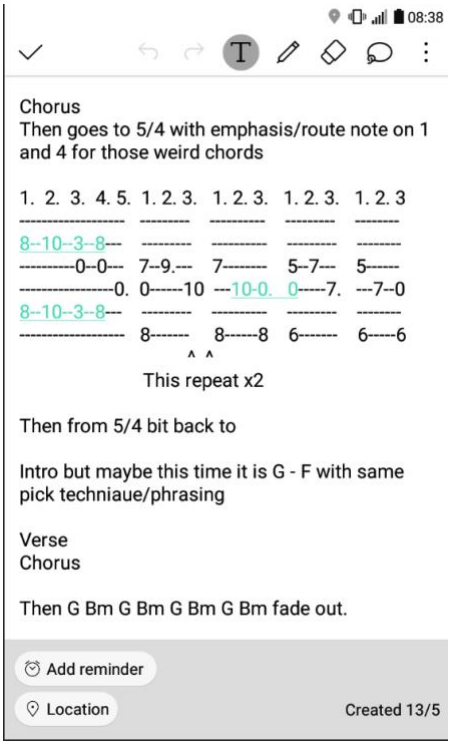
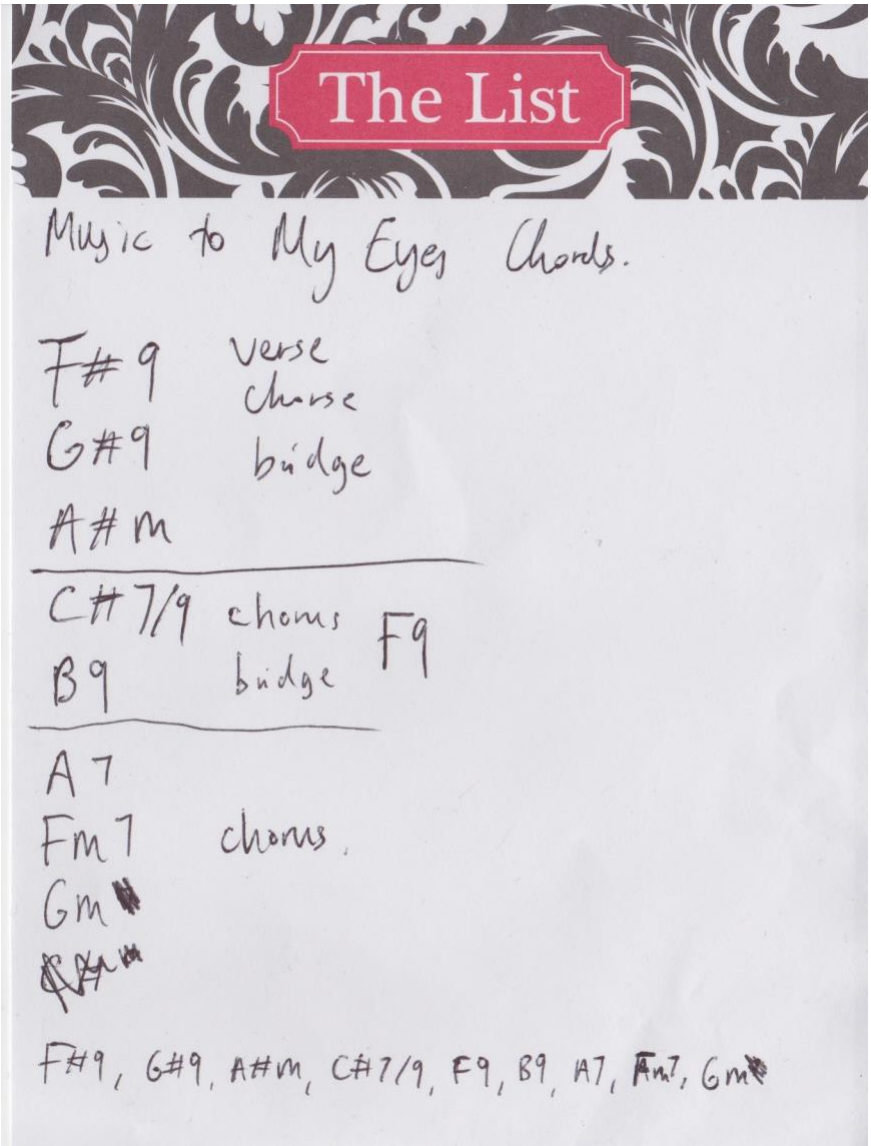


Fig 15. Written protocol made on notepad as natural part of practice



In total, 33 of the items of written protocol collected were selected for subsequent analysis.

5.4 Data type (b): Audio-Visual Recordings and Audio Recordings

The audiovisual recordings collected for this research comprise of audio and video recordings of myself working on creative musical practices including

composing, recording and mixing. Figures 17 and 18 show stills from screen-capture video recorded using the "Screen Recorder" in QuickTime, which additionally takes an audio feed direct from the soundcard and highlights mouse-clicks. I chose QuickTime screen recorder as the software I believed would be most practical in capturing the creative interactions with the DAW with the most clarity. Most of the screen-capture only features a view of the DAW interface, in appropriate scenarios the screen-capture also features a webcam feed. The webcam feed was implemented during creative activity that is not solely happening on screen; in Fig 18 for example I was transcribing chords from guitar to a software instrument and believed this activity was worth documenting. In some cases a separate camera is used in synchronisation with the screen-capture in order to document off-screen activity in more detail, this was also a useful method in circumventing the issue of CPU usage required to run the DAW, webcam program and QuickTime simultaneously. In total, 14 hours and 10 minutes of screen-capture footage was captured across 19 videos as represented in the figure below.

Fig 16. Breakdown of Audio-Visual screen capture

	Hours of screen-capture footage	No. of videos
Project #1	7 hours 10 minutes	8
Project #2	7 hours	9
Project #3	0 hours	0
Project #4	1 minute	2

Fig 17. Screen-capture

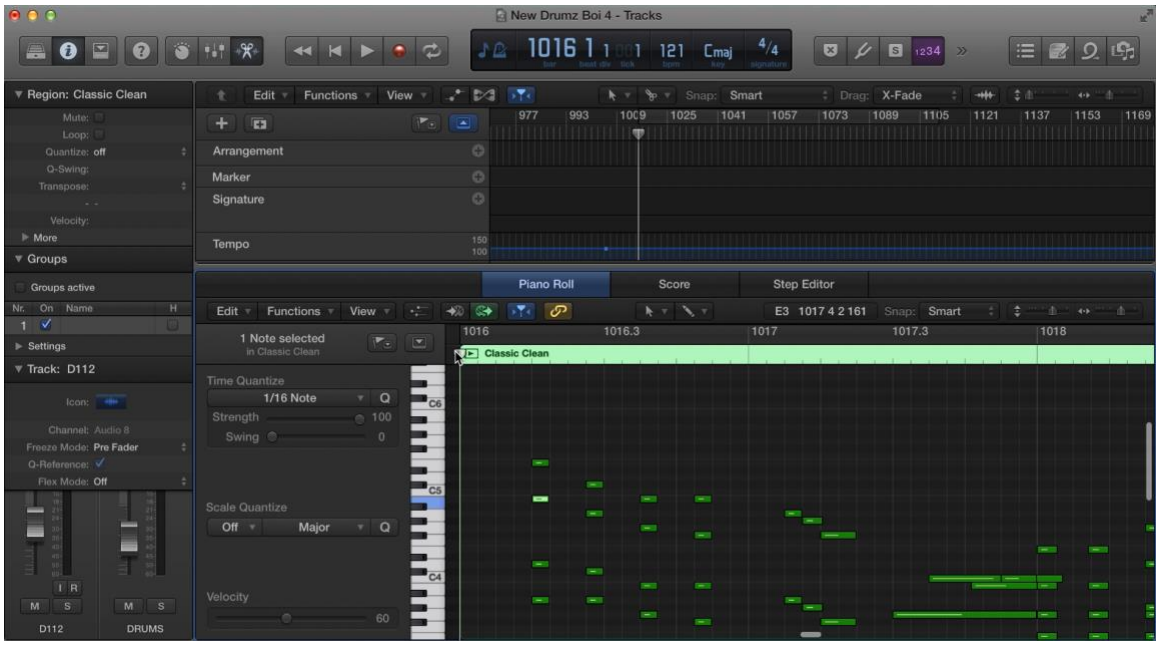
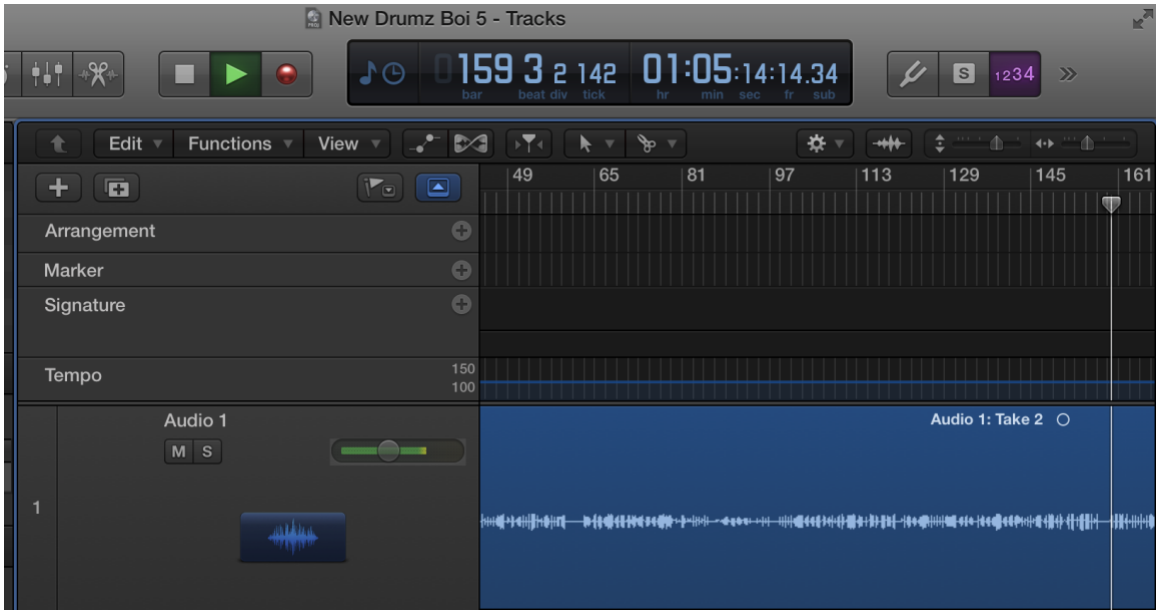


Fig 18. Screen-capture and webcam capture

Fig 19. Video capture

A consequence of collecting data through real-time audiovisual screen-capture was the masses of data that were collected and that had to be organized; in order to do this, a systematic criteria of selecting data was implemented (see: Data Analysis). Furthermore, while screen-capture allowed a moment-by-moment impression of certain tasks such as mixing, the restriction of having to conduct creative work in the DAW would have effected creative "flow" (Csikszentmihalyi, 1996). Therefore, an alternative method of capturing audio of creative work taking place was to conduct live recordings of the compositional process achieved through recording directly into Logic X. Real-time composition is captured by leaving a single take on a single track running of whatever instrument I am composing on, be it guitar, keys, or drums. In cases where it was not convenient to record into Logic X, I used a 'voice note' app on my mobile phone in order to keep a record of ideas as they happened and developed.

Fig 20. Live composition of drums captured in Logic

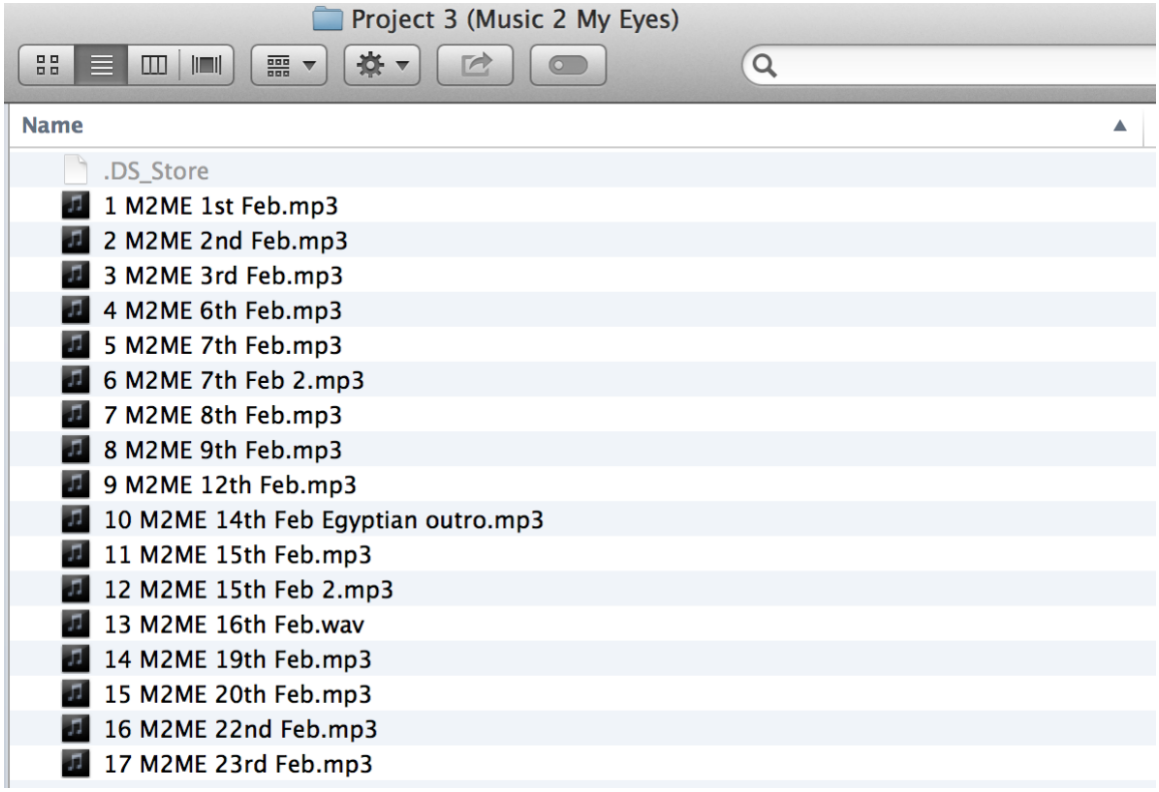


5.5 Data type (c): Audio Extracts

To demonstrate how the creative material has evolved over time, materials were exported at systematic intervals to highlight how they evolve temporally and how the ideas were narrowed down to the finalised musical artifact. To record the development of ideas, the audio material being worked on was systematically saved in .mp3 format in order to keep a record of its progression over time. Memos detailing the concrete and conceptual influences that led to the selection of certain materials and ideas over others accompany these extracts.

Creative output at various stages was organised into folders and dated as demonstrated in Fig 21 at various stages of development for comparison.

Fig 21. Folder of Bounces for Project #3 (Music 2 My Eyes)



6. Data Analysis

6.1 Overview

The data analysis is informed partly by the holistic approach of Eaglestone, who realises that a rich, clear set of data is able to speak for itself and that in a naturalistic setting, analysis is subjective (Eaglestone et al, 2002, p. 18). In using template analysis to develop a framework that acts as a template for others, Erlandson's comment regarding Emergent Category Designation applies: "The categories that emerge should be considered as one analyst's organization of the data. It is possible that no other scholar would discover the same categories" (1993, p. 118). For this reason, the study also integrates more systematic analysis methods used in other naturalistic analysis of music composition and production (Dobson, 2012; Eagleston et al, 2002; Collins, 2005; Keller, 2014).

In this research, the analysis is informed by three elements: template analysis guided by thematic analysis, mapping of the musical product, and structural analysis.

6.2 Template Analysis

Drawing on the methods used by Sawyer and Dezutter (2009) where criteria was introduced as a means of selecting material for analysis, episode selection was guided by a set of criteria, in turn framed by the research questions. Specifically, in order for data to be considered for analysis, an episode of data must meet a criteria outlined through template analysis (King, 1998). The "data sets" were selected for this study from a large body of past literature that already proposes outlines of various creativities and creative stages. Implementing template analysis as my method of selecting episodes for evaluation is founded on what is known to appear in longitudinal studies of computer-mediated musical creativity according to creativity theory and research and according to long-term studies of computer-mediated music practice. This thesis draws upon the creativity stages outlined by various researchers and consolidated in Explaining

Creativity (Sawyer, 2012, p. s) as a data set. To ensure that a template of previous literature does not limit this study, my study also introduces to the template any pattern of data not presently accounted for in previous models. Below is a list of potential creative stages that have been identified in my research and previous literature. In order for an episode or data item to be selected for analysis, the following creative categories are introduced for this thesis:

1. **Definition**: Described in past creativity literature as "Find the problem" (Sawyer, 2012) and "Posing questions" (Burnard et al, 2006) amongst others. In this thesis, an example of data featuring definition may consist of a record of "inner dialogue" (Wall, 2006) that indicates what I want to achieve or written protocol that maps out my aims. It may also consist of evidence of selecting tools to use or any record of "inner dialogue" where I decide whether to limit myself and how.
2. **Acquisition:** This is drawn from past literature that includes stages such as "Know the domain" (Sternberg, 2006) and "Exploring data" (Treffinger et al, 2000). This may consist of acquiring the know-how necessary in order to realise my ideas, for example listening to a "reference mix" or watching a tutorial on techniques for using music technology software. It could also incorporate practicing on an instrument or reading about any songwriting techniques.
3. **Generation**: This stage is almost unanimous amongst past models, which describe it most commonly as "generating ideas" (Sternberg, 2006; Sawyer, 2012; Treffinger et al, 2000). Examples of this stage may include scraps of ideas recorded as audio, written protocol featuring chord sequences, musical scores and audio-visual capture of compositional process among others. A generated idea could be anything from a simple lyric, melody or an entire song or structure or texture.
4. **Combination:** A stage drawn from past literature, which describes "Cross-fertilized ideas" (Sternberg, 2006) or "developing solutions" (Treffinger et al, 2000). In the case of this thesis, this stage constitutes the formulation of a structured piece out of many ideas, or layering ideas together.
5. **Incubation:** Previously described as "play" (Burnard et al, 2006) or "take

time off" (Sternberg, 2006). This constitutes "inner dialogue" that documents how time spent on an unrelated activity away from creative behaviour contributed towards the creative process. Written protocol that refers to potential track-lists or comparing ways of restructuring a track will be included in this stage, as well as any evidence of musical ideas or sonic manipulation that have been imagined as "auditory imagery" before being translated onto an instrument or plug-in. This stage also incorporates any evidence of a new idea regarding a project made after time spent at a distance from the work.

6. **Reflection:** Alternatively, "judging ideas" (Sternberg, 2006) or "select the best ideas" (Sawyer, 2012) amongst others. For example: returning to a previous stage of the process, to ensure the most suitable ideas have been selected; reflecting on whether I achieved what I set out to do, deciding whether my final mix is actually better than an early draft mix that potentially captured the spirit of the track or my intentions better; and any evidence of considering a project within context, deciding whether everything fits as a whole and whether the message and meaning of a piece is clear.
7. **Finalisation:** Deciding when a stage or overall work is finished. This step was added specifically for this thesis, a review of previous literature found that in previous models, the end point is rarely discussed or included.

