The User Experience of Mobile Music Making: An Ethnographic Exploration of Music Production and Performance in Practice

Keywords:

usability; digital; audio; human; design; experience

Abstract

The research herein describes the investigation of usability of software and hardware tools for musicians. Through an ethnographic approach, the aim is to broaden the scope of investigation and measure the usability of tools for musicians in a real world setting. Six musicians are observed through the planning and preparation stages, rehearsals, performing and post-performance in order to better understand the tools that they use and how these tools could be improved. This work builds on previous investigations into more traditional production environments. This investigation also explores how requirements and tools have changed. The research highlights main areas of usability problems in navigation, clarity of expression, problems in understanding flow and a mismatch between requirements and software tools that currently exist. The results highlight strengths in the flexibility of such systems and identify where they solve traditional, hardware based problems. The paper culminates in a discussion regarding the values, strengths and weaknesses of hard and soft tools and points to potential future directions of research.

Introduction

The music industry relies on technology from production, right through to dissemination as can be seen through the popularity of services like iTunes and usage of production studios. In terms of production and performance systems, a variety of attempts have been made to produce a usable system. The problem of creativity, innovation, usability and generating successful requirements can often dictate poor user-centred design and an end product or service which does not meet user needs. Multimedia systems such as composition and collaboration environments are inherently difficult to design. In many instances, the kind of problems that occur can be attributed to evaluation and testing methodologies in order to verify that the tools are fit for purpose. A user-centred, formative approach to evaluation would prove increasingly capable of identifying and reducing usability issues in such an environment (Huart, Kolski, & Sagar, 2004.) Huart et al address this issue in their work. While the evaluation methodologies used to assess usability vary greatly, there seem to be problems in evaluating particular aspects of systems and how they relate to the variable requirements of users in an ever changing technological environment (Hewett 2005)(Benford et al. n.d.)

Ethnographic research is a qualitative research method focused on the complex set of social interactions and cultural context in a given environment (Grudin & Grinter 1994; Wolcott 2003; Malmi 2011; Jackson 2012.) Ethnography is used to explore social constructs, rich real world contextual environments and originated in anthropology and sociology research. Ethnographies are famed for their power to explain issues in a rich, detailed context and examine perspectives in an ecologically valid way.

Ethnographic methods have been criticised for being directed by researcher focus and lacking in methodological control, particularly where reliability is concerned (Cecez-Kecmanovic 2007; Cecez-Kecmanovic 2010.) Ethnographic research is also criticised for being time consuming and inherently difficult to conduct (Millen 2000,) where time critical alternatives are suggested. These issues are not limited to ethnographic approaches, though they may be more apparent here than in alternative methods and need to be considered. The motivations for using this method follows.

It is important to recognise that multiple methods provide balance in researching a complex topic such as that of HCI in regards to music systems (John & Marks 1997; Huart et al. 2004; Cecez-Kecmanovic 2010.) The use of ethnography is designed to validate existing theories and findings as well as to generate new theories, themes, categories and codes accordingly.

Other attempts have been made to build a usable solution through utilising modern technology. One approach which may hold weight is one which suggests using processing tools which are powerful, but also transcend well to user schemas. Many of the successful efforts tend to be in contextualised situations, where the user has a specific process or goal within the system. The eJay project (Gall & Breeze 2008) made some headway into understanding the usability factors, rather than simply proposing an overly complex and multi-layered structure that adds complexity and little else. The work here focuses on a specific environment (educational, collaborative) and the management process, without focusing extensively on the technology. The results here are somewhat promising. In terms of understanding context (Laske 1990) some interesting discoveries have been made about creativity in musical compositions. The work here suggests a three pronged approach, similar to modern requirements engineering, in understanding the process involved. Firstly, an event is generated by making changes to a hypothesis element. Expectations are then generated by posting changes. Finally, a goal is generated by posting desired changes. (Wolcott 2003.) Ethnography provides value in terms of its exploratory and explanatory power, highlighting contextual issues with real world examples to support theories and notions (Ahmed et al. 2012.) In terms of music making, the process has already been defined as a socially broad, situational and interdependent (Benford et al. n.d.; Jordà 2005) therefore it needs to be explored as such. An ethnography provides an ecologically valid alternative to previous work and the generation of new themes, a large dataset for open coding and a better understanding of requirements in relation to the user (Perez & Valderas 2009; Newell et al. 2006.)

There are a number of different approaches to enabling creativity in multimedia environments (Crow 2006)(Riley et al. 2009)(Ahmed, Benford, & Crabtree, 2012.) The evidence presented thus far suggests that creativity is an imperative process and for a system to be considered usable, even by broad definition, it must at least be effective and efficient, as described by in early usability research (Nielsen, 1994.) A collaborative effort by different media, technology and infrastructure providers in Norway summarises the literature on the value and relationships of creativity (Karahasanović et al., 2009.) The paper provides a succinct and valuable overview of creativity and requirements engineering, their interdependencies and the challenges in providing technological solutions for creative or innovative people.

DMix for instance (Oppenheim 1996), a musical interface, proposes some solutions in bridging the gap between requirements and usability. The difficulty in understanding creativity is highlighted as a key concept by Oppenheim. The value of context is highlighted here as a key aspect in building systems which can be considered successful and usable. Oppenheim ultimately describes a user-centred approach, stating that flexibility and interoperability as the major components of a successful system. This concept can be observed in modern systems, where connectivity between hard midi applications and soft applications such as VST plugins

enables users with different level of technical skill to communicate. The research by Oppenheim goes on to suggest a presentation layer which provides such functionality.

Modern music systems encompass a wide range of technologies, both for the context of producing music and by changing the initial purpose of an instrument itself (Mcpherson & Zappi, 2015;Zappi & Mcpherson, 2014). Instruments are no longer designed for a specific purpose and now digital instruments provide utility beyond performance (Benford, Hazzard, Chamberlain, & Xu, 2015.) The role of performing and consuming audio is also changing due to technology shifts (Hazzard, Benford, & Burnett, 2015.) The emergence of social networks and the utilization of technology to engager with social listening is also a key concern (Bull, 2005; Su, 2013; Yadati & Larson, 2014.) While there is clear evidence that the space is changing due to developments in technology, it is important to consider how these changes manifest in practice. We must consider the design implications of technological changes in this space and assess where technology can better accommodate the needs and working practices of the modern, dynamic musician. The challenge here is not to implement a new set of technologies, but consider the implications of technology usage within this space.

The following section describes the purposes and objectives of the research, including any considerations that need to be taken into consideration when evaluating the success of the research and making and generalisations about the results. This research focuses on the usability of live performance software from the perspective of the user. Here, the definition of a musician has to be broadened to user in order to take into account the fact that not all live performance artists are encapsulated in the traditional definition of a musician. Users, may rely heavily on sampled music in order to create new media. This is not composition in a traditional sense, though it is an original composition of existing material into something new, therefore it can still be considered a creative process.