Limiting the analysis of data to episodes that fit the above criteria allows the analysis of recorded material to be focused towards the specific research questions of this study. Specifically, it allows me to identify how the "creativities" (Burnard, 2012) involved in my personal computer-mediated music practice interact and also allows me to understand how they have been informed by the concrete and conceptual contexts around me.

Fig 22. Sawyer's Eight Stages of the Creative Process, and How They Correspond to Other Process Models informed the criteria implemented in the template analysis (2012, p. 89)

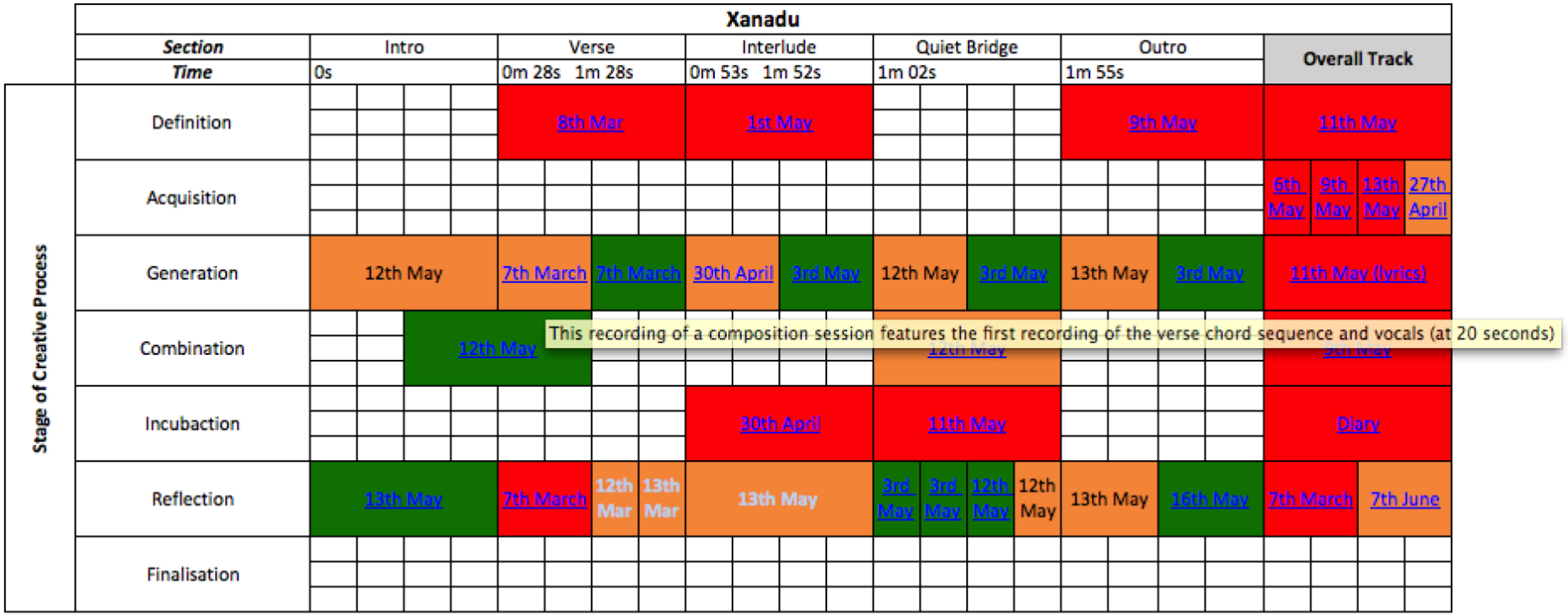
	Wallas (1926)	Creative Problem Solving (Isaksen, Dorval, & Treffinger, 2000)	IDEAL cycle (Bransford & Stein, 1984)	Robert Sternberg (2006)	Possibility thinking (Burnard, Craft, & Grainger, 2006)	UK QCA (QCA, 2005)	Synectics (Gordon, 1961)	Mumford's group (Scott et al., 2004)	IDEO (Kelley, 2001)
Find the problem		Framing problems	Identify problems, define goals	Redefine problems	Posing questions	Questioning and challenging		Problem finding	
Acquire the knowledge	Preparation	Exploring data	Learn	Know the domain			Groundwork	Information gathering	
Gather related information			Look		Immersion	Envisaging what might be	Immersion		Observation
Incubation	Incubation	Constructing opportunities	Explore possible strategies	Take time off	Play	Keeping options open		Concept search	
Generate ideas	Insight	Generating ideas		Generate ideas	Being imaginative	Exploring ideas	Divergent exploration	Idea generation	Brainstorming
Combine ideas		Developing solutions		Cross-fertilize ideas		Making connections and seeing relationships		Conceptual combination	
Select the best ideas	Verification			Judging ideas		Reflecting critically on ideas	Selection	Idea evaluation	
Externalize ideas	Elaboration	Building acceptance	Act and anticipate outcomes	Sell the idea, persevere	Self-determination		Articulation of solution, development and transformation, implementation	Implementation planning and action monitoring	Rapid prototyping, refining, implementation

6.3 Mapping of the Musical Product

Drawing on the sociocultural (Amabile, 1996) approaches of TaCEM (2015) and Eaglestone et al (2002) of conducting the analysis of a work within recognition of broader context, it is important for my own analytical methodology to acknowledge the personal and socio-cultural influences that have influence on my creativity.

One method of understanding the creative process is to illustrate how the work developed over a period of time. The structures of the projects are therefore represented on interactive maps (see Appendix) and feature hyperlinks to data that demonstrate how the material was generated. Hovering over the hyperlink opens an explanation of how the data relates to a corresponding creative category as outlined in the template earlier. In the interactive content provided, it is possible to navigate from the overall mapping of the musical product to *micro* Gandtt charts of selected episodes of audio-visual recordings (represented using hyperlinks with an orange background). This allows certain elements to be viewed in greater detail. Written notes, still images, real-time audio recordings and audio extracts can also be accessed through the hyperlinks. The interactive content is intended to provide further clarity to the findings of this research and can be accessed via the Google Sheets link in the appendix.

Fig 23. Mapping of Musical Product



6.4 Structural Analysis

Structural analysis is derived from Collins' graphical representations of thematic placement over time as a method of analysing musical structuring; in his paper, a global view of "the individual building blocks of the composition – melody, rhythm, instrumentation, etc. – have been subsumed into larger elements." (Collins, 2005). In my study, structural analysis was a useful tool in representing the chronology of creativities from a global perspective (viewing the creative process of each track as a whole), and representing small-scale interactions and observing mixed practice and multi-tasking within each individual audio-visual episode.

In this thesis, the structural analysis is presented as Gandtt charts created in Excel for each project, representing the different processes through which each track was developed on a chronological timeline. There are two types of charts: *micro*, which maps the moment-by-moment thematic content of specific audio-visual episodes selected for analysis (Fig 24); and *macro*, which surveys the overall longitudinal development of a selected track and refers to thematic mapping of the content of written protocol, audio extracts and audio-visual episodes (Fig 25).

Fig 24. Gandtt Chart: Micro representation of moment-by-moment creativities observed within episodes of audiovisual recordings

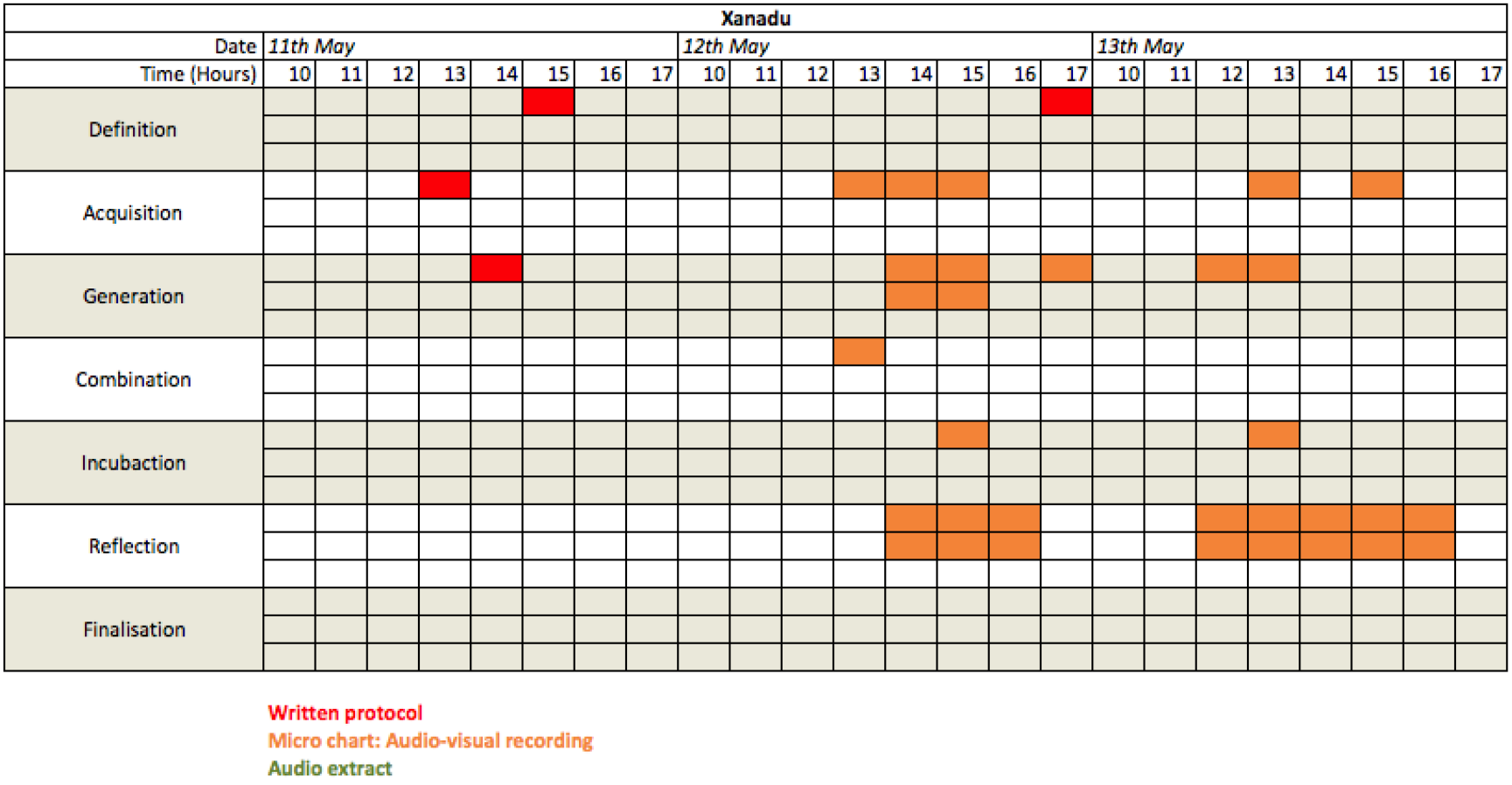
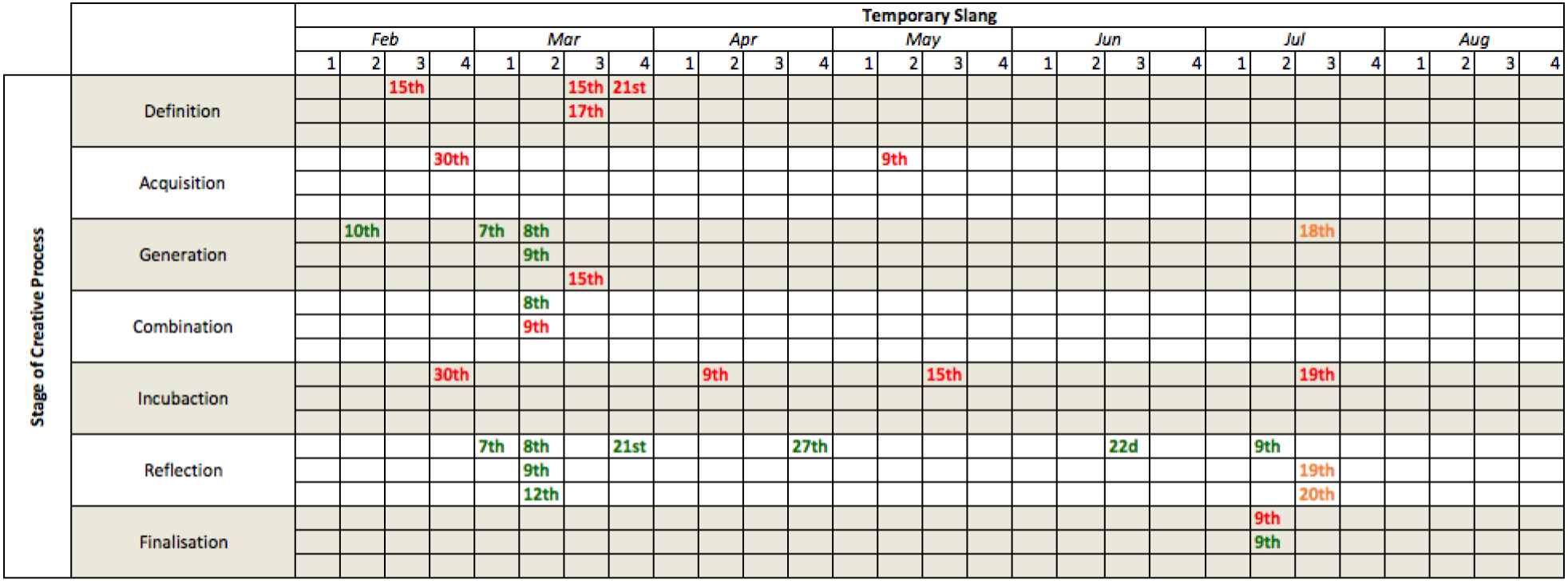


Fig 25. Gandtt Chart: Macro representation of longitudinal creative development observed via various data types over the course of the study



7. Findings

7.1 Overview

This thesis has discussed previous literature relating to the topics of computer-mediated music practice and creativity, outlined aims and questions, and presented and discussed the implementation of a methodology. The following chapter presents an overview of the findings of the data collection and analysis.

In response to the research questions the most salient characteristics of my computer-mediated musical creativity were identified: the chronology, direction of flow between creative stages and time spent on my creative activity is intuitive and context dependent; concrete and conceptual resources both had an observable and potentially malleable influence on my computer-mediated music practice.

These are not externally relevant findings, but findings used for my own reflection of process and outcome. Subsequently I offer the framework tentatively as a model of my computer-mediated musical creativity, but one that is based on a deep engagement with creativities literature, from the point of view of a practitioner who has experienced these ideas through practice.

7.2 How do I define the creativities and creative process involved in my personal computer-mediated music practice?

Framed by Sawyer's consolidation of various creativity models (2012, p. 89) as well as his own "Zig-Zag" framework of creativity (2013, p. 6), this chapter examines the nature and chronology of the creative stages identified in my computer-mediated music practice through template analysis (King, 1998). It focuses on the flow of creative activity, with focus on both moment-by-moment and longitudinal instances of the following stages: *Definition, Acquisition, Generation, Incubation, Reflection* and *Finalisation.*

Understanding my creative stages

This section firstly engages with the identification and understanding of each creative stage and its position and function within the context of my overall creative process. Sorting and coding items and episodic content across data types (a) through (c) revealed that evidence of every creative stage highlighted in the template analysis criteria was present in all four projects. This meant that the attributes of the creative stages could be compared between each project at a micro and macro level. Patterns in these findings are subsequently compared to models of the creative process that informed the template analysis criteria. The following section breaks down and analyses findings corresponding to each of these creative stages.

Definition

Through template analysis, many items of written protocol corresponding to each project were found to fit into the category of definition. In some cases definition was observed as a proposal of ideas for a specific section of a project. One item of written protocol recorded as part-of-practice, discusses the interlude of Project #2 (Xanadu): "Want to create a sci-fi sounding interlude with huge synths which gives way to a distorted, krautrock sort of element". Another example of definition as an act of determining the aims of a section is reflected through discussion of the verse of Project #3 (Music 2 My Eyes): "Try to make it spooky and moody". For Project #1 (Temporary Slang), examples of definition which refer not only to a section of a piece but the piece in it's entirety were also documented through written protocol, for example: "To Do. Temp Slang doesn't sound right. Will try to come up with different drum groove and go from there". Largely, the instances of definition recorded through part-of-practice written protocol either comprise of mapping the aims of a project (Fig 26), defining a problem (Fig 27) or offering a solution to a problem (Fig 28).

Fig 26.

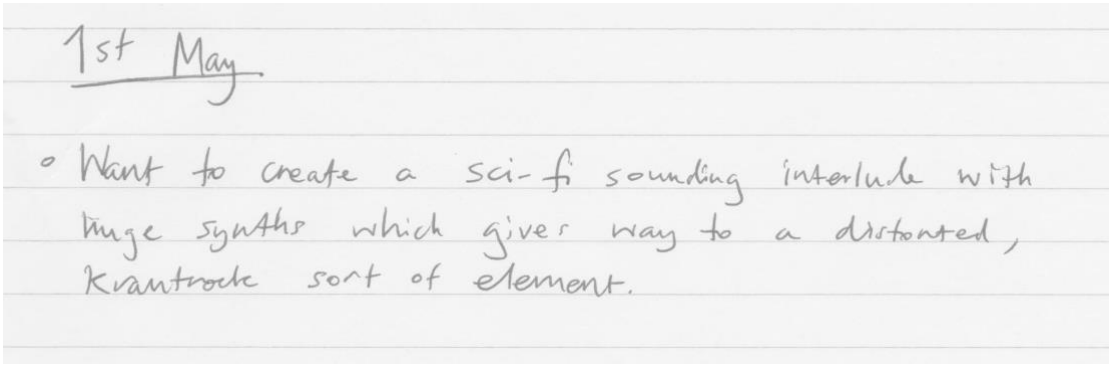


Fig 27.

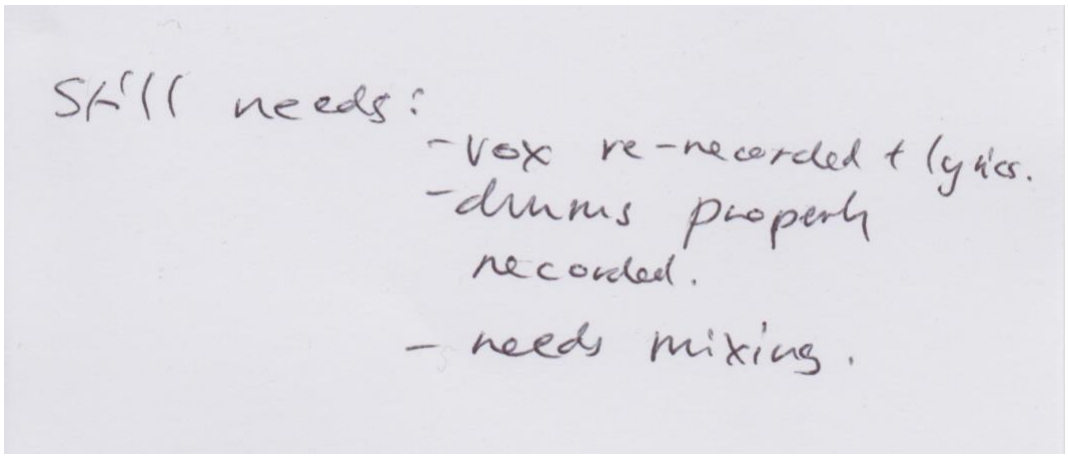
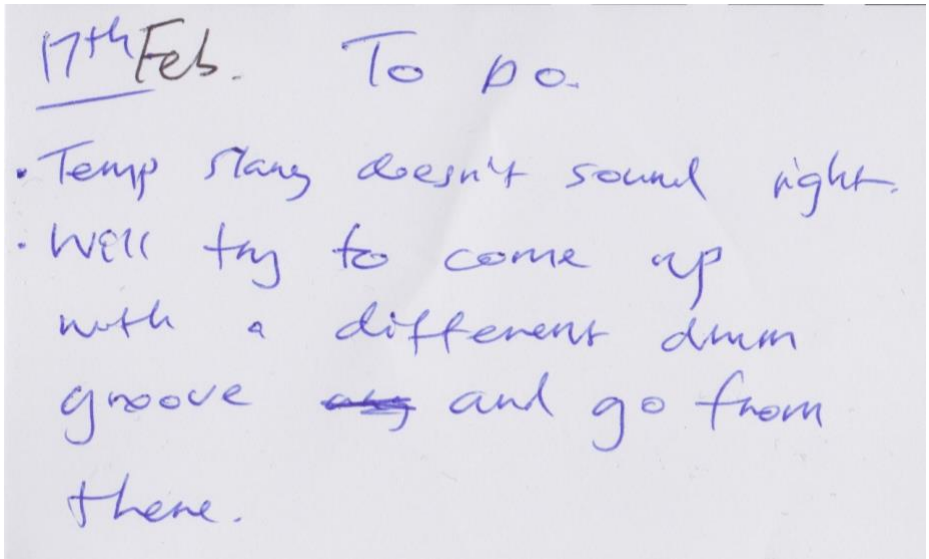


Fig 28.



Acquisition

Several examples of an acquisition stage were identified across all projects. Prior to data analysis, it was thought that as a conceptual task, acquisition would only be observable through analysis of written protocol. However, several audio-visual recordings demonstrate how I was learning and practising drum-parts based on MIDI drums that had been programmed for demos (see Audio Recording 1). Practising drums gave me a level of "know-how" on the instrument, enabling me to record live drums for three of the Projects (#1, #2 and #4). Other examples of acquiring know-how include making lists of music and ideas I was influenced by (Fig 29) for certain projects and in some cases making Spotify playlists of this material (Fig 30).

Fig 29.

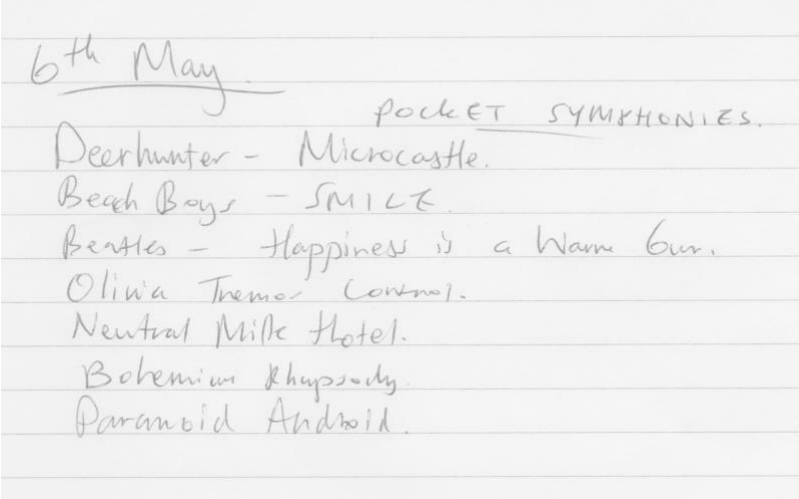


Fig 30.

These playlists were used to study the techniques of other songwriters, musicians and producers in cases where I sought to employ similar techniques in my own project. For example, the jazzy, harmonic textures of Tesla by Flying Lotus were appropriated into the composition and production of the Rhodes piano part in the pre-chorus of Project #4 (Blindness) (see Audio Extract 1).

Audio-visual recordings also highlight the moment-by-moment acquisition of knowledge that took place during creative activity. An example of this was found through activity consisting of me deciding on which software instrument to use (see Audio-Visual Recording 1). This finding corresponds to what Arvaja describes as the "concrete situation" (2007), the suggestion that know-how of physical tools mediates meaning-making. In this example, know-how gained through listening to the sonic content of different plug-ins was implemented through the imagined future use of music technology.

Generation

Analysis of the data identified instances of idea generation throughout every data type. Through recording written protocol I was able to capture the composition of lyrics for Projects #1 and #2, while audio-visual recordings and screen-capture captured a wide range of idea generation such as the development of rudimentary chord sequences (see Audio Recording 2) and melodies (see Audio-Visual Recording 2). The analysis of audio extracts subsequently illustrated how these ideas contributed towards the finished arrangements of full sections.

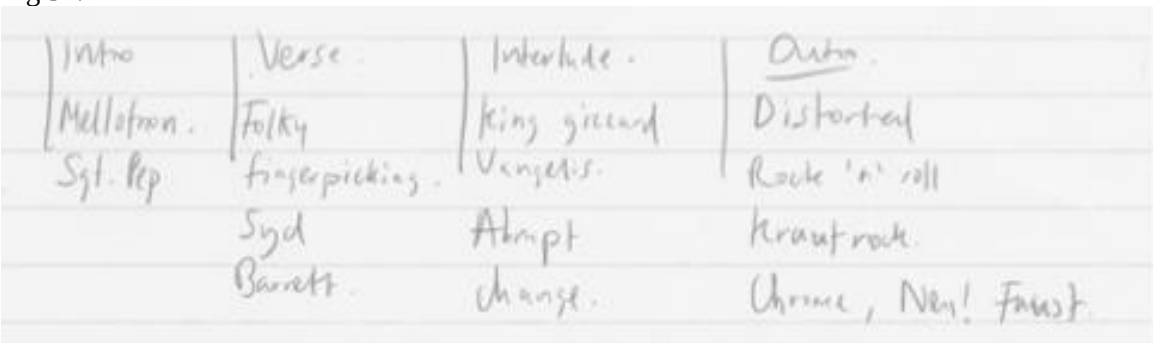
In most cases, the generation of ideas would emerge with a full arrangement in mind. For example, for Project #2 (Xanadu) I made a demo recording of the composition in a single live take on guitar and vocals only, but with the bass and drum parts being imagined in my head (see Audio Recording 3). This technique is also illustrated by a memo recorded on the 3rd June discussing the techniques used to compose Project #4 (Blindness): "Began the composition on drums which is unusual for me. As I recorded a demo track for the drums, I was playing along to the song as I imagined it in my head, so that when it came to laying down other instruments as I was hearing them, the structure would already be in place and I wouldn't have to edit or

re-record drums" This is arguably an example of how "auditory imagery" can be useful in the process of generating ideas that are intended as a single part of a layered arrangement. Since I composed and recorded all the material for Project #4 (Blindness) individually using multi-tracking, the ability to imagine the performances of other instruments was integral to generating ideas with a full arrangement in mind.

Combination

It was found through analysing the data that the process of combining ideas was integral to my compositional process. This is arguably due to a fundamental part of my compositional process involving the cannibalisation of pre-existing demos that I feel are unfinished in some way. My intent in combining and re-using contrasting sections of existent material is described in written protocol discussing Project #2 (Xanadu), which is perhaps the most extreme case of this compositional process: "Pocket symphonies. (Heroes + Villains, Cabin Essence, Surf's Up, Good Vibrations etc. […] Sketch like, sudden changes. Happiness is a Warm Gun - The Beatles. Paranoid Android - Radiohead. SMiLE cuts between different recordings with totally opposing ambience, localisation, texture etc. I want to do that". This item of part-of-practice written protocol demonstrates the influence of external music on my explicit experimentation with combining unrelated materials and contextual resources to produce unconventional song structure. The Beach Boys' *Smile Sessions* (2011) were of significant influence in the process of composing Project #2. The Figure below demonstrates the thought process regarding the combination of different influences and genres to produce the contrasting sections.

Fig 31.



Through implementing this technique, my aim was to create more interesting material by combining sequences with opposing harmonic content and rhythms.

Incubation

Of all the accepted creative stages that informed the template analysis, incubation was the most difficult to capture using the methodology introduced by this thesis. This is because inherently, incubation is a form of creativity that involves no direct interaction with any creative tools or music technology (Saywer, 2012). It was expected that incubation would be identifiable in written protocol, but much of the part-of-practice notes captured in periods of non-direct creative activity were instead categorised as either definition or acquisition. In all, only 6 items of data (all written protocol) were deemed to include evidence of longitudinal incubation, which is not to say that incubation is an unimportant stage of the creative process.

To the contrary, written protocol offering an overall diary of creative work across all of the projects discusses how my playing drums in a covers band allowed me to get out of my "comfort zone" and "helped me get out of writers block with my own material". During one incubation period that occurred between 21st March and 25th April according to the diary, I mixed a track I had played drums on outside of my usual creative projects which offered me a both a break from my usual pattern of creativity and an opportunity to use software and techniques I would not normally decide to use.

The influence of incubational periods is supported by findings in Eaglestone's research. "There was evidence in all observations that a lot of the creative process is happening away from the computer, e.g. between computer based composition sessions and during field recordings." (Eaglestone, 2002, p. 32). In regards to my own practice, it could be argued that the incubational activity of distancing myself from the projects involved in this thesis guided the acquisition of know-how both in terms of improved drumming proficiency and experience with software. Subsequently, this know-how demonstratively influenced the projects involved in this thesis. This is evident in a memo recorded after another period of incubation, which

states that I had “loads of ideas and did loads of work” after some time away from the projects. These findings arguably demonstrate a tentative link between acquisition and incubation, as periods of incubation appear to coincide with the acquisition of know-how. This would explain why periods away from the creative projects associated with this thesis were proceeded by periods of prolific idea generation.

As demonstrated by episodes of audio-visual screen-capture (see Audio-Visual Recording 3), instances of incubation were more obvious in moment-by-moment practice and were a useful method of alleviating listener fatigue.

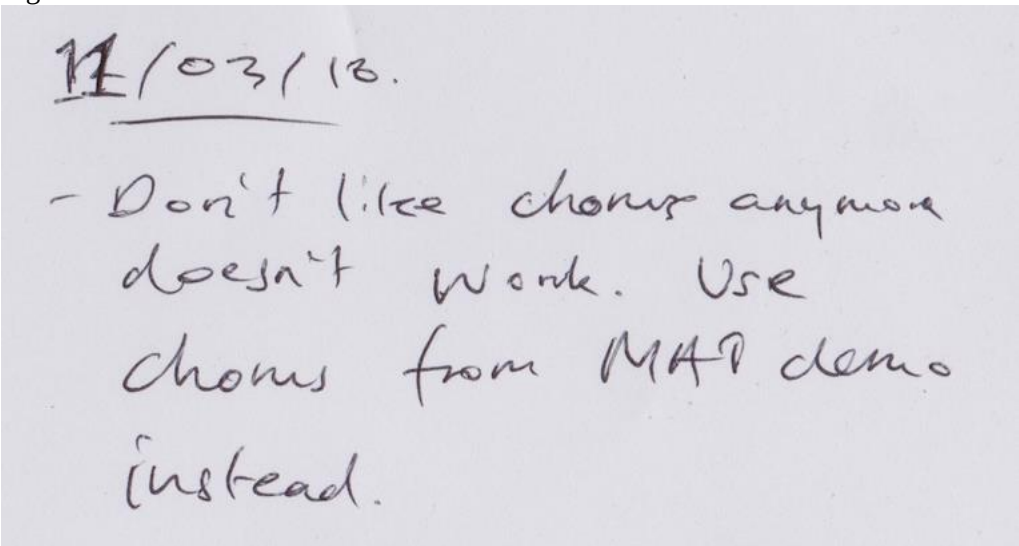
Reflection

It was found through analysis that the reflection stage was one I relied on extensively throughout my creative process. In some cases, over a longitudinal timeframe, projects went through several revisions where a section of a project or the project in its entirety was re-worked or re-recorded. The several versions of Project #1 (Temporary Slang) demonstrate this process (see Audio Extracts 2 - 5).

In the case of my computer-mediated music practice, it was not unusual for the final music product to have deviated vastly from the initial generation of ideas that formed its basis. This is illustrated through comparisons between early demos of Project #1 (Temporary Slang) (see Audio Extract 2) and the final musical product (see Audio Extract 6).

One interesting finding was the amount of ideas that were fully developed before they were either consciously scrapped, or fell out of consideration unconsciously. For the purposes of presenting these instances with clarity and chronology, data which illustrates the generation of these ideas is categorised in the analysis and interactive tables and charts as part of the “Generation” stage. Evidence of a decision to drop these ideas, or a decision to revisit them or replace them within an existing project entirely was categorised as part of the “Reflection” stage, an example of this is shown in the figure on the following page.

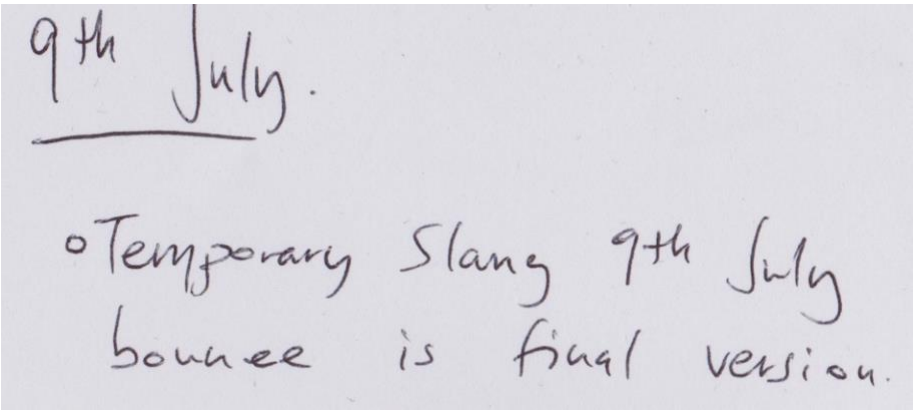
Fig 32.



Finalisation

This stage of the creative process is not featured in any literature reviewed in previous chapters and was therefore devised for the purposes of this thesis. For this reason, it was not as easy to identify data that fit this category without a pool of previous literature to draw from in its definition. Therefore, only a small proportion of data was find to correlate to this stage. This data consisted of audio extracts representing the completed composition or mix of a project, and two instances of part-of-practice written protocol which corresponded to finalisation as shown in the example below.

Fig 33.



Understanding the chronology and direction of my creative process

This section compares how my creativities correspond to models presented in previous literature which demonstrate both linear frameworks (Osborn, 1963) and more intuitive expansions of those models (Sawyer, 2012). Patterns in the data are explored in relation to the chronology and direction of my creative process and consideration is also given to how time contributed as a factor in my computer-mediated music practice.

Chronology

Through systematic analysis and presentation of the data through Gandtt charts and deconstructions of the musical product, patterns of data revealed that while my overall creative practice reflects chronological models of creative process (Osborn, 1963) to an extent, there is undoubtedly also a reflection of a more meandering, sporadic flow between these steps. Comparing the Gandtt charts shown on the following pages, we can see that this process happened not only on a moment-by-moment basis as observed in episodes of audio-visual screen-capture, but across more longitudinal time-frames ranging from anywhere between a day (fig 34) to six months (fig 36).

Fig 34.

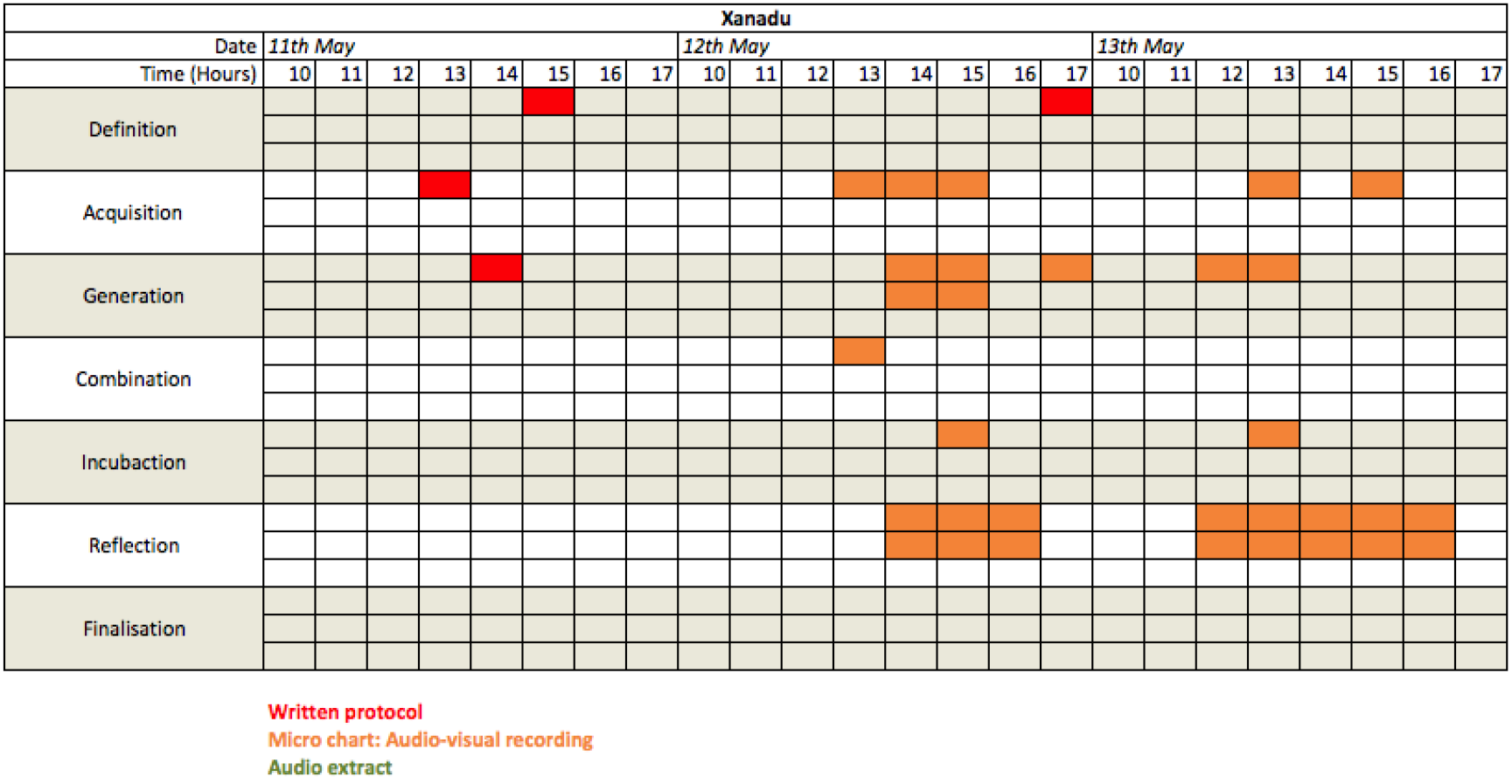

Xanadu
Date
11th May
12th May
13th May
Time (Hours)
10 11 12 13 14 15 16 17 10 11 12 13 14 15 16 17 10 11 12 13 14 15 16 17
Definition
Acquisition
Generation
Combination
Incubaction
Reflection
Finalisation
Written protocol
Micro chart: Audio-visual recording
Audio extract

Fig 35.