The following research questions provide the basis for this work:

- How is music created in a live environment? Are these tools more or less usable than traditional alternatives and why are they used?
- How can software tools be used to better plan and organise a live performance? Do these tools enable a complex process to be broken down or made easier and if so, how?
- In what ways are software tools used to add to performance and how do performers gain from a seemingly additional layer of complexity? Surely playing would be simpler than playing and using additional tools?
- What additional functionality does the software provide, if any? Also, are there degrees of usability within these tools and does that correlate with a more positive performance?

- How are supporting software packages used to streamline the process from song inception to performing in front of a live audience?

Aims

The aim of the study is therefore to work with musicians to understand usability factors relating to the tools that they use to support their performance (or indeed perform with.) The ethnographic approach breaks the focus down into a set of processes, an evaluation of the tools in relation to their context and finally a generalisation (design implications) about the current state of tools for musicians in a live setting based off the findings of this particular community of users.

Objectives

The main aim here is to understand the factors and features relating to the usability of live music production and performance systems. The objectives are:

- To describe how technology improves the process of making and performing music
- To investigate how technologies could be used to further improve usability of systems to ensure that they provide additional benefits to live performers.
- To understand the relationship between requirements of a user and discuss how various implementations of software based music systems match said requirements within a given context or situation.

5.2 Pilot Study

The pilot study enables the examination of methods to ensure validity, reliability and to reduce any confounding variables(Riley et al. 2009; Følstad et al. 2012). This study focuses on ethnographic approaches with a view to highlighting context and understanding the intricate details of usability problems, examining qualitative data as it occurs in a natural environment (Ahmed et al. 2012; Cunningham et al. 2003; Hammersley 1989.) Ethnographies are much more difficult to control in terms of isolating environmental factors, removing confounding variables and controlling the nature of the experiment (Benford et al. n.d.; Inskip et al. 2008; Cunningham et al. 2009.) An experiment in a lab based setting, where the temperature, environment and equipment can all be controlled is likely to produce results which are more reliable however the validity comes into question with this type of method. The dynamic nature of such experimentation results in a series of events occurring which are difficult to predict at best, though the researcher has taken every effort to reduce the effect that they might have on the research, it is impossible to remove this effect entirely. The ethnographic approach has been chosen primarily for ecological validity (Benford et al. n.d.). In spite of the outside effects, the research examines musicians in their workplace, performing tasks which are not a simulation but have real world effects and consequences.

For the purpose of this research, the pilot study needs to be thorough in considering a multitude of possible outcomes and confounding variables that are likely to affect the results (Kaminskas & Ricci 2012). For this reason, the pilot study takes place in different venues, with different musicians in each venue and different criteria to measure in each environment to determine the best course of action going forward. As the ethnographic method is largely about forming a contextual, domain specific set of measuring criteria and due to the lack of existing knowledge with in the field of music-technology ethnographics, this approach can be used to find a ‘best fit’ for the method used.

5.2.1 Pilot 1

The venue chosen for this study is an acoustic open mic night in Elephant and Castle, London. Here, musicians perform for thirty minutes in a genre of music of their choosing. This study involves two participants, with differing technical requirements. The first performer professes to use no technology to aid their performance, while the second relies heavily on technical tools.

Table 1 describes the participants of the first pilot study.

	Musician 1	**Musician 2**
Pilot 1	Non-Tech	Tech

Table 1 - Pilot 1 participants

It is important to recruit participants before the performance event, in order to get informed consent, explain the nature of the study and examine their technical habits in planning and preparing for a performance. While the initial scope of the study focused around performance elements only, participants explained the usage of technology before and after the performance as key to its success, therefore these areas cannot be ignored, though are not explored at length herein.

5.2.1.1 Results

The first musician described technology as a *"nuisance"* and *"another way to make things more complicated than they have to be."* Upon probing, it was later discovered that the participant did use technology in other aspects of life. The participant owned an iPhone, a laptop and several other technologies. In spite of this, the participant exhibited a real reluctance to use technology to aid their performance. Even tuning aids were dismissed. The performer described their rehearsal as, *"polished and prepared,"* explaining that they would play through their set list several times a day in order to get the performance right. Without the use of technology, the performer completed their set with no obvious causes for concern. The

performer used only a Westwood acoustic guitar into a digital input and a Shure SM57 microphone. The sound engineer used a hardware based interface which fed directly into the amplification system at the venue. The engineer also used a laptop to keep track of performers and record performances. The audience watched and listened attentively and applauded after each song. While it is difficult to gauge the success of a performance on an audience's reaction, it would be unreasonable to suggest that the performance ended badly. One member of the audience described the performance as*, "lovely and warm,"* elaborating by saying it made her feel, *"like being on holiday in the Caribbean."*

The second (technical) musician described their performance as, *"using software to make my life easier."* The rehearsals of the performer involved using a number of technologies to assist. These included various applications to generate backing tracks to play along to and a metronome application to help with timing and rhythm. The musician struggled to name the tools that they used, but mentioned FruityLoops, Sibelius and Metronome for OSX. The performer did not mix their own tracks however, choosing to leave the process to a studio that they relied on and trusted. Their reasoning is described as follows.

"it takes too long to use all of that stuff. I'm out four or five days a week playing. When I do want to record something, I'll spend a couple of hours in the studio, then be back out playing later. Going to classes or spending money I don't have trying to learn something I don't need has no value for me." – Technical user

The second musician, the technical user, performed with the assistance of various technologies. Many of the technologies used were iPhone based apps, including a portable metronome and guitar tuner. They used an electric guitar, into an effects pedal which changed the sound to make it sound like an acoustic guitar. They also used an SM57 microphone for vocals. They also used a sound level monitor to measure the decibel level of ambient sound and ensure a consistency in their performance. While this is largely controlled by the sound engineer, the performer explained that they can affect the levels by*, "moving closer or further away from the mic"* and *"strumming harder."* When prompted, the participant explained that, *"sometimes*

adrenaline takes over and you think you're playing at the same speed or volume. Quite often, you're not."

While the second musician didn't receive as positive a response as the first, the audience did applaud each song and seemed to enjoy the music in much the same way. One audience member described the performance as*, "good, probably not the sort of stuff I'd listen to at home, but that's what these nights are for. We get to hear four or five completely different styles of music and that's nice."*

5.2.2 Pilot 2

The second pilot study took place in a small pub in Clerkenwell, London. While the study was designed with three participants in mind, one of the participants had to cancel their performance due to illness. This meant that the second pilot study matched the sample size of the first and was able to provide a contrast against the discussions and observation of the first study. The audience here was much more intimate and involved. For this reason, the researcher did not have the opportunity to speak with them personally, though groups could be addressed in this setting.