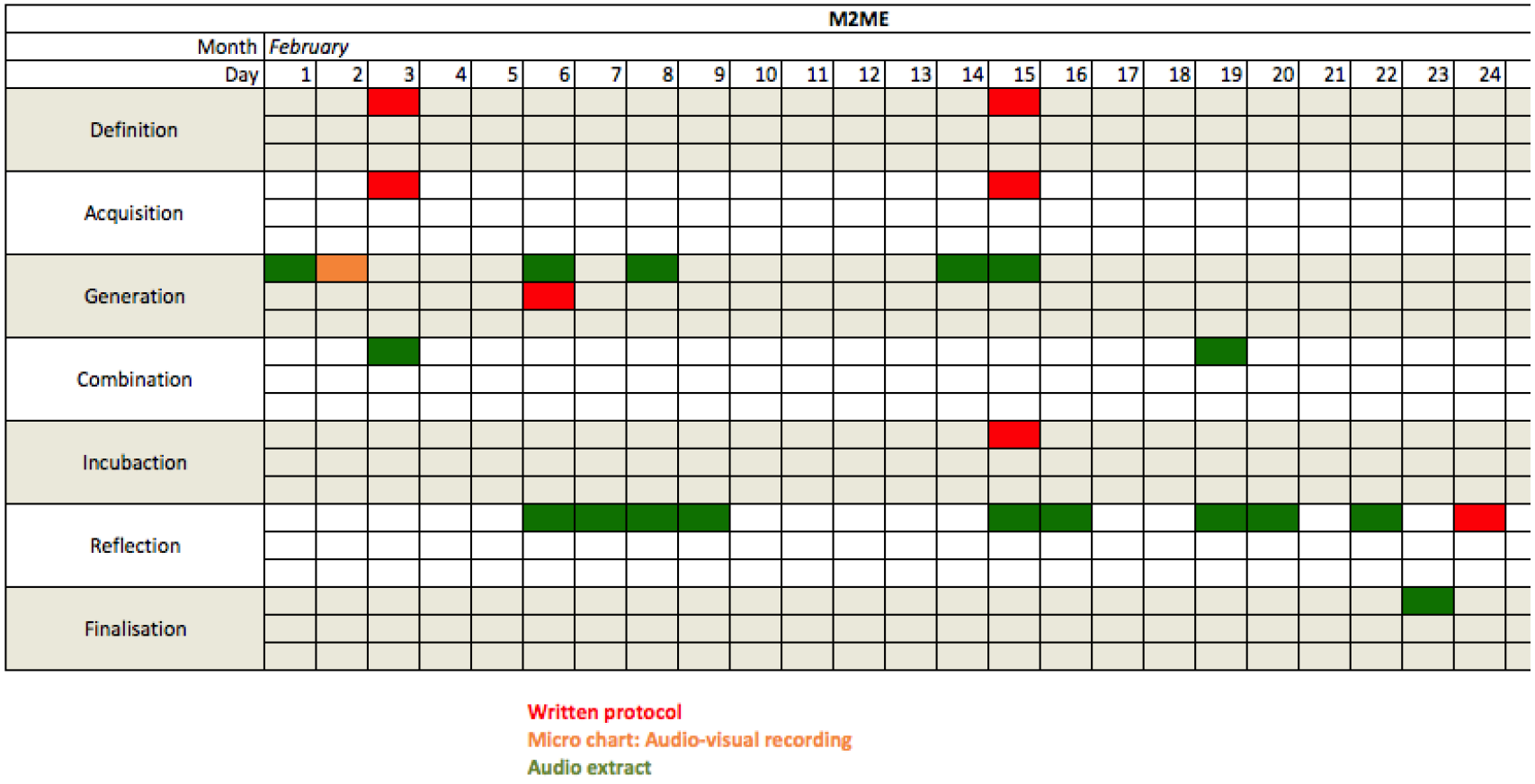
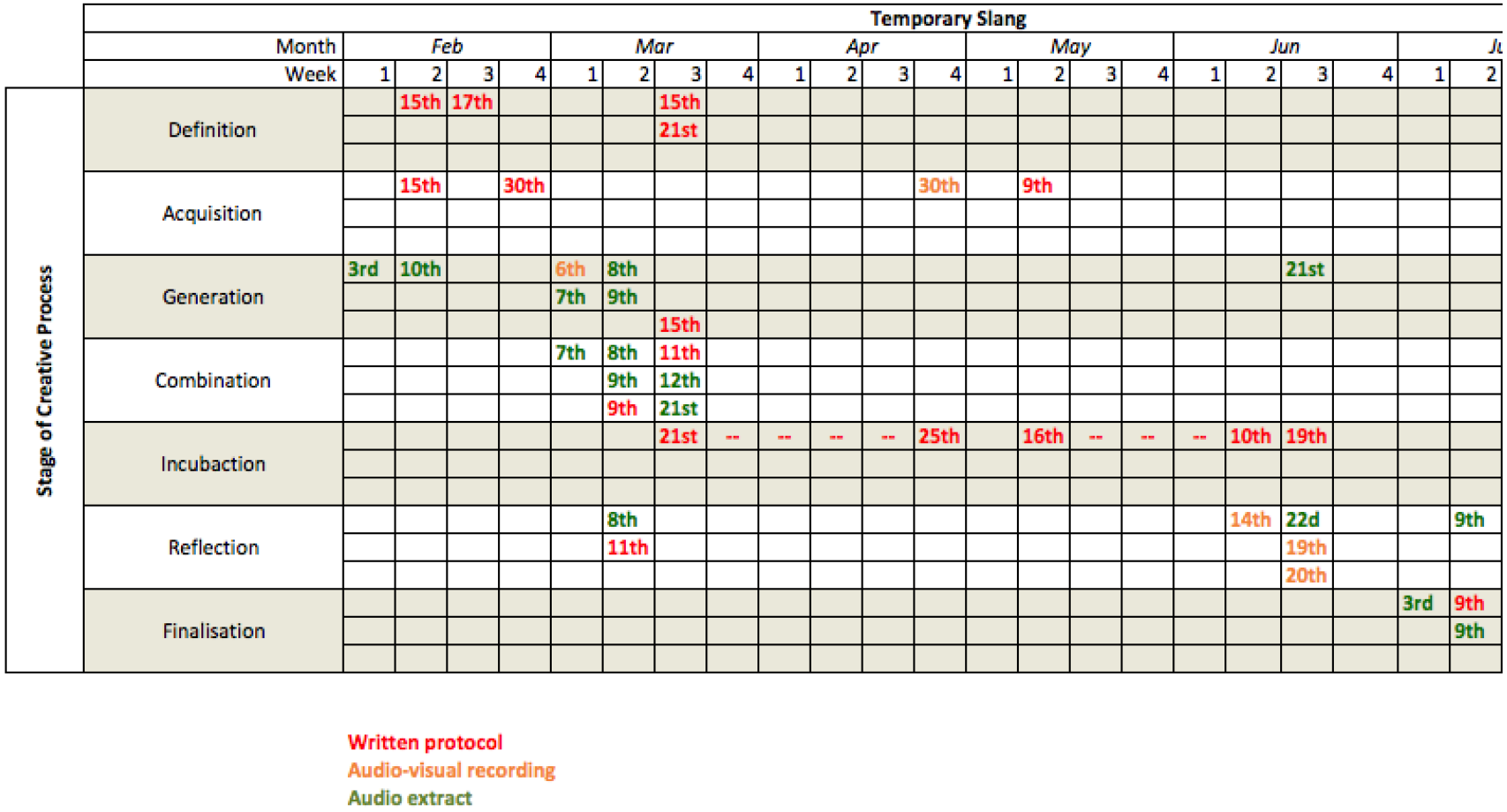
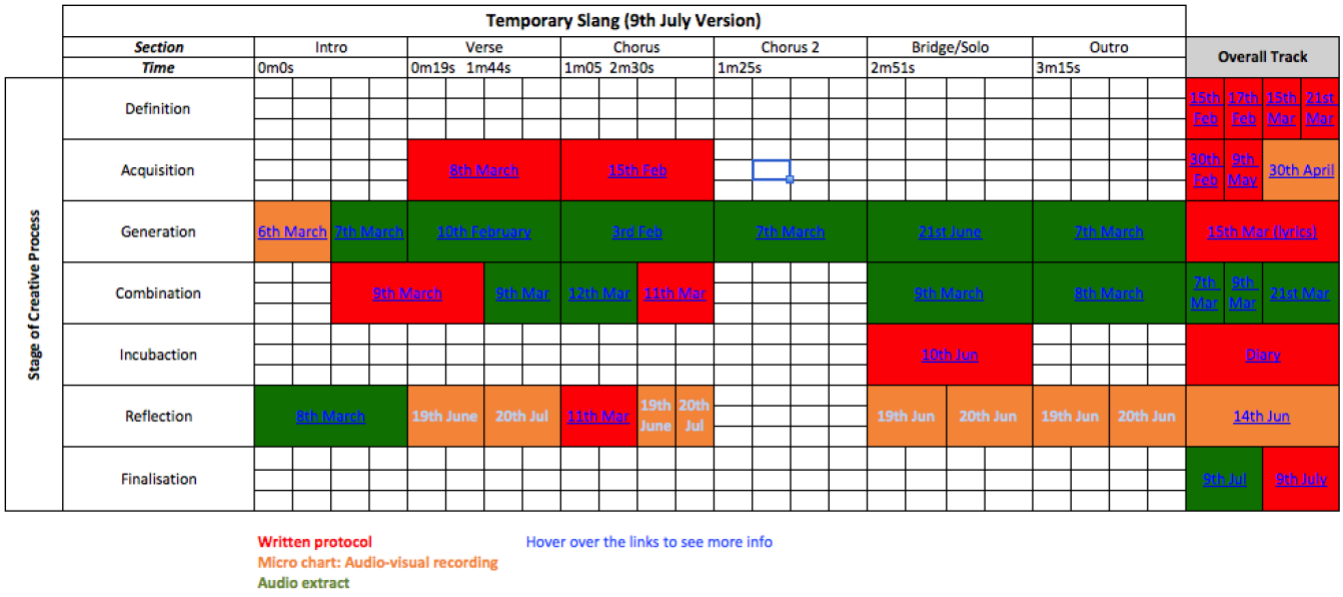

M2ME
Month
February
Day
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Definition
Acquisition
Generation
Combination
Incubaction
Reflection
Finalisation
Written protocol
Micro chart: Audio-visual recording
Audio extract

Fig 36.


Temporary Slang
Month
Feb
Mar
Apr
May
Jun
Week
1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2
Stage of Creative Process
Definition
15th 17th 15th
21st
Acquisition
15th 30th 30th 9th
Generation
3rd 10th 6th 8th 21st
7th 9th
15th
Combination
7th 8th 11th
9th 12th
9th 21st
Incubaction
21st -- -- -- -- 25th 16th -- -- -- 10th 19th
Reflection
8th 14th 22d 9th
11th 19th
20th
Finalisation
3rd 9th
9th
Written protocol
Audio-visual recording
Audio extract

Incidentally, as observed in the interactive material shown in the figure below (and more easily visible on page 69), the order in which the sections of each project are developed tends to bare no resemblance to the order in which the track is structured. This finding is arguably in accordance with the non-linear chronological progression of my creative progress. The non-linear compositional process through which the structure emerges also reflects what Folkestad (1997) termed as a "vertical" compositional strategy, whereby each strip or section of a piece is fully composed, arranged and expanded before working on the next. This is illustrated by a bounce of the initial version of the verse to Project #3 (Music 2 My Eyes) which was fully composed, arranged and mixed independently of any other sections (see Audio Extract 7).

Fig 37.



The process through which every project was developed began was either through definition, acquisition or generation. This was followed by discursive navigation between various creativities in progression towards reflection and finalisation as the projects neared completion.

In a longitudinal example, Project #4 (Blindness) began with idea generation on the 25th May when basic chord and melody phrasing was developed prior

to any evidence of the definition or acquisition stages (see Audio Extract 8). A playlist of reference tracks was then made on the 4th June to more succinctly influence the composition and production style of the track, and by the 8th of June, more concrete definitions were made in terms of the style of the track. Written protocol recorded as part of practice suggested that the piece should feature "contrast between jazziness and funkiness with sections which are more rugged and riff based" and "lots of sections but no clear verse-chorus, conventional structure." Following this, the chord sequences from the 25th May demo were re-written to create more tension as a reflection of this ruggedness and in appropriation of the moodier atmosphere of the material drawn on from the playlist. This example is interesting as it demonstrates the definition, acquisition and generation stages appearing in an opposing chronology to the progression anticipated by linear models of the creative process presented in previous literature (Osborn, 1963; Sawyer, 2012). It also highlights a common theme found in much of the data, the exploratory generation of concrete musical ideas mediating a more concise definition of a project's conceptual aims.

Idea generation influencing definition

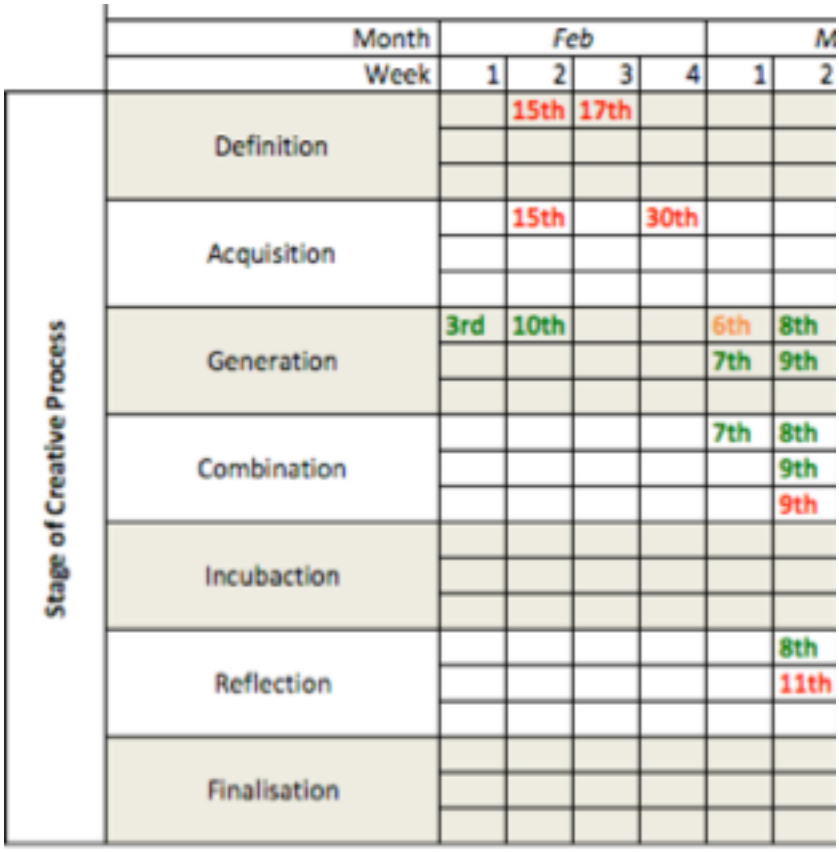
Perhaps the most illustrative example of idea generation informing definition was noted with Project #1 (Temporary Slang). The process of developing this project began with the generation of a chord sequence, vocal line and lyric, which were later recorded as part of a fully arranged demo on the 10th February. A memo recorded on the 15th February describes this: "Have come up with a decent chord sequence which goes with some nice vocals. The line "temporary slang" sticks out to me. I came up with it out of nowhere, the words sounded good with the melody. Has a similar melody to UMO-Secret Xtians. Would make a good last track on the album". Written protocol recorded as part of practice was made on the same day, reading "TO DO: Temporary Slang: […] The way the chorus is sung sounds like a warning? Or an 'I-told-you-so', keep this in mind for the rest of the song". In accordance with these definitions, the project developed from a piano and guitar-based composition influenced by the Beatles (Fig 38) into a more foreboding, atmospheric composition shrouded in effects (see Audio Extract 6).

Fig 38.

- Temporary Slang 2:40 beatles

The lyrics, chord sequences and production of Project #1 from March onwards were built around the "warning" and "I-told-you-so" definitions recorded in written protocol at the time of initial idea generation. The chronology of this process is illustrated by the figure below.

Fig 39.



In this example, we see that it is at least the case in my own computer-mediated music practice that it is possible for the formulation of some musical and lyrical ideas to take shape prior to any concrete definition of the aims of a piece. Arguably in this case, the definition stage happened spontaneously and unconsciously as part of an early generation of ideas and the subsequent definitions then guided the following creative work.

It is also of note that throughout the development of Temporary Slang, the generation, combination and reflection stages informed definition not only at the outset of work on the project, but even following the composition and recording of the bulk of the musical content. By the 21st March, after several versions of the track had been recorded with different tempos (discussed as V1 through V4), written protocol recorded as part of practice documented further evidence of the definition stage: "be stricter with myself, narrow it down to a definitive version […] decide between V3 + V4. Still needs: vox re-recorded +lyrics. drums properly recorded. needs mixing". This item of written protocol evidences further definition happening in conjunction with reflection. In accordance with the content of the written protocol, the project was narrowed down to a definitive version and draft mix. Following a period of incubation, several elements of Project #1 (Temporary Slang) were re-recorded and some minor reflections were made in regards to the mix (see 19th, 20th, 21st June). In this sequence of events it can be observed that in my computer-mediated music practice, definition is not only important in outlining the initial ideas of a piece, but also as an aspect of the final stages of reflection and finalisation.

Time as a factor

As most of the projects remain unfinished upon the conclusion of this thesis, it is difficult to systematically provide comparison between the times taken to progress through the creative stages. However, in the data presented through this research, it is clear that alongside the varying directions of the creative process between each stage, there are disparities in the length of time it took to develop each project. The full compositional structure of Project #1 for example emerged gradually and intermittently over the course of five months. The breakdown of when each section of the project was composed is disclosed in the Figure below.

Fig 40.