5.2.2.1 Results

The setting here was somewhat different to the first. A sound engineer was not provided, nor was there a PA system. Musicians were expected to bring all of the equipment that they need to perform for 20-30 minutes, with 10 minutes for setting up and packing up. The first participant reported as, "semi-technical," while the second reported as, "technical, or very technical."

Table 2 describes the participants of the second pilot study.

	Musician 1	**Musician 2**
Pilot 2	Semi-Tech	Tech

Table 2 - Pilot 2 participants

The first performer relied largely on supporting tools, rather than tools for performance. These tools enabled the performer to track progress, make notes and keep track of the information that they needed the most. In essence, the system chosen could be described as a semi technical management/knowledge information system. The three main tools the musician relied on where as follows:

- An electro-acoustic guitar with built in active pickups that could act as a digital tuner. The pickups are a standalone device, designed to measure pitch of a note and describe the tuning of the instrument, as well as boost the signal of the instrument before it passes on to another output device. This enables tuning without having a separate tuning device and is physically attached to the instrument. It runs from a battery and literally 'picks up' the noise of the guitar. It is similar to a pickup used in an electric guitar, however with a hollow body to capture the resonating sound.
- A physical, portable recording device. The device is a generic, non-brand, portable recording device designed for taking notes of speech or sound. The performer used this tool for both note taking and recording elements of performance, including clips of vocals, guitar riffs and drum riffs tapped out on the guitar. The performer described their use of this tool as, "a way to store ideas, things that are on my mind, a way to get it out and keep it safe. My recorder enables me to come up with song ideas and keep notes of sounds that I like. I use it like a journal for music"
- The musician also owned a laptop with Sibelius for recording, "more concrete riffs, ideas that have become songs, or parts of songs." Though they went on to state, "I don't really like relying on technology too much. I can't really afford to lose money or work when it [the technology] lets me down or goes wrong. As much as I love what I do, it's hard work making a living out of it."

The performance ended with a round of applause. Upon consulting with members of the audience, the general consensus was that the performance was, "good," and one group mentioned that they'd like to, "buy his album, if he has one." The audience seemed more

engaged than at the previous venue, though this may be due to the timing of the event, local factors or for entirely different reasons.

The second musician relied heavily on technology, beyond supporting their performance. It could be said that the technology is a part of their performance and enables the performance to take place, in the same way that an instrument, microphone or dancer may be integral to the performance. The tools are split into three sections, based on the chronology of where they were used. Table 3 describes where the tools were used, before, during or after the performance in question.

Before Performance	During Performance	After Performance
Guitar Pro	BackTrack	Cubase 6
BackTrack	BOSS ME-50	Pro Tools
MIDI Pickup		SoundCloud

Table 3 - Tools used during, before and after performances

The tools are described as follows:

- Guitar pro is a specialised tool for guitarists, which also includes other instruments. Guitar pro enables the composition of tracks, as well as playing along with the tracks. The software enables the customisation of each track, composition using external tools or the keyboard and mouse and a range of other effects, utilities and export mechanisms.

- BackTrack is a physical device created by Line6 for musicians. It enables the recording of tracks, exporting, importing and provides a portable platform for musicians who travel. Line 6 describe the device as, ‘a creative safety net.’ Guitar, vocals or any 1/8 or ¼ jack input can be used with the device.
- Cubase and Pro Tools are examples of Digital Audio Workstations (DAWs) in use. These are used to produce music, including stages of pre-production and post-production.
- SoundCloud is a web based platform for musicians to upload tracks and communicate with their fan base. It is a primarily free service, with some premium features for musicians who wish to communicate to a wider audience. It is similar to services provided by MySpace and several other musical web-based apps that are currently available. It provides a unique feature in that users can comment ‘in time’ with the track, where comments are not placed in a forum structure but on a timeline of the song.

The second musician to play, described their process of music as one which was “evolving all of the time.” Here, Guitar Pro was used for ideas, which could then be passed on to other musicians or fed into software which would create a more ‘realistic’ sound. The musician described a typical usage scenario as follows.

“I’ll get an idea or something and sketch it out on GP [Guitar Pro.] Once I’m happy with how it sounds, I’ll go down to one of the rehearsal studios in Denmark Street and get hold of a drummer who can emulate the sound. If it sounds good together with what I’m playing, then I’ll throw it into Pro Tools, add some effects and customise the sound how I like it, then stick it on my BackTrack and take it with me. That way, I don’t need drummers, bassists, or anything else. I have my BackTrack and it does the job that they do without all the fuss.” – Technical user

They also explained that they use a MIDI pickup device on their guitar, so that sounds can be input directly into the software by clicking a button and then playing. While this didn’t work well when asked to do it, the musician put this down to, *“software error,”* and a later demonstration of the device showed that it worked well with the software in question. The

significance of this is that the software failed to work as expected and provided no reasonable solution to the user. Not only was a solution not provided, but the problem could not be clarified beyond it simply not working, a “software error.” This failure of the software forced the user to look for solutions in finding a way to solve a problem where the solutions are unknown and the problem is difficult to identify. The support pages provided little help beyond reconnecting the devices and ensuring that everything was plugged in and switched on, as well as being configured in the settings screen. The user having to go to these lengths to solve a problem like this would seem unreasonable and suggest at first, that the software solution is not usable. However, the user choosing to persist with the device suggests that there is some value in using it, perhaps as the user mentioned in time saved or because a similar solution would be equally cumbersome.

The musician described the use of technology in the following way.

“It makes my life simpler. I don’t need to drag a drummer, kit, bags and other instruments around with me. My MacBook is like my band and the parts I need for my performance that night, go straight on to my BackTrack. Pro Tools and BackTrack are all I need to do what I need to do.” – Technical user

The user was then prompted about their reasons for choosing technology over a traditional touring band or alternative method.

“Time is the main thing. I probably spend half my week travelling. I’ve got all I need in my bag, when I need it. I dunno… I mean, sometimes it would be easy to get a travel guitar or something. I just like that I can re-create the sound and feel of a song on stage. After all, I am a performer.” – Technical user

When prompted about the usage of a travel guitar for their performance, the participant commented as follows.

“To be honest, I kind of look down on ‘simple’ performances. I don’t wanna pay to see that unless you’re Adele or something. No, even then, no.” – Technical user

Finally, the user was asked to comment on the emerging theme of usability and reliability of the tools as opposed to traditional methods.

“Stuff goes wrong all the time. I’ve used Pro Tools since college [5 years] and I don’t use half the stuff on there, unless I’m trying to be fancy with it.” – Technical user

This quote is particularly interesting as it highlights the extensive support for processes, not always of utility to the user.

5.2.3 Discussion

We see a number of different tools and technologies in usage here, with different purposes in mind. While DAWs are used for the core production practice, many other tools and technologies are in usage in this space that help to support the composition and production process. We also see that tools are often used at different stages with a different intended purpose, such as portable recorders for planning (before performance) and replication of sounds (during performance.)

An ethnographic approach is one which is designed to be deductive however, there are instances where being inductive can also benefit the research. As with either approaches, there are concerns. The underlying issue is that of reliability. There is difficulty in repeating such research in a controlled, consistent and dependable environment. The only feasible way to approach such research is by examining musicians within an environment in which they are comfortable. It would be unreasonable to expect the results of a controlled experiment to yield valid results. The setting is unnatural and the musician is being removed from an environment in which they are familiar and comfortable. For this reason, the musicians are more likely to

behave in a way which they believed they should. The work here is designed to capture rich accounts of musicians working in a live, distributed and often dynamically shifting way. The richness of data here helps to form a discussion regarding motivations, choices and the usage of tools in a real world context. This applied focus offers a novel research contribution by describing the how and why of technology use in music production and performance at a live setting and the findings can generalize to a discussion about implications for design in live music production technology.

While many of the musicians relied on technology, it seems as though these technologies are also met with a certain cynicism and fear amongst a few. The musicians who chose not to use the technology at the core of their performance, addressed the issues as related to trust, reliability and difficulty in learning or gathering the tools required. While it is expected that a digital divide would exist, as in any technical field, themes emerged which have not been previously addressed. The literature and previous research fails to discuss the issues of trust, difficulty of gathering tools and ultimately of the reliability of the tools. Whether this reluctance to rely on technology stems from a fear of the technology failing, a learning gap or a cause for genuine concern in the design of systems is, at least at this stage, unclear.

It is clear from the observation and discussion around the theme of technology in assisting musicians that users did not feel that the technology was at all usable if it could not be relied upon (trusted.) The users who did choose to use technology as a supporting tool, did so because of trust and a belief in the tools being reliable. What is clear is that a tool cannot be considered ‘usable,’ even in the basic sense of effectiveness, if it cannot do the job it was meant to do successfully. The pilot study however, is not conclusive and this theme requires further investigation in a larger, more applied setting in the main study itself. The discussion amongst musicians lacks any kind of consistency, in that each user has a different set of requirements and pre-conceived notions about the use of technology. However, it does highlight major usability issues and this is the aim. The approach chosen seemed to work reasonably well. The only issues are those inherent, between validity and reliability. For these reasons, the approach chosen is a satisfactory one and the experimental design will remain the same for the main study.

Flaws in the experimental design relate to data gathering techniques. Initial pen and paper information gathering methods proved troublesome. This method of collecting information does not lend itself well to an environment where observations and discussions happen quickly, over a short space of time. A combination of video data, pictures, audio and pen and paper techniques enabled the researcher to collect data that was meaningful in an efficient way. It is imperative that the methods and approaches to the research are validated before continuing,

due to the novel nature of what is being examined. Enough was derived from the research that the methods and approaches can be considered successful and the main body of the research can be pursued.

The approach shows real promise in generating rich, contextual data. The sample size proves manageable in that data can be collected in a timely manner and there is sufficient time for questions and discussions. Pen and paper data collection proves to be troublesome, especially as events happen quite quickly. Photographs with annotations prove to be the most successful method of data collection as they can be recorded and expanded on when time is a less critical factor and events are not happening as frequently. Audio notes also prove to be useful in explanatory and discursive issues, for instance where a link between cause and effect can be identified or a scenario occurs which requires a more involved description about supporting processes and multiple events occurring simultaneously.

Issues arising at this stage include poor time management, ineffective interaction with the system and a lack of structure in the interface to match that of the performance. While no errors have been observed, a lack of fluidity and a struggle to interact with the interface using one hand proves to be equally problematic. As the performances are informal and semi-structured, many of these issues may not transcend to other scenarios or identify real world problems and so further, more involved work is required to better understand the cause of usability issues.

5.3 Main Study

The following section describes the approach and findings of the main study.

5.3.1 Design

The design of the investigation is set out as follows. A sample size of 10 participants, over a 12 week period, from 6 different venues are observed and asked to discuss their use of technology in relation to live performance. This involved four participants in the pilot study and six in the main study. Participants are recruited using purposive sampling as users have prior experience of using similar systems and it is important to reflect their experience and working practices in a study that focuses on the usability and user-experience of tools for professionals. The main study group comprises of four males and two females, all based in London. Each participant is takes part in at least one performance of length ~30 minutes, with ~15 minutes spent setting up and clearing up on completion of their performance. Their rehearsals are also observed and documented as part of the ethnographic process.

The study takes place in multiple venues, over a twelve week period. Participants are interviewed to discuss their usage of technological tools, with a chance for the researcher to ask questions relating to their choices. Participants are then asked questions relating to their usage of non-technical tools and if appropriate, questioned about why they choose a non-technical tool over a technical one or vice versa. There is also an opportunity to ask further questions as themes and concepts become more apparent throughout the course of the investigation. Participants are then observed for 45 minutes, including their sound check and performance. The observation involves taking notes relating to their usage of technology, including any problems or limitations they encounter. Questions are then asked to the participant about their performance and usage of technology.

5.3.1.1 Participants

The following table – Table 4 - describes the participants in the main study.

Description	Years of experience	Age	Gender
Live performer	29	52	Male
Mastering engineer	11	33	Female
Musician/ producer	4	27	Male
Musician	7	18	Male
Songwriter	3	22	Female
Live sound engineer	9	37	Male

Table 4 – Participants self-reported descriptions

5.3.2 Method

Ethnography considers the rich social, cultural and contextual complexities within a given environment. The aim here is explore this context in the role of live music performance and production (Ahmed, Benford, & Crabtree, 2012.) At some point within the evening of investigation, the researcher performs, in order to become more involved in the process and provide a relative comparison of technology usage in live music performance. Data is collected through various mediums including paper, video recording, audio recording, e-mail communication and telephone conversations.

Hammersley's process of analysis (Hammersley 1989) is the model of analytical induction chosen for this research. The process focuses on reformulating a hypothesis presented on page 88 until there is adequate fit between consistency of occurrence and explanation of said occurrence. Where relevant exceptional cases are highlighted.

The process takes place as follows**.** Initial discussion for the basis of the work, asking about tools used. Discussions also focus on the reasoning behind the use of tools, typical usage

patterns, reliance on tools and range of technology used (environment.) Performances are then observed, with the use of tools a key point of focus. The data captured is then matched against the discussion results and compared and contrasted, in order to verify data and as an opportunity to 'fill in the gap' where necessary and prompt further questions or investigation. Post-performance discussion enables performers to reflect on their practice. This process is split into two parts. After the performance, participants are asked about positive and negative aspects of their performance and what role technology played here. Finally, the work culminates in a group discussion to try and elicit any further information or fill any gaps that exist in knowledge where a problem has been described but a solution has not been found. Table 5 highlights initial points of interests identified from the literature.