Temporary Slang (9th July Version)								
Section	Intro		Verse	Chorus	Chorus 2	Bridge/Solo	Outro	**Overall Track**
Time	0m0s		0m19s 1m44s	1m05 2m30s	1m25s	2m51s	3m15s	
Generation	6th March	7th March	10th February	3rd Feb	7th March	21st June	7th March	15th Mar (lyrics)

At the time of composing and recording, it was also observed that it took longer than usual to compose and structure Project #3 (Music 2 My Eyes). One memo observes:

"It took me a day to come up with literally two chords for the pre-chorus of *M2ME*; and the verses went through many revisions before I eventually settled back to the first version. The chorus took forever to reveal itself, it sprang out of nowhere in a true "eureka" moment. Just jamming around an idea. I had been focusing on just coming up with a guitar part I could later sing over. Spontaneously deciding to sing while playing guitar was what resulted in the chorus. Instant ideas such as this are the ones I normally settle on, if it comes fully formed from nowhere that quickly, I assume it has some value."

This finding discusses how the chorus, which is comprised of 5 chords and is over 30 seconds long, was generated spontaneously and serendipitously. Conversely, it took an entire day to come up the opening two chords (Amaj 7 and Fmin 7) and melody of the pre-chorus, which takes up only 10 seconds of the recording each time it is repeated. This is one example of many in this thesis that could be used to demonstrate that no real pattern was observed in the amount of time dedicated to the stages of the creative process in my computer-mediated music practice.

One interesting finding however is a pattern observed in the Gandtt charts representing how time was spent on creative activity throughout the development of Project #3 (Music 2 My Eyes) over the course of a month and the development of Project #1 (Temporary Slang) over 5 months. The charts are annotated to illustrate the generalised flow between creative stages.

Fig 41.

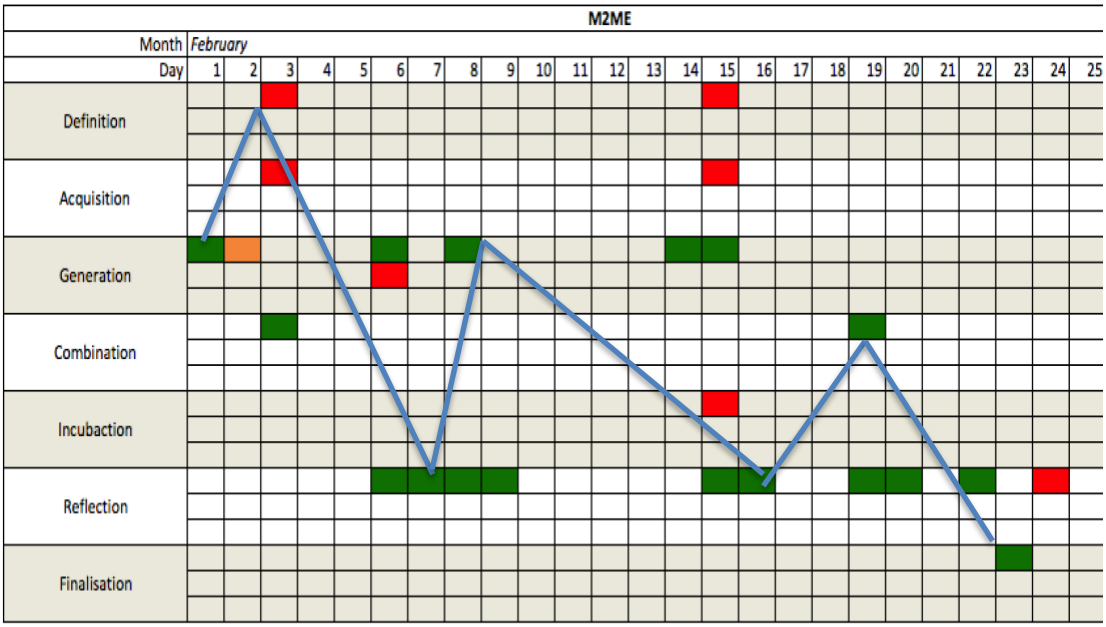
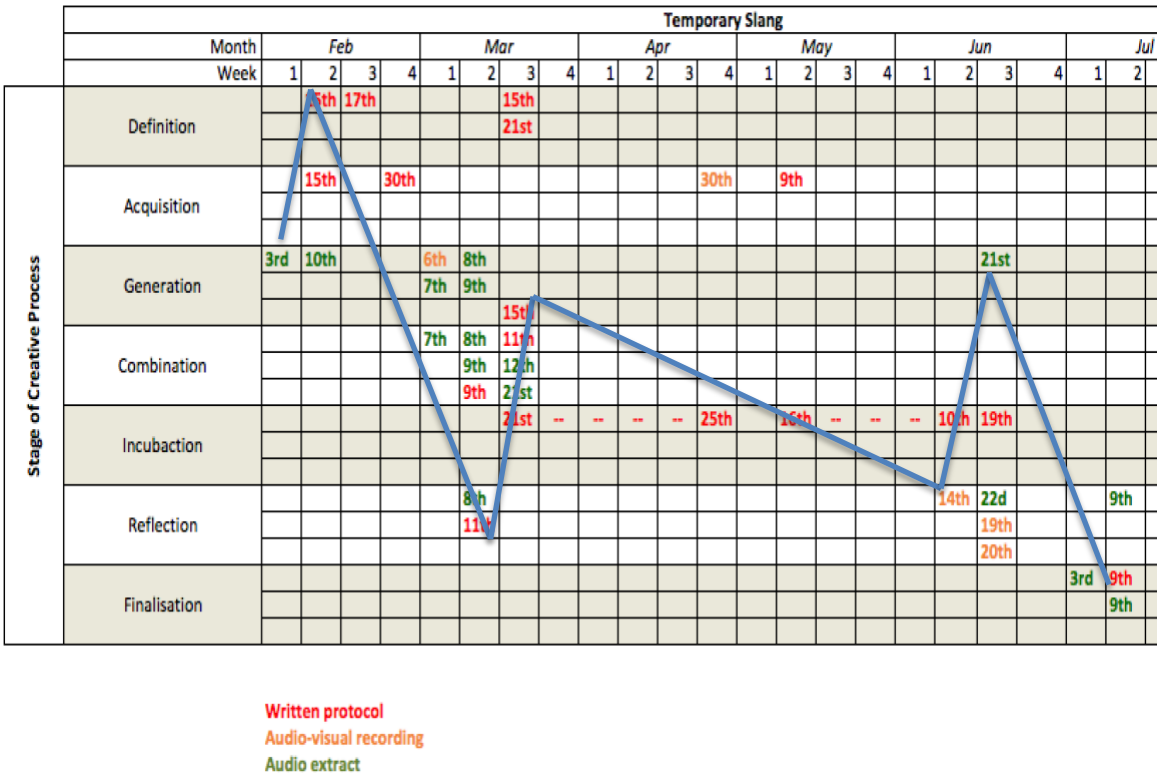

M2ME
Month February
Day 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Definition
Acquisition
Generation
Combination
Incubaction
Reflection
Finalisation
Written protocol
Micro chart: Audio-visual recording
Audio extract

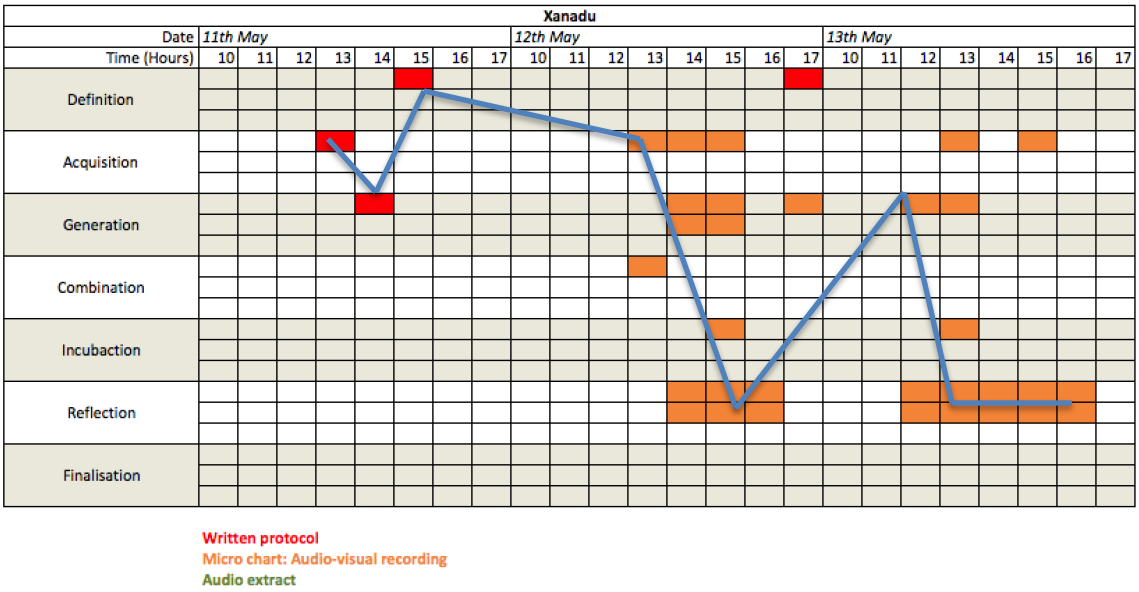
Fig 42.


Temporary Slang
Month Feb Mar Apr May Jun Jul
Week 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2
Stage of Creative Process
Definition
Acquisition
Generation
Combination
Incubaction
Reflection
Finalisation
15th 17th 15th 21st
15th 30th 30th 9th
3rd 10th 6th 8th 21st
7th 9th
7th 8th 9th 9th 21st 25th 14th 19th
8th 14th 22d 9th
19th
20th
3rd 9th
9th
Written protocol
Audio-visual recording
Audio extract

The comparison illustrates that while the amount of time dedicated to activity was different, the overall progression between activities shown on the Gandtt chart of Project #3 (Music 2 My Eyes) could arguably be viewed as a compressed version of the activities of Project #1 (Temporary Slang). Each project began with idea generation, informing the definition and acquisition stages, which in turn informed generation, combination and reflection stages. Following this in both cases, there is a period of no direct activity with the material, before returning to the acquisition stage. Following this, there is marginal generation and combination activity before a return to the reflection stage and finalisation.

The patterns observed in these findings could indicate that the time dedicated to each stage of the creative process of my computer-mediated music practice is arguably dependant on the overall time dedicated to a project as a whole. In effort to corroborate this, I chose to investigate whether this pattern could be observed on a moment-by-moment basis. For this I chose to examine the data collected for Project #2 Xanadu, which was developed at an advanced rate in comparison to the other projects. The processes taken to produce Project #2 (Xanadu) are outlined below by a Gandtt chart highlighting its chronological progression over the course of 3 days.

Fig 43.



As with the other projects there is a progression, albeit highly non-linear, from the first three stages of the process through to the reflection stage. However, it can be observed that the pattern does not line-up quite as succinctly as the charts for the other two projects. Potentially this disparity in the data is due to further creative work, such as early idea generation and later reflection and finalisation, taking place outside the 3-day period shown in the chart. Project #2 (Xanadu) was in fact worked on between 7th March and 7th June, with the bulk of work taking place in early May. Admittedly, a lack of any pattern between Project #2 (Xanadu) at a micro level and the other projects at a macro level may also simply be explained by regarding the supposed pattern between Project #1 and #3 a coincidence. However, it could also be argued that these same patterns are simply not observable in my practice over such a short space of time.

7.3. What concrete and conceptual resources are involved in the mediation of my computer-based musical creativity?

Creativity literature has acknowledged how great an influence concrete and conceptual context is on creativity, and a large body of contemporary creativity research has moved away from idea that the creator is the fixed and only author. In The Social Production of Art (1993), Wolff's philosophy of creativity rejects the conception of the author as "a fixed and monolithic originator of meanings" (p. 129), instead implying that the author is a combination of social and ideological factors which, through collaboration, guide creativity by "some internal logic of its own".

The study asks how my creativities are influenced by human-computer interaction (Lubart, 2005), sociocultural contexts and resources (Amabile, 1996; Wolff, 1993), the "semantic gap" (Eaglestone et al, 2002) and by the imagination-driven practices and "inner dialogue" (Wall, 2006) that happens away from the active creative process and equipment.

Following the previous chapter, which discussed the content, chronology and direction of my creative process, this chapter discusses how the influence of these factors can be understood in my computer-mediated music

practice. It further asks how the problems and limitations associated with these factors can potentially be navigated in order to become more productive in my creativity. This chapter is therefore a reflective discussion of my personal creative behaviour and is not externally relevant overall. It is however anticipated that some of the findings and conclusions I make about the influence of contextual resources on my particular creativities will be relevant to anyone with a similar computer-mediated music practice.

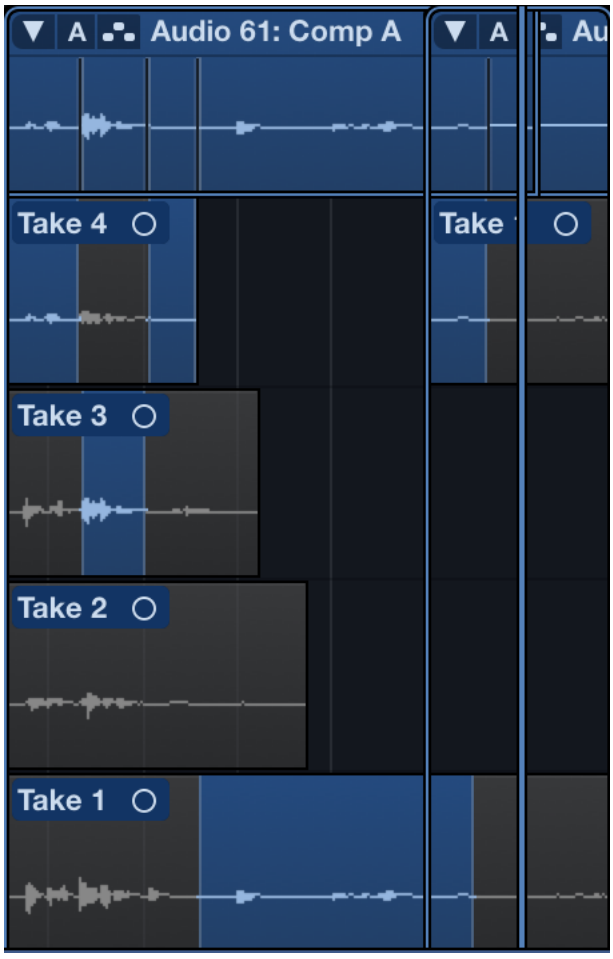
Human-computer interaction

This chapter discusses how human-computer interaction and the involvement of the computer as a creative partner influenced my computer-mediated music practice. Systematic analysis of audio-visual screen-capture and audio extracts provided an understanding of the relationship between my creative process and the physical settings and tools used in my computer-mediated music practice.

One insight provided by the findings of this study was the observation that digital technology in music production allows for a near infinite catalogue of ideas generated for any project. This applies not only to infinite takes of one line of one instrument, but also to the creation of multiple versions of a project with differing tempos, rhythms or in a different keys for example. This is worth noting as a way the practice of computer-mediated musical creativity may differ from the practice of those who record to a finite storage medium such as tape.

The figure below illustrates how many takes were taken of a single vocal line for a demo of Project #1 (Temporary Slang). Logic Pro X allows these multiple takes to be compiled into a master take. On a macro level, Audio Extracts 2-6 illustrate how digital file storage allows multiple versions of one Project to be recorded, fully mixed and stored.

Fig 44

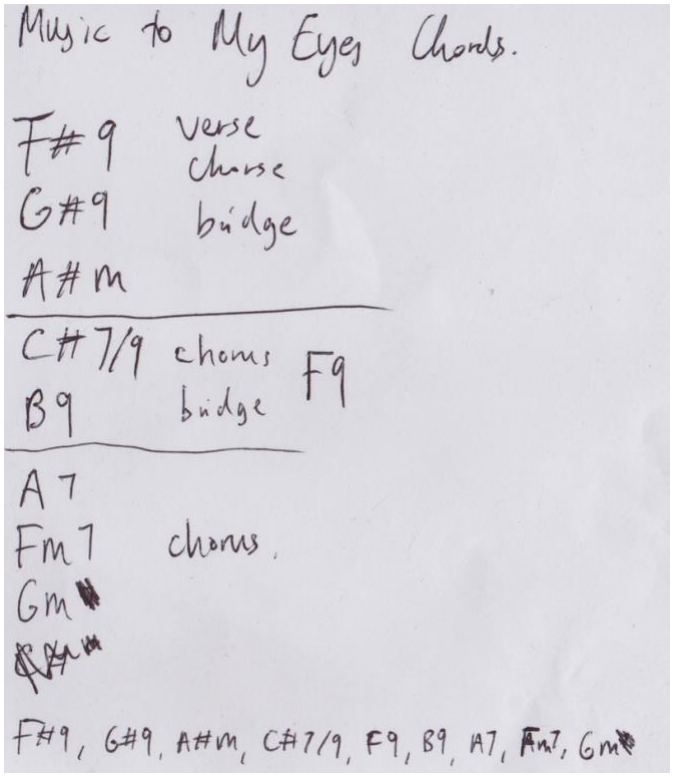


The virtually infinite nature of digital storage facilitates the ability to constantly revisit material, until the creator arrives at what they deem as the definitive version of their creative intention. In managing such a large quantity of material, it is difficult to be objective, especially in the case of this thesis as I was responsible for objectively reviewing my own material. There are many cases amongst my projects where perhaps the most suitable take, idea or version was forgotten about and a mediocre alternative was used instead due to its familiarity.

In evaluating the use of Logic X, it was found that the DAW is useful tool in experimenting with the arrangement and structuring of material, as the software allows any element of any track to be placed anywhere. In contrast however, it was found that during composition, the re-organisation of a

developed structure as an experimental exercise is not practical within a DAW. Instead, a simpler method was to spend time away recording the various ideas in writing, and then experimenting with their placement using a stereo bounce of the entire project.

Fig 45.



These findings illustrate the influence of time spent away from direct involvement with musical material and technology, and subsequently demonstrates a potential flaw in regards to the layout and implementation of DAWs.

Visual tools and the influence of the GUI

Through extensive analysis of audio-visual screen-capture, it was revealed that visual tools and the GUI are highly influential on the shape of my creativities. On-screen representations of sound were important in directing me to areas of audio that needed attention dynamically or in terms of frequency.

The screenshot below demonstrates my reliance on visual aids in order to determine which frequencies to boost and cut. In this case I am using the "Analyzer" tool which, when engaged, represents the frequency distribution of the sequenced audio. These visual representations inarguably guided which frequencies I chose to cut and boost.

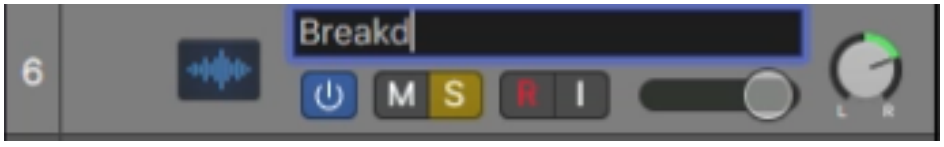
Fig 46.