Live Composition Tools	Role
Supporting tools (visual for writing, non-visual for sharing.)	Supporting technology.
Production tools (keyboards, synths, monitoring software.)	Performance tools.
Collaborative tools (bands only.)	Collaborative or communicative technology.

Table 5 - Categories of tools

Hammersley's process of analysis (Hammersley 1989) is the model of analytical induction chosen for this research. The general steps involved in the process are identified in table 6.

1.	*An initial definition of the phenomenon to be explained is formulated. In this case, the pilot study should generate some general ideas, explanations and at least a single, simple case.*
2.	*Some cases of this phenomenon are investigated, documenting potential explanatory features.*
3.	*A hypothetical explanation is framed on the basis of analysis of the data, defined to identify common factors across the cases.*
4.	*Further cases are investigated to test the hypothesis.*
5.	*If the hypothesis does not fit the facts from these new cases, either the hypothesis is reformulated or the phenomenon to be explained is refined to exclude negative cases.*
6.	*The continual process is reformulated until the hypothesis is confirmed with consistency.*

Table 6 - Ethnographic process defined by hammersley

Table 7 describes points of interest in relation to the set of initial observations from the pilot study. These are not exhaustive and are subject to change (as is seen) however they provide the basis for categorisation and investigation in the first sense. Table 7 presents compositional tools and examples for further investigation in the main body of work.

Live Composition Tools	Examples
Supporting tools (visual for writing, non-visual for sharing.)	Midi interfaces, onscreen timers, crowdsourcing.
Production tools (keyboards, synths, monitoring software.)	Feedback, level indicators, visual and special effects and controls.
Collaborative tools (bands only.)	Twitter, Facebook, sampling.

Table 7 - Categories of tools used

5.3.3 Results

The results of the investigation are split into sections relating to the key aspects discovered. There is some crossover here between sections. To avoid repetition, discoveries are mentioned in the section under the heading which has the most relevance or grounding, in particular where problems originate. For example, where a musician has issues with processing in the software, though the eventual output may be a hardware based interface, the software is the source of the issue and will be addressed as such.

5.3.3.1 Software Tools

Through the course of investigation, many software tools were used. Participants utilized technology in different ways and to achieve different goals. When describing and using these tools, the musicians show a great deal of variance in terms of how and why they are using the tools. The scenarios of usage help to drive this and explain the motivations and reasoning behind using tools for a specific purpose. Several of the tools mentioned herein are used throughout the performance process and often cannot be attributed to a single phase of a musician's workflow. This crossover of tools is something which has not been anticipated and could perhaps shed some light on how broad tools can match somewhat fuzzy requirements.

Many of these tools have been examined fairly extensively in previous work (Arndt & Katz 2010; Ilom 2008) and the key here is to identify issues relating to the software that have not been mentioned in previous research. This is driven by a context of use. In understanding how successful the tools can be, it is first important to understand their purpose and to understand the requirements of the user within this context. It is possible to identify each of the applications being used, however, understanding the reasons why one tool might be used over another is less clear. Surely a production system must hold a set of functions or values which are key in creating a sound? The researcher here is able to identify, both from their own experience and from observation, that many of the functionalities of the software tools are not unique in their appearance. The researcher posed the following question to the participants.

"Why are there so many different applications for creating music, when they mostly do the same thing?"

An informal discussion followed, which shed some light on the issue.

“I suppose they do. It’s much more about experience than them being different though, isn’t it? I’ve used a few and they mostly do the same thing, mostly. It’s just sometimes easier to work with something recognisable, knowing where stuff is and how to place it.” - Musician

Much of the discussion that followed discussed key technical issues of the software and identified functionality that participants thought were unique, before eventually coming to the realisation that the application feature’s ‘uniqueness’ usually dissipated with the release of a new cycle of applications. Two key pieces of information can be identified from this discussion. Firstly, the functionality of these applications, even those familiar to participants, is somewhat fuzzy. It proves difficult to identify whether an application can perform a task beyond the user’s personal experience and identifying where or how to perform a task is something that users struggle with. Whether this is a learning or memory issue is unclear, though the discussion focuses around experience and considering that these users are all somewhat experienced in using these systems, memory would certainly seem to be the key issue. Secondly, the issue of familiarity is key in choice of applications. Though participants tend to argue about their reasons for choosing a software tool, the discussion often culminates in the same conclusive remarks relating to familiarity. This can be seen through the following comments.

“Ultimately, it’s about getting the job done. Cubase does that. Everything is where it should be.” – Musician/Producer

The preference of DAW here differs between participants. Other opinions offer justifications for or against using particular tools.

“I wouldn’t say Pro Tools is better, just I like it. I imagine someone else learning to use it would struggle. Even I sometimes find it hard to use. I usually find what I need though. I know

where to find things, not always where they are, but I know where to look." – Mastering Engineer

"Pro Tools is horrible, it's hideous. It's terribly designed and probably wouldn't even exist if it wasn't for studios hopelessly clinging on to the old way of doing things. There are so many better alternatives, but nobody wants to learn any different. Producers are lazy and that's the only reason it even exists anymore." – Mastering Engineer

While some of the comments are fairly extreme and do not necessarily transcend to a general consensus of musicians, or even the group in question, the points raised are valid ones. The issue of learning and memory has previously been tested both through an array of tasks and sketching exercises, though memory can be examined much more thoroughly through day to day usage scenarios that reflect those of the real world. The pressures, constraints and concerns of the real world soon began to highlight some serious issues in the software being used. One participant in particular showed signs of frustration, swearing and lots of noise making. While this may purely be a ploy for attention, it seems unlikely that a participant would aim to bring focus onto their failing to use a system. The environment is very much a competitive one and it would seem unusual for a participant to try and draw attention to any of their flaws. Hours are often spent where participants aim to come up with "better riffs" than one another and this competitiveness could be one of the key reasons for participants behaving so diligently. At this stage, the questions asked were very short. The researcher does not aim to ask leading questions, but to gauge the successes and failures of the software. Short, vague questions give the participant an opportunity to express their own viewpoints at the time in which they are experiencing an issue. The researcher asks a very simple and open ended question.

"How's it going?" - Researcher

Comments were as follows.