Other examples of reliance on visual tools include my tendency to favour compressor plug-ins with visual information such as meters and graphs over plug-ins with the same function but minimal visualisation.

Fig 47.

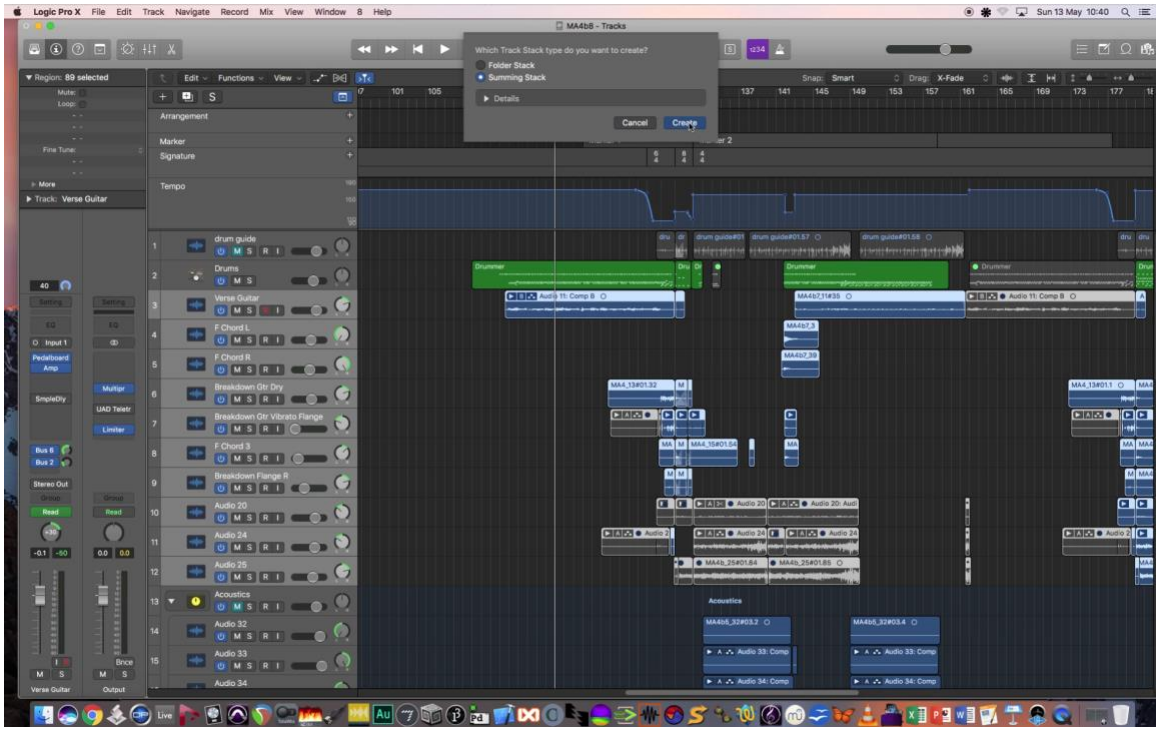
The figure below highlights a process I engaged in whereby tracks were named and colour coded according to personally defined categories. This eased navigation between the various audio material involved in the multi-track recordings.

Fig 48.



The screen-shot below shows a number of tracks to be put in a “summing stack” to organise audio material and additionally clear up visual space on the screen.

Fig 49.



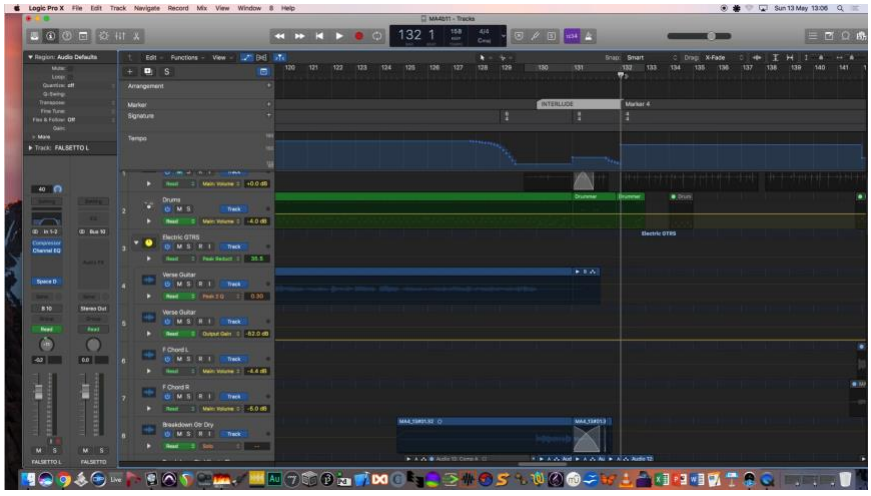
From these findings it is clear that my visual experiences when composing and producing were having an influence on my creative practice. According to Eaglestone, "To some extent the negative, or at least distracting, impact of visual representation of sound (events) is supported by the fact that composers would frequently request to listen to composition in a totally acousmatic situation, i.e. from minidisk over a hifi system." (2002, p. 31) One method of negotiating the problem of being unconsciously influenced by visual information is arguably to take breaks from it. According to Eaglestone, "very short interruption from working on the computer can act as a huge inspiration for the compositional process, similar to the catalytic effect of switching between computer processes previously discussed." (Eaglestone et al, 2002, p. 32). Eaglestone's statement reflects the importance of incubation as a stage of the creative process of computer-mediated music practice.

One observation I made during data collection was that I found it more comfortable working in the University studio than my home studio. One

justification for this decision was the greater sonic experience provided by the environment and the availability of a range of concrete audio tools. However, it should additionally be acknowledged that by comparing Figures 50 and 51, it can be observed that more information is displayed on the larger screen featured in the University studio work station. This finding demonstrates how the physical environment in which I engaged in creative activity had an influence on flow. (Amabile & Hennessy, 1988; Csikszentmihalyi, 1992).

Fig 50. Laptop screen at home

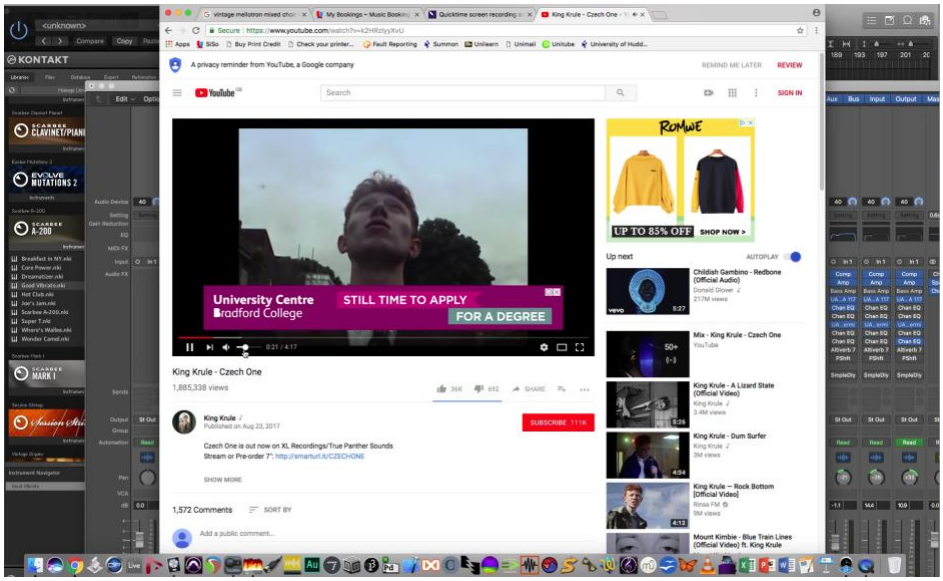
Fig 51. Desktop screen at university



Sociocultural contexts and resources

Through analysis it was revealed that various aspects of my computer-mediated music practise aligned with sociocultural framed definitions of creativity (Arvaja, 2008). Findings reveal that in many instances, contextual resources were appropriated in creative activity. In the figure below for example, the opening chords to *"Czech One"* (King Krule, 2017, track 1) are being used as a reference in guiding the timbre of a keyboard instrument used in the bridge of Project #2 (Xanadu). This process of acquisition can be observed in greater detail by reviewing Audio-Visual Recording 4.

Fig 52.



This finding illustrates how external music acts as a contextual resource, which subsequently forms the basis of my own idea generation and reflection. External music was explicitly used to inform my creative choices at several points throughout interaction with my own material. Direct interaction with external music largely consisted of interaction with streaming sites or the generation of Spotify playlists. Indirect interaction with external material was also observed through the analysis of part-of-practice written protocol, as exemplified in the figure on the next page.

These materials were used as a practical reference in order to appropriate

specific sonic characteristics and meaning. Subsequently, this form of acquisition inherently shaped my material to fit within a specific domain (Gardner, 1993).

Another example of this is that I acquired know-how by accessing an online tutorial of a specific drumming technique that I had deemed necessary for one of the tracks. Therefore, rather than my approach to drums happening as an extension of my personal background, it was informed by community know-how. This is an example of how computer-mediated music practice is mediated and constituted by social and cultural contexts (Arvaja, 2008).

These findings demonstrate that once know-how of a conceptual resource is acquired, it becomes a creative tool much in the same way as a physical musical instrument or a piece of software is a creative tool. As Papert explains, "In the context of composition, a notation system acts an 'object to think with', a vehicle for exploring the material in hand, examining its attributes with a view to transforming or extending it." (Papert, 1980). Citing Feldman's metaphor for the "composerly hand", Keller states that in view of the trend towards "extra-musical process" (2014), the image of the isolated composer creating music through imagination and interaction with musical material alone is eroded. It could be argued therefore that "know-how" of musical instruments, DAW software and external music are all examples of creative "tools" or objects "to think with" (Papert, 1980) in the context of computer-mediated music practice.

The semantic gap and imagination-driven practices

As evidenced by the compositional differences between my multi-track recordings and the single-track demos on which they are immediately based, it was found that the very act of engaging in a recording changes the way I perceive and therefore perform material. For example, changes were made to the vocal melody of Project #2 (Xanadu) during the recording of the first demo. A memo recorded at the time states: "In rehearsing and composing Photosynthesis, I would play it exactly the same each time, during recording I changed the vocal melody of the chorus upon realising during recording that it sounded good. Hearing myself back through the headphones prompted

me to do this, as I realised the original vocal melody was not "cutting" above the guitar and could not be heard." This illustrates the way in which concrete resources can shape auditory imagery.

In the same way that concrete tools mediate creativity, a finding of this thesis is that imagination also acts as a mediating creative resource. There were many instances in which auditory imagery was manipulated in my head in order to formulate future musical ideas. Subsequently, know-how of music production methods and techniques guided my ability to realise these ideas. While the difficulty of navigating the semantic gap was expected, it was not anticipated that once auditory imagery subsequently became a realised idea, the present auditory imagery would subsequently adapt to this realisation. One memo states: "Playing a melody on an instrument changes the way it was heard in your head, it is hard to hear it back again as the initial, internal auditory imagery/idea." From this perspective, it could be argued that auditory imagery and the use of concrete tools mediate and influence one another, a phenomenon that arguably contributes to the difficulty in realising auditory imagery as a physical musical artifact.

7.4. What kind of salient concerns and focus should be afforded to a framework for computer-mediated musical creativities?

The purpose of the model developed through this thesis is to guide the creative processes of my computer-mediated musical practice, drawing from Burnard's model for "mapping the diversification of musical creativities in practice" (2012, p. 230), Collins's synthesis process model of creative thinking in music composition (2005), Eno's Oblique Strategies (Eno & Schmidt, 1975) Sawyer's eight step "Zig-Zag" model of the creative process (2013, p. 14) and his table comparing the models of previous researchers (2012, p. 89). This chapter draws on the findings of the previous sections to guide the development of this framework, which is available in the appendix.

Representing the chronology and flow of my creative process

I have found that frameworks of creativity based around a problem-solving model (Osborn, 1963) do not accurately reflect my creative process, as they somewhat imply that creativity is a path going from A to B. This model of the creative process fails to highlight the value of the divergences and tangents involved in my computer-mediated musical practice, where something unexpected happens during the process and has the potential to be explored. It is my opinion that Sawyer's Zig Zag (2013) creativity model more accurately represents the process of my computer-mediated musical creativity, but I continue to highlight the need for a more comprehensive model designed specifically for the creativities of computer-mediated music practice in general.

As illustrated through analysing the development of Project #1 (Temporary Slang) and much of my practice, a significant deviation in my creative behaviour to that of previous models is my tendency to represent ideas in musical form before I am able to define and make meanings from them, a circumstance which is not accounted for in linear representations of the creative model that begin with a stage of definition or problem finding (Osborn, 1963; Sawyer, 2012). I would argue that this is because my specific compositional process involves recording material as a process of composition and as a means of cataloguing ideas. This is a factor that I considered in the development of my personalised digital audio creativity framework.

In this thesis, it was found that while it was possible for spontaneous, serendipitous bursts of creativity to happen out of nowhere, these instances were almost always identified as the culmination of persistent creative experimentation across various creative stages. This supports Sawyer's assertion that creativity is almost never instant, even where it may seem so. Reflecting on his own "moments of insight", Sawyer's states that "sometimes those ideas did feel like gifts, arriving unsolicited at the perfect time. But in reality, a lot of daydreaming, eclectic research, wild imagination and hard choices had paved the way" (2013, p. 2). From this perspective,

one reason that flow (Csikszentmihalyi, 1992) should be considered in the development of a framework for my computer-mediated music practice is to account for the fact that idea generation is unpredictable and therefore constitutes persistence.

It should also be acknowledged that it might not be beneficial to explore every possible creative tangent in the pursuit of greater creativity. In an excerpt of Every Frame a Painting: the Marvel Symphonic Universe, film composer Alexandre Desplat describes how sometimes some musical ideas are selected not because they are the right choice, but because the composer has listened to the them "again and again and again for hours and hours […] and at some point the music sticks to the picture" (Ramos & Zhou, 2016). Drawing from Desplat, it could be argued that the more attached to an idea a composer becomes, the more increasingly difficult it is to attempt to create or accept a more suitable or alternative idea.

To navigate these issues, a framework for my computer-mediated music practice should encourage experimentation with different ideas, as it is not possible to know whether a more suitable idea exists unless experiment with alternative ideas has been carried out. Correspondingly, there is inevitably a point where alternative ideas are exhausted and the work must be finished. Recognising this moment is a factor I should consider within my computer-mediated music practise.

Self-imposed limitation as a creative resource

Contemporary digital music technologies have afforded infinite choice and possibility in the mediation of idea generation. Some literature supports an argument that this abundance of choice does not inherently promote greater creativity. For example the recency effect, a concept of general psychology which applies to this topic, describes a tendency to more easily remember items near the end of a sequence than those at the beginning or middle of a sequence. (Murdock, 1962) In the context of my computer-mediated music practice, this applies to the recording of an abundance of takes of the same idea. The infinite possibility afforded by modern technology therefore creates a problem in concisely focusing idea generation and reflection.

Analysis of my own creative practice found that a substantial amount of time was invested in negotiating the abundance of software at my disposal. One example is shown in Audio-Visual Recording 5 where I am attempting to select a suitable software instrument. A pattern in previous literature demonstrates a method of navigating this problem through welcoming or introducing limitations to creative practice. In an evaluation of software environments employed in electro-acoustic composition, Clowes found that software limitations could be turned into an advantage (2000). Similarly, in Eaglestone's research it was found that "composers often regard externally imposed limitations as welcomed challenges around which to design their compositional strategies" (Eaglestone, 2002, p. 21) One finding of this thesis was that narrowing the accessible resources down to a rigid set of concrete and conceptual tools resulted in a more concise and purposeful generation of ideas as opposed to unrefined, scattershot experimentation. Through analysis, it was observed that this form of self-limitation seemed to happen instinctively over the course of the creative process, as the definition stages of the process refined the intent and focus of the projects. Brian Eno's cards promote the conscious introduction of this form of limitation. These encouragements appear in the form of open instructions and suggestions, for example: "only one element of each kind" (Eno & Schmidt, 1975). This use of self-limitation as a mediator of more focused creativity should be considered in the development of a framework for my computer-mediated music practice.

Representing and managing the influence of concrete tools

As established, creative musical process is in fact the interaction of multiple musical creativities (Burnard, 2012) that mediate creative authorship outside the immediate control of the creator in the form of concrete tools. In exploring my own approach, it is important to consider the extent to which my creative practice is consciously influenced by concrete technologies.

Previous literature explains that in computer-mediated music practice, concrete tools such as the computer and software plug-ins are not merely practical resources, but conceptual "objects to think with" (Papert, 1980).

Analysis of written protocol revealed that throughout my practice I was engaged in "thinking as instrument", in other words the organisation of auditory imagery into an imagined musical arrangement. In this context, the term instrument can refer to any physical tool from the guitar to signal-processing software. This mediation of creativity through the imagined use or performance of an instrument reflects Arvaja's assertion that concrete tools can mediate meaning when individuals engaged in creativity plan to use them in the future (Arvaja, 2007). It further corroborates Dobson's finding that "Prior knowledge and imagined use of music technology software" (2012, p. 298) mediates computer-based musical creativity. In the relationship between concrete technology and musical creativity, it is important to acknowledge that a degree of authorship is granted to these "objects to think with" because the realisation of auditory imagery is shaped by the limitations inherent in practical tools.

Systematic analysis revealed that know-how of a specific set of tools led to a cognitive bias involving my over-reliance on familiar plug-ins and instruments. In psychology a concept known as "law of the instrument" (Maslow, 1966), describes selecting tools out of habit rather than selecting them because they are the most suitable for the task. As observed by Abraham Maslow, "I suppose it is tempting, if the only tool you have is a hammer, to treat everything as if it were a nail." (1966, p. 15). My reliance on familiar tools contradicts Eaglestone's findings: "Composers considered unfamiliar tools to be good, and their idiosyncrasies were particularly valued" (2002, p. 38). The disparity between my creative tendencies and that of the group of elecro-acoustic composers examined by Eaglestone highlights the need for a personal framework developed for the understanding of my individual computer-mediated music creativity, as it illustrates that no universal creativity model will fully reflect any given person's creative tendencies fully. I also regard acquiring more knowledge of concrete tools to be an aim of my computer-mediated music practices.

Representing and managing the influence of conceptual resources

Drawing from literature which frames creative practice within "sociocultural context" (Amabile, 1996; Wolff, 1993), it is important that a framework of

computer-mediated music practice considers the degree to which I allow my creativity to be influenced by conceptual resources. This section covers the influence of know-how, external music and imagination-driven practice on my computer-mediated musical creativity.