Many of the complexities manifest when trying to achieve particular tasks. This is evident where a

“I’m struggling. I’m trying to sync[synchronise] my tracks in Reaper but it’s misbehaving. It’s great for customisation, but not so good for problem solving. I’ve reached the track limit trying to connect everything together with my other mixers and I’m confused about where everything is going. I don’t know if the synch issues are latency or a problem with one of the tracks. I should’ve probably used Pro Tools, but it’s hard and over rated and I don’t have time to learn one crappy way over another.” – Musician/Producer

The tone here was one of familiarity and trust. At this stage, the researcher felt comfortable in asking further questions about the nature of the tools, without overstepping marks or creating any bias through questioning. Further prompts were made as follows.

“So where do you go from here?” - Researcher

Again, a vague and fairly open ended question. The participant has already identified an issue and the key here is finding out both the perceived problem and proposed solution. The participant responded as follows.

“I… I don’t know. I think I’ll spend a while trying to clean up some of the transitions and then if that doesn’t work, go back to an earlier mix. I hope I have an earlier mix.” – Musician/Producer

Here, the user became visibly quite upset and the researcher took the initiative to give them some space, wishing the participant, “good luck,” before moving focus elsewhere. The participant later returned to the researcher and described the issue in more detail.

“You remember that mix earlier? I had no idea where half of it was going and that was fine while it was working. In the end I scrapped it and went back to an older version. Picked out some of the timing issues in the drum track too. Sounds great now, come take a listen.” – Musician/Producer

The inability to perform or automate backups as in a version control system is something that would be expected of the software. The participant described the process of settings backup and restoration, but did not identify a viable backup method beyond being proactive and relying on naming conventions and a file system structure to create backups of tracks. The issue itself however is one of visibility and clarity provided by the system. The user knew where the core audio recording and midi versions of the tracks were and could access this, however the software fed into other applications and as the feed began moving between applications and tools, it became less and less clear where the processing on the track was taking place. Until this point, it can be considered a non-issue. When latency issues present themselves in delays and the track becoming inconsistent, the user experiences a seemingly unsolvable problem.

The previous discussion and findings led the researcher to further ask questions relating to managing content.

“Where do you store your music?” - Researcher

One of the participants answered this question as follows.

“Personally, I have stuff all over the place. A load of websites, plus band pages and three or four different computers that I’ve used in the last year. It’s all a mess. I used to use a USB but I can’t remember to do backups every five minutes. If I went ‘round picking up all my old tracks I could probably make a CD out of it all. Maybe I’ll do that…” - Musician

Another participant made the following remarks.

“I try to use DropBox. It’s a better way than before. But I don’t always have Internet. It’s really difficult on the train or waiting for buses. I don’t use more than one computer but it would be nice to access it and show friends, family and other people when I don’t have it with me. If it crashed, well, then I’d be lost. I should back it up but I don’t.” – Mastering Engineer

While companies such as Adobe are providing tools like the Creative Cloud to enable distributed working patterns of real people, the current crop of software for musicians fails to provide the same features. When such a system was proposed to the participants, they each suggested that this would be a feasible solution to their problem, however when asked about why they thought such a system did not already exist, they failed to respond. While SoundCloud and similar tools provide a vaguely similar functionality, they require a great deal of user input and this seemed to be the issue for many users. In fact, one user in particular commented that the process is, “too long as it is and doesn’t need to be any longer.” Even large scale desktop systems, through providers such as Apple, are providing both hardware and cloud based backup systems. Where time and music are huge sources of revenue, it seems counterintuitive that these are not the major concerns of software providers.

5.3.3.2 Communicative and Collaborative Tools

A variety of software tools used through the course of the investigation cannot be categorised as performance or production tools, at least not in the strictest sense. Though the pilot study highlighted pre-production, production and post-production tools and some performance related tools, communication is not something that has previously been considered. Interestingly, many of the core processes that a musician goes through do not relate to either production or performance of music.

Firstly, musicians need to communicate with one another. The types of interactions observed range from sharing and collaborating on tracks to organising events and sharing contact details. Table 8 summarizes tools used and their intended purpose of use in this domain.

Purpose	**Tool**
Organising events	Facebook, Eventbrite (tickets)
Discussing events	FB Chat, Skype, MSN Messenger, Google Talk
Informal chat	FB Chat, Skype, MSN Messenger, Google Talk
Video discussions	Skype, MSN Messenger
Communicating with fans	Soundcloud, Youtube, Facebook, personal webpages, E-mail
Distributing Audio	Soundcloud, iTunes, Dropbox
Distributing Video	YouTube, personal webpages
Sending out information to fans	E-mail groups, Newsletters (PDF), Facebook posts

Table 8 – categories of tools and usage

The first observation made is that the specialised software for musicians (Abelton, Cubase, ProTools) are not used for communication or collaboration. Upon further investigation as to why this was the case, the researcher came to the realisation that these software packages, designed for musicians, do not enable them to communicate beyond the constraints of the system and engage with a larger community. While it would be unreasonable to expect a tool for musicians to enable social networking as something akin to Facebook, the software lacks the facilities to communicate any data, whether that be metadata or musical data, outside of the constraints of the system. This led the researcher to ask further questions about the types of communication that can take place within the constaints of such a system. At this stage, the researcher took the initiative to try to find methods by which musicians could at least communicate information about the state of a track. Again, the search turned up little information beyond some improvised ways of working. One musician identified some novel ways of tracking progress in Cubase by naming the tracks accordingly. The tracks used naming conventions as follows.

'<song_Instrument_Effects>'

Where song is the name of the song that the individual track belongs to. <Instrument> is the first letter of the instrument recorded (G for guitar, B for bass, D for drums.) <Effects> describe any processing already on the track, for instance <Wah>, <Distortion>, <Echo> and <Phaser>,

These naming conventions, while ingenious in nature, are not easily understood by other musicians or external entitites. The researcher and other participants could not identify the reasons why tracks were named this way during the course of discussion. There are a number of possible ways that tracks could be described, as in tools such as guitar pro, instruments are described. Garageband for example, shows icons of the instrument in use. The inherent problem here is that a track may not be 'instrument based' or the instrument that the track could be played on might not be obvious when working on early versions of the track or may change over time. Ultimately, this type of discussion is frivolous. The point here is that the tool does not provide clarity amongst collaborating musicians or the facilities to communicate outside of the constraints of the system. One of the ways musicians overcame this issue of clarity is by using a web based track management system known as SoundCloud. Here, the website allows a user to upload tracks and write notes on the tracks that they own or tracks of other people.

There is also a personal messaging service, however this ability to provide feedback in the context of track time proves to be very useful amongst musicians. This type of communication happened frequently, between those participating in the study as well as to outside individuals such as fans and band members who did not take part in the study. SoundCloud provides a form of content management system in that it allows communication, while the tools used to create the tracks are specialised in their own purpose. One musician described this process as, “having the best of both worlds.” Further discussion highlighted the reasoning behind stating such a comment.

“Which two worlds do you describe?” - Researcher

The participant answered this question in the following way.