Weisberg (1988) highlights the limitation of an individual's dependence of past experience when engaged in creative problem solving. In my own computer-mediated music practice, this is apparent in my lack of music theory know-how. As discussed earlier, my method of navigating this issue is to record rather than notate my compositions. This reflects arguments made by Sawyer (2013) and De Bono (1970) that lack of know-how and the limitation of past experiences can be circumvented by divergent thinking, or thinking laterally. Finding ways of navigating past these issues is considered in the development of a framework for my computer-mediated music practice.

On the other hand, while dependence on past experience may appear to be a limitation, it is arguably also a factor that contributes to the unique novelty of creative ideas from person to person. One of Eno's creative strategy cards features the phrase, "honour thy error as a hidden intention" (Eno & Schmidt, 1975), implying that successful creative work is not simply down to know-how and experience, and implies that what could be perceived as a creative limitation or error, may in fact be what makes someone's creativity or creative work unique.

Much contention is given amongst composers and producers on the topic of external music as an influence on the composition and production of new music. For example Connan Mockasin dismisses the use of external music as a contextual resource, explaining, "at some point you just want to figure out doing your own thing". (Arnold, 2013). On the other hand, Mac Demarco's open appropriation of external music is a defining principle of his creative process. "Sometimes I hear a song and I'm just like, 'well I'm gonna try and rip this song off today'" (Seagate Technology, 2014). In this thesis it was found that the degree to which external music influences my practice arguably sits between these two extremes. As discussed earlier,

analysis of written protocol reveals that I regularly make reference to specific artists and songs that feature characteristics I was aiming to appropriate into my own material. The extent to which I rely on external music is considered in the framework of my computer-mediated music practice as a factor that may influence both my process and socio-contextual perception of my creative output.

In terms of imaginative creative process, Younker and Smith's study of composition process (1996) revealed differing methods of approaching music between novices and professionals: Novices considered only isolated, individual sounds at one time, while those working at a higher level demonstrated an approach where elements of music were considered from the "perspective of the structured whole" (p. 274). Through analysis of written protocol, it was found that Younker and Smith's findings were reflected in my practice. It was observed that in several cases, real-time idea generation on a physical musical instrument was accompanied by "auditory imagery" representing an imagined layering of the whole arrangement. In accordance with this, methods of integrating imagination-driven conceptual resources should be a considered in developing a framework of my computer-mediated music practice.

8. Discussion and Implications

8.1 Conclusions

Through an analysis that triangulated naturalistic and systematic approaches, the following conclusions were made in regards to my computer-mediated musical creativity:

1. The chronology and direction of focus between creative stages, and the time spent on these stages, was found to be of an intuitive and context-dependent nature.
2. The influence of concrete and conceptual resources can be observed and tentatively understood through metacognitive investigation.
3. A suitable framework for my computer-mediated musical creativity should represent and allow conscious intervention and mediation with these concrete and conceptual resources, and offer a medium for understanding them.

8.2 Evaluation of the methodology

In relation to music and musical creativity research, Laske argues: "the elicitation of personal knowledge and of action knowledge still awaits a methodology" (cited in Polfreman, 1999, p. 31). The following chapter summarises how this thesis has attempted to fill this research gap.

This thesis draws from Folkestad (1997) and Collins' (2005) systematic cataloguing of MIDI files as a map of longitudinal creative process. It additionally draws from TaCEM's (Clarke et al, 2015) method of isolating and exporting individual elements from the works of composers, before retrospectively deconstructing the process that created them. As contemporary data storage allows the collection of considerably more data, this study up-dated the methodologies of Folkestad and Collins to allow a rich analysis of systematically exported audio extracts in order to highlight real-time, longitudinal creative processes.

Moment-by-moment and longitudinal analysis across multiple data types has allowed for the observation of musical creativity occurring in a naturalised setting and environment (Eaglestone, 2002). Developing criteria for analysis that considered creativity from a socio-contextual perspective (Amabile, 1996) allowed me to map and better understand my personalised computer-mediated musical creativities.

Audio-visual capture and audio extracts were a suitable method of capturing the majority of the creative stages presented in the template analysis criteria, and the analysis of written protocol was helpful in recording any "inner dialogue" (Wall, 2006) that showed evidence of definition, acquisition and reflection. However, on a macro level, some expected creative activity such as incubation and finalisation were not as easily identifiable through the data collection and analysis methods implemented in this thesis. It is my suggestion that a longer period of data collection and analysis with more material and a revised methodology would allow more insight into these missing elements.

8.3 Implications and Summary

This aim of this thesis was to develop a template onto which practitioners of computer-mediated music could map a metacognitive investigation of their creative process. The conclusions offered by this thesis suggest that there could be further implication for the domain of computer-mediated music practice. The framing of this project has served as a guide to the understanding of my own creative process and acts as a reference for my future creative endeavours. Ideally, this thesis will also encourage digitally informed musicians to think critically about their own creativity and guide the exploration of sociocultural context as a mediating resource and inspiration.

9. Bibliography

Adolphie, B. (2013). *The Mind's Ear: Exercises For Improving The Musical Imagination For Performers, Composers, And Listeners.* US: Oxford University Press.

Amabile, T. (1996). *Creativity in Context*. US: Westview Press.

Amabile, T.M. & Hennessey, B.A. (1988). The Conditions of Creativity. In R . J. Sternberg (Ed.) *The Nature of Creativity: Contemporary Psychological Perspectives* (pp. 11-38). Cambridge: Cambridge University Press.

Arnold, B. (2013, September 13th). Connan Mockasin: the contrarian. *The Guardian.*Retrieved from https://www.theguardian.com/music/2013/sep/13/connan-mockasin-interview

Arvaja, M. (2007). Contextual resources in meaning negotiations of a student pair in a web-based history project. *International Journal of Educational Research, 46* (1), 215-228.

Arvaja, M., Häkkinen, P., & Kankaanranta, M. (2008). Collaborative Learning and Computer-Supported Collaborative Learning Environments. *International Handbook of Information Technology in Primary and Secondary Education, 20* (1), 267-279.

Bevilacqua, F., Fels, S., Jensenius, A., Lyons, M., Schnell, N., & Tanaka, A. (2013). SIG NIME: Music, technology, and human-computer interaction. Paper presented at the 2529-2532. doi:10.1145/2468356.2468822

Blake, A. (2007). *Popular Music: The Age of Multimedia*. London: Middlesex Publishing Press.

Brown, G., Eaglestone, B., Ford, N., Moore, A. & Nuhn. R. (2001). Requirements Specification for a Composition Tools System. UK: University of Sheffield p.19, 34, 44

Burnard, P. (2012). *Musical Creativities in Practise*. Oxford: Oxford University Press.

Burnard, P. (2007). Reframing creativity and technology: promoting pedagogic change in music education. Journal of Music, Technology and Education. 1 (1), p37-55.

Burnard, P. & Younker, B.A. (2010). Mapping Pathways: Fostering creativity in composition. *Music Education Research, 4* (2), 245-261.

Card, S.K., Newell, A., & Moran, T.P. (1983). *The Psychology of Human–Computer Interaction*. US: Lawrence Erlbaum Associates.

Chen, J.C.W. (2012). A pilot study mapping students' composing strategies: Implications for teaching computer-assisted composition. *Research Studies in Music Education, 34* (2), 157-171.

Clarke, M., Dufeu, F. & Manning, P. (2015) *Francis Dhomont's Phonurgie: A New Case Study from the TaCEM Project.* In: Electroacoustic Music Studies Network Conference (EMS15): The Art of Electroacoustic Music, 23rd - 26th June 2015, Sheffield, UK. (Unpublished)

Clarke, M., Dufeu, F. & Manning, P. (2013) Introducing TaCEM and the TIAALS software. In *Proceedings of the 2013 international computer music conference*

Clarke, M., Dufeu, F., & Manning, P. (2015 October). *Tracking the creative process in Trevor Wishart's Imago*. Poster presented at Tracking the Creative Process in Music conference (TCPM) Paris, France.

Clowes, M. (2000). *An investigation of compositional practices in the field of electro-acoustic music, with an evaluation of the main software environments currently in use.* (PhD). University of Sheffield, UK.

Collins, D. (2001). *Investigating computer-based compositional processes: a case-study approach.* (PhD Thesis). University of Sheffield, UK.

Collins, D. (2005). A synthesis process model of creative thinking in music composition. Psychology of Music. 33 (2), p193-216.

Craft, A. (2000). *Creativity Across the Primary Curriculum: Framing and Developing Practice*. London: Routledge.

Craft, A. (2007) *Creativity and Possibility in the Early Years.* Retrieved from http://www.tactyc.org.uk/pdfs/Reflection-craft.pdf

Cross Cultural Survey Guidelines. (2018). *Global Glossary: Auxiliary Data*. Retrieved from http://ccsg.isr.umich.edu/index.php/resources/advanced-glossary/auxiliary-data.

Csikszentmihalyi, M. (1996). *Creativity: Flow and the psychology of discovery and invention.* . New York: Harper Collins.

Csikszentmihalyi, M., Magyari-Beck, I., & Wehner, L. (1991). Current approach used in studying creativity: An exploratory investigation. *Creativity Research Journal, 4* (1), 261-271.

Csikszentmihalyi, M. (1999). Implications of a systems perspective for the study of creativity. In R . J. Sternberg (Ed.) *Handbook of Creativity* (pp. 2-1). Cambridge: Cambridge University Press.

Csikszentmihalyi, M. (1992). *Flow: The Psychology of Happiness*. UK: Rider.

De Bono, E. (1970). *Lateral Thinking Creativity Step by Step*. New York: Harper and Row.

DeSantis, D. (2015). *Making Music: 74 Creative Strategies for Electronic Music Producers* . Berlin: Ableton AG.

Dobson, E.D., Littleton, K., Flewitt, R., & Miell, D. (2011). Studio Based Composers inCollaboration: a Socioculturally Framed Study.. *Proceedings of the International Computer Music Conference*, 373-376.

Dobson, E. (2012). *An investigation of the processes of interdisciplinary creative collaboration: the case of music technology students working within the performing arts* (PhD Thesis). Open University, UK.

Dobson, E.D. & Littleton, K.S. (2015). Digital technologies and the mediation of undergraduate students' collaborative music compositional practices. *Learning, Media and Technology*, 1-21.

Duignan, M., Noble, J., & Bibble, R. (2010). Abstraction and Activity in Computer-Mediated Music Production. *Computer Music Journal, 34* (4), 22-33.

Duncan, M. (2005). Autoethnography: Critical appreciation of an emerging art. *International Journal of Qualitative Methods, 3* (4). Retrieved from http://www.ualberta.ca/~iiqm/backissues/3_4/pdf/duncan.pdf.

Eno, B. & Schmidt, P. (1975). *Oblique Strategies*. Retrieved from https://joeribollaerts.files.wordpress.com/2010/04/brianeno_obliquestrategies1.pdf.

Ericsson, A., Krampe, R.T., & Tesch-Romer, C. (1993). The Role of Deliberate Practice in the Acquisition of Expert Performance. *Psychological Review, 100*(3), 363-406.

Ericcson, K. & Simon, H. (1993). *Protocol Analysis: Verbal Reports as Data* (2nd ed.). Boston: MIT Press.

Erlandson, D., Harris, E., Skipper, B., & Allen, S. (1993). *Doing naturalistic enquiry: A guide to methods*. US: Sage.

Folkestad, G. (1997). *Computer Based Creative Making: Young People's Music in the Digital Age*. Göteborg: Acta Universitatis Gothoburgensis.

Folkestad, G. & Nilsson, B. (2005). Children's practice of computer-based composition. *Music Education Research, 7* (1), 21-37.

Ford, N. (1999). Information retrieval and creativity: towards support for the original thinker. *Journal of Documentation, 55* (5), 528-542.

Friedman, B.H. (2000). *Give My Regards to Eighth Street : Collected Writings of Morton Feldman* . US: Exact Change.

Gardner, H. (1993). *Creating Minds: An Anatomy of Creativity Seen Through the Lives of Freud, Einstein, Picasso, Stravinsky, Eliot, Graham and Gandhi*. New York: Basic Books.

Gelineck, S. & Serafin, S. (2012). Longitudinal Evaluation of the Integration of Digital Musical Instruments into Existing Compositional Work Processes. *Journal of New Music Research, 41*(3), 259-276.

Gibson, D. (2005). The Art of Mixing: A Visual Guide to Recording, Engineering and Production. US: LLC. 2nd ed p.28

Gladwell, M. (2009). *Outliers: The Story of Success*. US: Penguin.

Goldberg, L.R. (1993). The Structure of Phenotypic Personality Traits. *American Psychologist, 48* (1), 26-34.

Guilford, J.P. (1957). Creative abilities in the arts. *Psychological Review, 64* (2), 110-118.

Izhaki, R. (2013). *Mixing Audio: Concepts, Practises and Tools*. US: Focal Press. p. 6

Jennings, K. (2005). Hyperscore: A Case Study in Computer Mediated Music Composition. *Educational and Information Technnologies, 10* (3), 225-238.

Joyce, J. (1922). *Ulysses*. Paris: Sylvia Beach.

Keane, D. (1986). At the Threshold of an Aesthetic. In . (Ed.) *The Language of Electroacoustic Music* (pp. 118-97). London: Macmillan.

Keller, D., Timoney, J., Constalonga, L., Capasso, A., Tinajero, P., Lazzarini, V. ... Johann, M. (2014). Ecologically grounded multimodal design: The Palafito 1.0 study. In *Internatioanl Computer Music Conference/Sound and Music Computing. Athens, Greece*, Retrieved from https://www.researchgate.net/publication/270509650_Ecologically_grounded_multimodal_design_The_Palafito_10_study.

Kim, K. (2002). *Critique on the Torrance Tests of Creative Thinking*. Retrieved from https://web.archive.org/web/20080119015727/http://kyunghee.myweb.uga.edu/portfolio/review%20of%20ttct.htm.

King, N. (1998). Template analysis. In G. Symon & C. Cassell (Eds.) *Qualitative Methods and Analysis in Organizational Research.* London: Sage

King Krule (2017). Czech One. On *The Ooz* [Digital]. UK: XL.

Kirkman, P. (2010). Exploring contexts for development: Secondary music students' computer-mediated composing. Journal of Music, Technology & Education. 3 (2, 3), p107- 124.

Lately, L. (2011). *Creative Problem Solving: Six Steps to Exercise Your Creative Muscle*. Retrieved from http://www.centerforimagination.org/2011/11/creative-problem-solving-six-steps-to-exercise-your-creative-muscle/.

Lubart, T. (2005). How Can Computers be Partners in the Creative Process: Classification and Commentary on the Special Issue. *International Journal of Human-Computer Studies, 63* (1), 365-369.

MacDonald, R., Byrne, C., & Carlton, L. (2006). Creativity and flow in musical composition: an empirical investigation. *Psychology of Music, 34* (3), 292-306.

MacKinnon, D.W. (1962). The Nature and Nurture of Creative Talent. *American Psychologist, 17* (7), 484-495.

Maslow, A.H. (1966). *The Psychology of Science*. New York: Harper and Row.

Mayer, R.E. (1989). Cognitive views of Creativity: Creative Teaching for Creative Learning. *Contemporary Educational Psychology, 14* (3), 203-211.

McGurk, H. & MacDonald, J. (1976). Hearing Lips and Seeing Voices. *Nature, 264* (5588), 746-748.

Mehan, H. (1979). *Learning Lessons: Social Organisation in the Classroom.* Cambridge, MA: Harvard University Press

Menon, D. & Wolpert, S. (2011, December 8). Sound and vision work hand in hand, UCLA psychologists report. *Newsroom UCLA.* Retrieved from http://newsroom.ucla.edu/releases/sound-and-vision-work-hand-in-220261

Murchison, J. (2009). *Ethnography Essentials: Designing, Conducting and Presenting Your Research*. US: Jossey-Bass.

Murdock, B.B. (1962). The serial position effect of free recall. *Journal of Experimental Psychology, 64* (5), 482-488.

Olaisen, J. (1991). Pluralism or positivistic trivialism: important trends in contemporary philosophy of science. . In H . E. Nissen, H . K. Klein, & R. Hirschheim (Eds.) *.). Information systems research: contemporary approaches and emergent traditions.* (pp. 235-265). Amsterdam: Elsevier.

Osborn, A. (1963). *Applied Imagination; Principles and Procedures of Creative Problem-Solving*. US: Scribner.

Owskinski, B. (2006). *Mix Engineers Handbook.* Course Technology Inc. 2nd ed p.104

Papert, S. (1980). *Mindstorms: children, computers, and powerful ideas*. New York: Basic Books Inc.

Pearis, B. (2017, June 27). Connan Mockasin doing standup comedy set at Baby's opening for bandmate Infinite Bisous. *Brooklyn Vegan.* Retrieved from http://www.brooklynvegan.com/connan-mockasin-doing-standup-comedy-set-at-babys-opening-for-bandmate-infinite-bisous/

Polfreman, R. (1999). A task analysis of musical composition and its application to the development of Modalyser. *Organised Sound , 4* (1), 1-1.

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

Ramos, T., Zhou, T. [Every Frame a Painting]. (2016, September 12th). *The Marvel Symphonic Universe* [Video file]. Retrieved from https://www.youtube.com/watch?v=7vfqkvwW2fs

Retiman, W.R. (1965). *Cognition and thought: an information processing approach*. Oxford: Wiley.

Renzulli, J.S. & Reis, S.M. (2010). The Schoolwide Enrichment Model: A Focus on Student Strengths and Interests. *Gifted Education International, 26* (2-3), 140-157.

Renzulli, J.S. & Reis, S.M. (2011). Challenging Gifted and Talented Learners with a Continuum of Research-Based Intervention Strategies. In M . A. Bray & T . J. Kehle (Eds.) *The Oxford Handbook of School Psychology* (pp. 456-482). UK: Oxford Library of Psychology.

Rilke, R.M. (1987). *Briefe (Letters)*. Weimar: Rilke Archive.

Rogers, C.R. (1954). Towards a Theory of Creativity. *ETC: A Review of General Semantics , 11* (1), 249-260.

Sawyer, R.K. (2006) *Explaining Creativity: The Science of Human Innovation.* US: Oxford University Press.

Sawyer, R.K. (2012). *Explaining Creativity: The Science of Human Innovation*. US: Oxford University Press.

Sawyer, R.K. (2013). *Zig Zag: The Surprising Path to Greater Creativity*. US: Jossey Bass.

Sawyer, R.K. & DeZutter, S. (2009). Distributed creativity: How collective creations emerge from collaberation. *Psychology of Aesthetics, Creativity, and the Arts, 3* (2), 81-92.

Shneiderman, B. & Plaisant, C. (2006). Strategies for Evaluating Information Visualization Tools: Multi-dimensional In-depth Long-term Case Studies. In *The International Conference on Advanced Visual Interfaces. Venice, Italy*, Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.476.3334&rep=rep1&type=pdf.

Seagate Technology. (2014, Jan 10). *Interview: Mac Demarco - songwriting as ripoff and bad habits* [Video file]. Retrieved from https://www.youtube.com/watch?v=Ftj08_lCb34

Seddon, F.A. & O'Neill, S.A. (2003). Creative Thinking Processes in Adolescent Computer-Based Composition: An Analysis of Strategies Adopted and the Influence of Instrumental Music Training. *Music Education Research, 5* (2), 125-137.