“Well, I have Cubase. It works well when I'm messing with my track, trying to find the right balance and key. It's my own private workspace that can't be seen by outside eyes. When I'm ready and happy with the track, I can share it using a different forum. I have a personal space and a public one. It would be nice if I could pass information between the two, but it works well enough for me.” - Musician

Throughout the study, Facebook proved to be the major point of communication. Each musician has a Facebook page which they openly shared with fans and musicians alike. Each of the musicians also used Facebook on multiple occasions, with most usage happening shortly before and shortly after a live performance. Participants were asked about why they chose to use Facebook and the kind of facilities and benefits it provided for them. They responded in the following way.

“Everybody uses it don't they? Everybody knows what Facebook is and everybody knows how to like pages.” - Musician

Further comments were made by another musician.

“Most people have it on their phones or iPods or whatever so they can connect instantly. I don't have to worry about giving out any personal details and they can go on Facebook and like my page, see what I'm doing, where I am and connect with me. I'd prefer a bit more control, but it's not like I can change Facebook. It's good enough for what it is” – Musician/Producer

When observing software based communication tools, the researcher noticed a series of sticky notes being used. These notes had images drawn on by hand and the participant who was making these notes was asked about what they represent.

“It’s a way to show progress of a part of a track. We’re working on a track together and he needs to know how far along I am. If I draw a picture of a guitar on one of these notes and write ‘1’ then he knows the first guitar is done. He will do the same when he’s finished with the drums and the lyrics. It’s just better this way so we don’t have to disturb the other person mid-work. Obviously you have to concentrate and it’s a silent way for us to communicate without any fuss.” - Musician

The software in use has no facility to express the completeness of a track or to allow multiple musicians to communicate progress. This novel concept enables the communication of status while allowing the participants to focus on the task at hand and know when the right time to come together is. While tools such as Garageband represent tracks in an iconic way, progress in this software state is unclear and the way that musicians tended to use the sticky note software tool was largely to formulate their own ideas and opinions. Often, notes were as brief as a single word, such as ‘finish’ and ‘7ths.’ While this might have meaning to the person writing the note, it is certainly not intended to communicate such concepts or ideas to others.

5.3.3.3 Activities and Sequence

The initial theory of activities and sequences proposed a three phase process, involving pre-production, production and post-production. The stages involved were then examined and refined into relationships focusing around a central performance (production.) While the three-phased approach encapsulates many of the processes that a musician goes through, it fails to identify a task or goal based approach and can therefore only be used as a general tool to categorise data collected. Ultimately, a more robust relationship model needs to exist to fit key goals and major aims of musicians within any given context.

The following groups of tasks have been generated based on the ethnographic data, with four distinct stages described; all focused around the major theme or goal of performance. Figure 1 presents these processes and table 9 describes them.

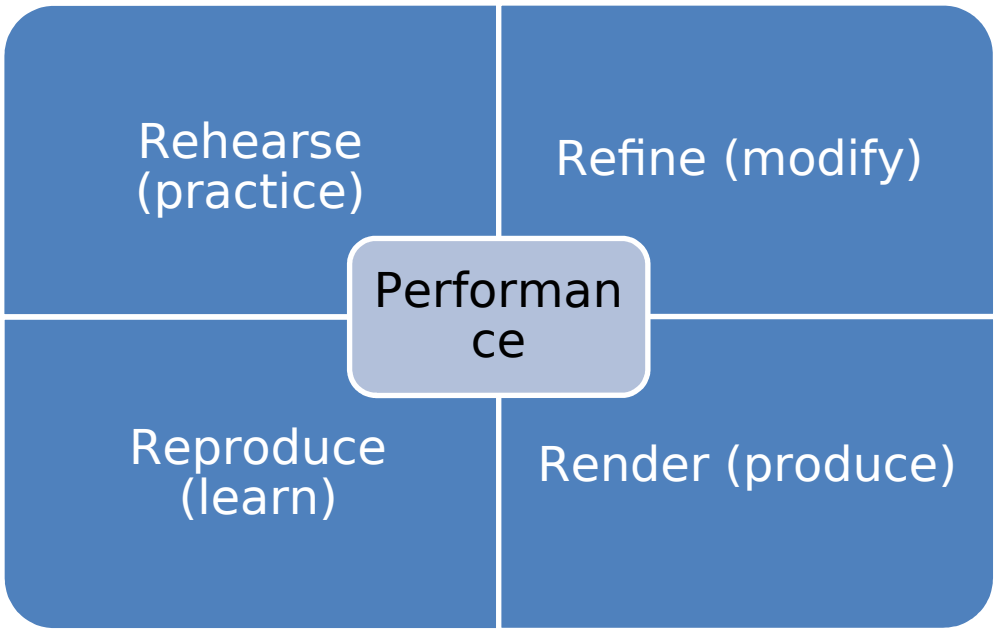

Figure 1 - Interconnecting components of live performance and their relationships

It is important to recognise here that any independent or non-formalised process, for instance rehearsal at home, is not strictly considered rehearsal. In the same way that a cognitive model

of a song cannot be considered a refining process, as no action is taking place. Each of these stages has some kind of activity attached to it to enable the achievement of a goal and should be treated as such. It is also important to recognise that this model does not aim to encapsulate 'fuzzy' goals, ie goals that can be categorised as either scenario-oriented or story-oriented. The space between the processes is also relevant in understanding where there is crossover. Rendering and refinement are adjacent as one process (refinement) enables another (rendering.) For this same reason, rehearsal and rendering have been kept apart, with only refinement, reproduction and performance linking the two distinct stages. The stages on the right are processes which rely on existing knowledge or state, while the stages on the left can happen at any stage in the course of a musician's work. These goals have been identified and categorised through the following observational and discursive approaches. Table 9 describes the four stages of music production observed, including situations and places where they take place.

Rehearsal	Happens in a particular space where instruments and equipment are available. This is either at a studio or at an event where a performance is or will be taking place. This stage has been observed and discussed in arranging times and spaces to rehearse. Software such as metronomes or click tracks and guitar pro are often used herein.
Refinement	Working within the constraints of either a software or paper based tool to make changes to a song. This process sits alongside rehearsal as changes that need to be made are recognised in rehearsal and made in refinement. This process usually culminates in a rendering of a "final version," though this is not always the case. Many track productions were not complete in the time that the study ended.
Reproduction	Reproduction is the process of recreating an original sound or song, or covering an existing song. Reproduction involves creating a sound which matches the musician's expectation or minimum rate of recognition. While difficult to quantify, it is ultimately a criterion which varies from person to person. The musician usually identifies a song as being successfully reproducible when it is added to their list of tracks that they play ("setlist.")
Rendering	Rendering involves processing the track, either recording it or using a software package to create a finished version of the song. The song is considered 'rendered' as and when it has been exported into an audio format such as MP3 or OGG.