Shams, L. & Odegaard, B. (2016). The Brain's Tendency to Bind Audiovisual Signals Is Stable but Not General. *Psychological Science, 27* (4), 583-591.

Stavrou, M. (2003). *Mixing With Your Mind*. US: Flux Research.

Sternberg, R.J. (1999). *Handbook of Creativity*. UK: Cambridge University Press.

Sternberg, R.J. & Davidson, J.E. (Eds.) (1995). *The Nature of Insight*. US: MIT Press.

Sternberg, R.J. & Niu, W. (2006). The Philosophical Roots of Western and Eastern Conceptions of Creativity. *Journal of Theoretical and Philosophical Psychology, 26* (1), 18-35.

Suchman, L. (1987). *Plans and Situated Action. The Problem of Human-Machine Communication*. New York: Cambridge University Press.

TaCEM. (2012-15). *University of Huddersfield*. Retrieved from https://research.hud.ac.uk/institutes-centres/tacem/.

The Beach Boys (2011). *The Smile Sessions*. [Digital]. US: Capitol.

Torrance, E.P. (1974). *Norms-technical manual: Torrance Tests of Creative Thinking*. Lexington, MA: Ginn and Company.

Treffinger, D.J. (1986). Research on Creativity. *Gifted Child Quarterly, 30* (1), 15-19.

Treffinger, D.J., Isaksen, S., & Dorval, K.B. (2000). *Creative Approaches to Problem Solving: A Framework for Innovation and Change*. US: Sage.

Universitat Pompeu Fabra. (2018). *Music Orchestration Systems in Algorithmic Research and Technology*. Retrieved from https://www.upf.edu/web/mtg/mosart.

Van Mannen, M. (2007) *Phenomenology & Practice, 1* (1), 11-30.
Voigt, G. (1960). *Die Wiederbelebung des classisches Altertums: Oder der erste Jahrhundert des Humanismus*. Germany: de Gruyter.

Wall, S. (2006). An Autoethnography on Learning About Autoethnography. *International Journal of Qualitative Methods, 5* (2), 146-160.

Wallas, G. (1926). *Art of Thought*. New York: Harcourt, Brace and Company.

Weisberg, R.W. (1988). Problem solving and creativity. In R.J. Sternberg (Ed.) *The nature of creativity: Contemporary psychological perspectives* (pp. 148-'). Cambridge: CUP Archive.

Winner, E. (1982). *Inverted Worlds: The Psychology of the Arts*. Cambridge, MA: Harvard University Press.

Wolff, J. (1993). *The Social Production of Art*. New York: NYU Press.

Younker, B.A. & Smith, W.H. (1996). Comparing and Modelling Musical Thought Processes of Expert and Novice Composers. *Bulletin of the Council for Research in Music Education, 128* (1), 25-35.

10. Appendix

10.1 Interactive Materials

Link to Interactive Materials:
https://docs.google.com/spreadsheets/d/1Rp2pxo6WV1eWWx1MGDnGahYJTndaa49hL8ngMepo0MM/edit?usp=sharing (set zoom to 50%)

10.2 General

Link to Dropbox folder:
https://www.dropbox.com/sh/4mwi90sy70tvfzr/AAA75BrgMv5_HN2uM2kj1z0qa?dl=0

Link to Soundcloud folder:
https://soundcloud.com/user-588019093/sets/ma-music-materials

Link to my Undergraduate Research paper:
https://www.dropbox.com/s/wowi6ygifxmr0ji/RMPT_3000-word_Mixing_In_The_Box.pdf?dl=0

10.3 Audio Recordings

Audio Recording 1 - https://soundcloud.com/user-588019093/audio-recording-1-temporary

Audio Recording 2 - https://soundcloud.com/user-588019093/audio-recording-2-temp-slang?in=user-588019093/sets/ma-music-materials

Audio Recording 3 - https://soundcloud.com/user-588019093/audio-recording-3-xanadu?in=user-588019093/sets/ma-music-materials

10.4 Audio Extracts

Audio Extract 1 - https://soundcloud.com/user-588019093/audio-extract-1-5-blindness?in=user-588019093/sets/ma-music-materials#t=0:28

Audio Extract 2 - https://soundcloud.com/user-588019093/audio-extract-2-1-temp-slang?in=user-588019093/sets/ma-music-materials

Audio Extract 3 - https://soundcloud.com/user-588019093/audio-extract-3-3-temp-slang?in=user-588019093/sets/ma-music-materials

Audio Extract 4 - https://soundcloud.com/user-588019093/audio-extract-4-5-temp-slang?in=user-588019093/sets/ma-music-materials
Audio Extract 5 - https://soundcloud.com/user-588019093/audio-extract-5-9-temp-slang?in=user-588019093/sets/ma-music-materials

Audio Extract 6 - https://soundcloud.com/user-588019093/audio-extract-6-9-temporary?in=user-588019093/sets/ma-music-materials

Audio Extract 7 - https://soundcloud.com/user-588019093/audio-extract-7-3-m2me-3rd?in=user-588019093/sets/ma-music-materials

Audio Extract 8 - https://soundcloud.com/user-588019093/audio-extract-8-1-blindness-1?in=user-588019093/sets/ma-music-materials

12.5 Audio-Visual Recordings

Audio-Visual Recording 1 - https://www.dropbox.com/s/w1271gqizh6yg3k/Audio-Visual%20Recording%201%20-%20Experimenting%20with%20software%20instruments.mp4?dl=0

Audio-Visual Recording 2 - https://www.dropbox.com/s/486utzwkjkx22cl/Audio-Visual%20Recording%202%20-%20Writing%20glockenspiel%20part%20for%20Xanadu.mp4?dl=0

Audio-Visual Recording 3 - https://www.dropbox.com/s/3djj6buokitx5r5/Audio-Visual%20Recording%203%20-%20Incubation.mp4?dl=0

Audio-Visual Recording 4 -
https://www.dropbox.com/s/kjmho1cy0xoi9f9/Audio-Visual%20Recording%204%20-%20King%20Krule.mp4?dl=0

Audio-Visual Recording 5 –
https://www.dropbox.com/s/67tqj2d2qpuu9h2/Audio-Visual%20Recording%205%20-%20Selecting%20software%20instrument%20again.mp4?dl=0

Framework Information

On the following page I offer the framework that was developed as a result of this research. The stages that make up the framework are intentionally open, in order to accommodate the wide variety of creativities that make up my computer-mediated music practice and those who wish to use this as a template. Below is an overview of some key concepts that will be useful in following the framework. It should be kept in mind that I have my own idea of what these concepts and stages mean, the ideas listed below are merely examples of how people can interpret the framework.

Conceptual aims:
These are any conceptual thoughts relating to defining aims, identifying a problem, or offering a solution to a problem.

Acquisition:
This refers to the acquisition of know how, for example:

- Familiarising with software
- Familiarising with a style of music you wish to adopt
- Practicing on an instrument
- Reading about any songwriting techniques.

Define limits:
This refers to self-imposed limitation, for example:

- Relying on no visual tools
- Relying on only a certain selection of plug-ins or having a limit on the amount of plug-ins
- Recording and mixing with no plug-ins at all and relying on microphone placement
- Not listening to any outside music for inspiration
- Composing only on an instrument you are not proficient with
- Writing a song less than a minute long

Incubation:
Time spent away from direct contact with the material in mind, for example:

- Imagining a full arrangement or structure in your head, and writing it down
- Imagining how you can manipulate and produce sonic ideas by imagining timbres, textures etc.

Fig 53. Framework for My Computer-Mediated Musical Creativities

Key:
Green arrow = Yes
Red arrow = No
Black arrow = Automatic progression

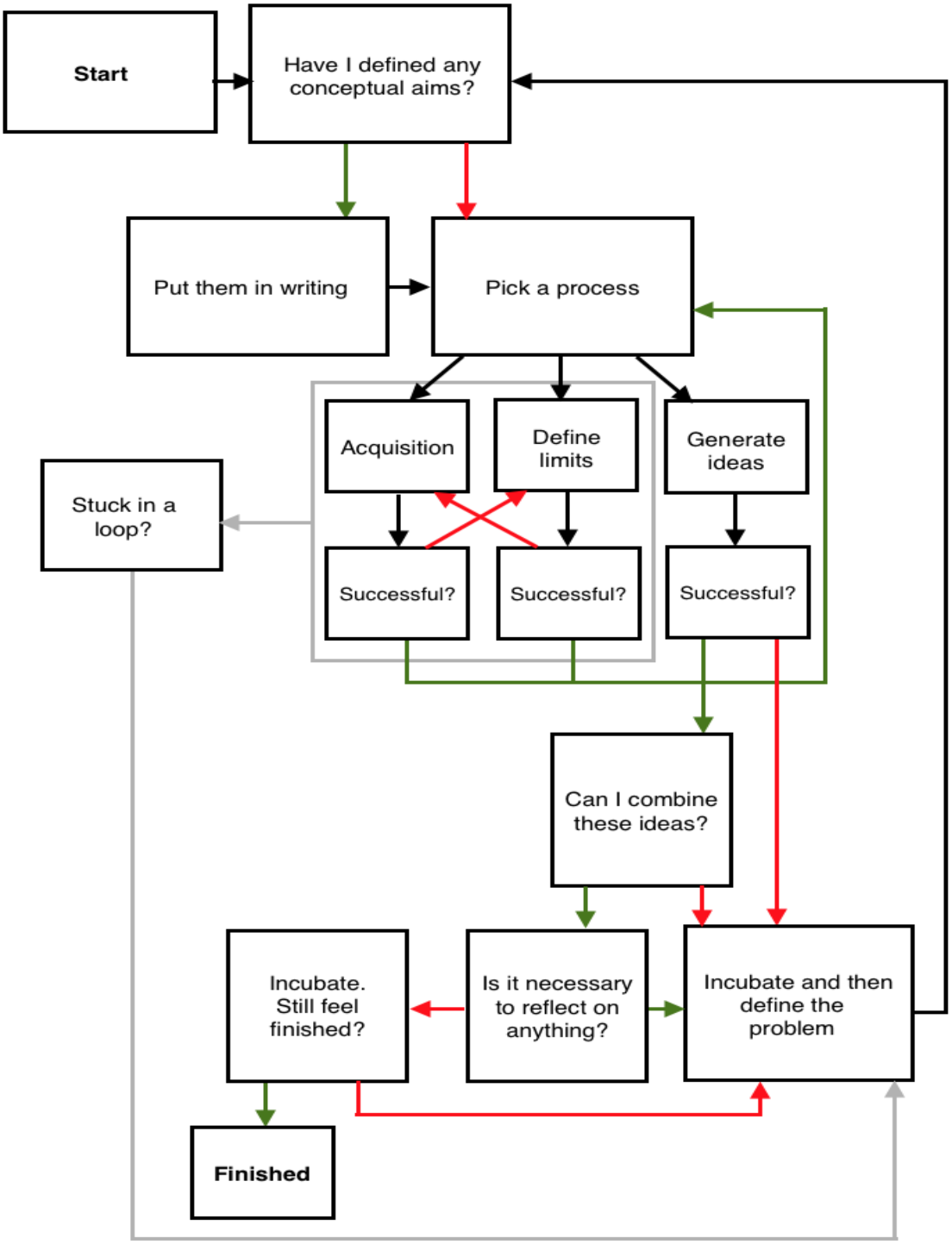


Fig 54. Framework Draft 1

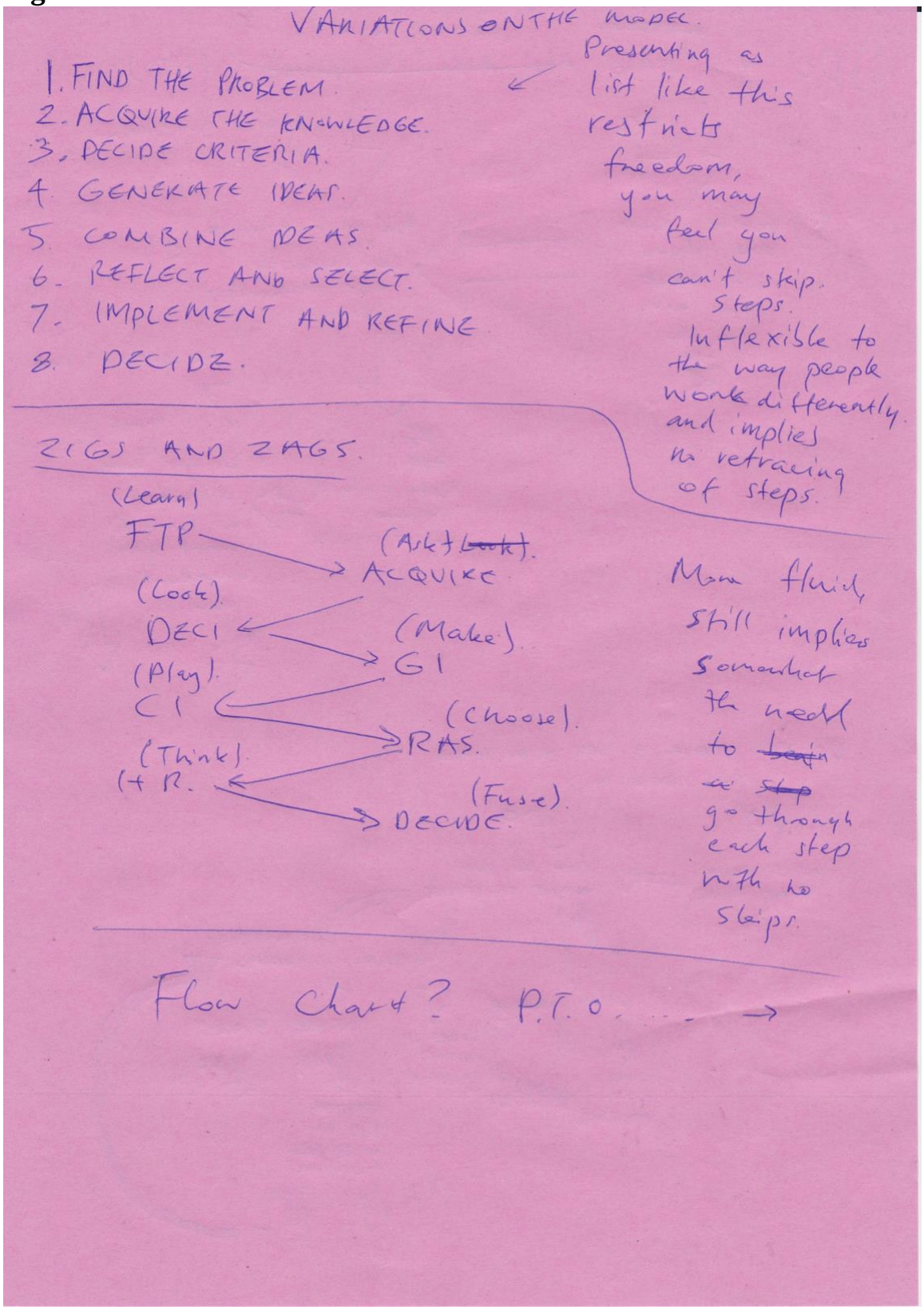


Fig 55. Framework Draft 2

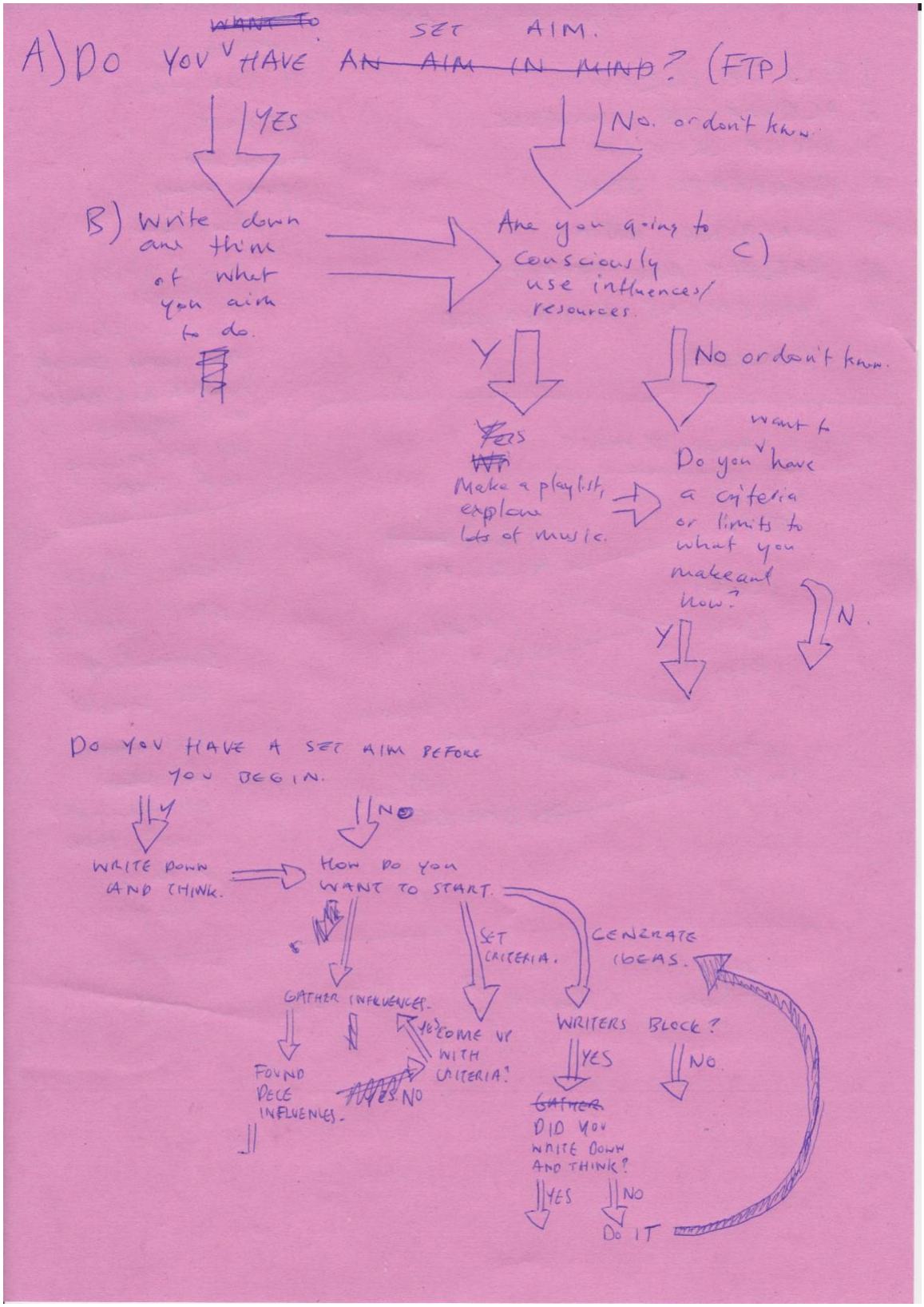


Fig 56. Framework Draft 3