Table 9 - Four stages of music production observed

5.3.3.4 Knowledge and Decision Making

Much of the knowledge to make decisions and choices exists within the musician's embedded working knowledge and practices. Eliciting this knowledge is integral in understanding how software systems could better cater to a user's needs. In the first instance, it is important to recognise whether a need for software exists within such a context.

Meetings were often held on a non-formal basis, with impromptu jamming sessions and general discussions being formed around a rehearsal set. Much of the information and knowledge that was required to make decisions, if non critical, would be discussed leading up to an event. Many of the more formalised knowledge and decision based information is encapsulated within a set of systems. Again, Facebook and texting prove to be a very effective and efficient means to communicate important information across musicians, promoters, events managers and the general public (potential audiences.)

One of the major issues identified with the method chosen is that information has to be passed and processed by multiple individuals before that information can then either be transformed into knowledge or to aid in decision making. This also caused some information replication, in that many people had the knowledge to help to make a decision, however that knowledge remained tacit and unspecified beyond a single context. An example of this problem arose when trying to promote an event. Rather than use a centralised system leading up to the event, detailing who would be arriving, or even using a ticketing system and recording sales, no such system was set in place. Instead, questions were often asked about how many people were turning up, with a great deal of confusion caused.

The end result of a lack of knowledge sharing highlighted some of the positive and negative aspects of formalised process and content control systems. The advantage of having a system here is that the progress, sales of tickets and each musician's responsibility to sell their 'allocation' of tickets can be tracked. The advantage of not having a system here however, enabled the musicians to make a quick decision on the day of the event to go out and promote it

through busking and sell tickets this way. In spite of the effort made, however, the event did not sell out. As this didn't present itself as an issue in the first set of events leading up to the study, there was no reason for the team to believe that this type of incident would occur. However, a lack of information is considered the cause of concern here. Had the musicians for example not been familiar with the environment or area (as was true with the pilot study) then a lack of knowledge would result in an inability to make a quick decision regarding busking. Knowledge is a key factor in the success of these events. Though it might not be considered integral for musicians to share knowledge about their compositions and practicing styles for example, it's imperative that they are able to work together on the day of a performance. It is also imperative that users recognise their accountability within the constraints of a system, whether people or software based. Even beyond the musicians, everybody within the system has a set of goals and should be able to ascertain accountability. In this study, there is little evidence to suggest this exists and for these reasons, responsibility is often deferred. Musicians being forced to busk as a means to improve marketing is a clear oversight from the marketing manager and one which could have been addressed had a system of responsibility been introduced.

The communication and collaboration sections of the study detail further issues relating to a lack of formalised structures. This section has detailed how the lack of communication can inhibit successful decision making and essential knowledge sharing. It is unclear at this stage whether or not a software system would be able to accommodate the needs of the user, though this provides a course for further investigation.

The knowledge, both of how to play and how to use the systems, is key here. A user relies on competency in order to produce tracks and to perform tracks in a live environment. While this knowledge is not necessary to share, it is important for musicians to open lines of communication to ensure that collaboration and performance can happen in a problem-free environment. The issues of time management, communicating concerns, sharing ideas and appreciating the magnitude of problems within this context are important. The tools that currently exist fail to consider these concerns successfully. Though there were not too many major issues with the performances, in part due to the experience of the people involved, these issues could have proved detrimental to the success of the project and the musicians'

reputations. It is also important to recognise here that the event is one of a relatively small scale and while the issues may not necessarily transcend to environments that are broader in scope, it could very well be the case that these issues are further compounded. In this case, everyone had a key role and responsibility, from photographer to marketing manager. Had this have been a distributed environment where lines of communication cannot remain closed and distribution is greater, then the issues become an even bigger threat.

Evaluation

The results of the ethnographic work describe tools in usage, including their successes and failures. Both typical usage scenarios and patterns (trends) in behaviours were examined in order to develop a holistic perspective of the usability of software tools for musicians. Identifying problems in usability (Ã 2006)(Lindgaard & Dudek 2003) and perceived usability (Tuch et al. 2012) proves challenging, especially in a complex environment such as the one here. The results show that the usability problems in these software tools are not in functional areas. Often, the usability issues proved to be the system failing to encapsulate the requirements of the user or indeed making a tool fit a purpose that it was not initially intended for.

The reasons for the failings of a system to encapsulate requirements are likely to be varied. Through participatory requirements elicitation (Perez & Valderas 2009) and by better understanding how requirements map to functionality (Alexander 2011) it would be possible to eliminate some of these issues. Here, the focus is on building functionality into a system without imposing barriers to entry when migrating from other software packages or upgrading from previous versions. Ultimately these tools are designed as a means to an end, ie a production tool and developing multimedia interfaces for this purpose is often challenging (Gall & Breeze 2008)(Miletto et al. 2006). Whether or not these tools should provide the facilities, functionality and tools to better plan and manage working patterns is debatable, though better integration to support the workflows of musicians is necessary. What is clear here is that musicians identify both a need for clarity in the design of systems and actively seek out alternative tools to meet their needs where tools are less than supportive. As such, this functionality can be considered a requirement at a fairly fundamental level. When we further

consider the context of this situation, in that these people are earning a living and depend on live performance to do so, it is critical that they are able to plan and organise their performance in a manageable way.

Communicative and collaborative tools are not the only areas with usability issues. The sheer complexity of the tools proves problematic, in that users could not understand the flow (Lee 2009) in the same way that they might with a physical guitar and pedal system for instance. Users are in some cases, forced to revert to previous versions of songs that are days or even weeks old, losing a large volume of work.

The reasons identified for a loss of flow and continuity could be due to a lack of clarity in presentation and the hidden nature of VSTs and plugins. Tools relating to mixing, processing effects and such are well hidden, within multiple sub menus, several layers deep. While this seems logical in that screen space is limited, when we consider the hardware counterpart this is not the case. Take a guitarist in performance for example. At bare minimum they will have a guitar, tuner, PA, amplifier and a series of cables. When we add multiple daisy-chained effects pedals, a microphone, multiple stands, plectrums and the variety of configurations, the complexity of these tools models that of software counterparts.

The musician is able to recognise many of the features that they may not be able to recognise in the software counterpart though. Flow presents itself in order, from the instrument, through multiple effects and then more outputs. This complexity is well managed, mapping off to a cognitive model which the user is able to understand. Changes in the structure do not affect the flow of information. If an issue is identified here, the user is able to manage that through investigating components through systematic removal. First, by testing the outputs by using a direct input and then, if necessary, identifying where the problem exists in processing. It is also important to recognise that any of these components can usually be disabled with the click of a button or by kicking the pedal. It is not to say that these hardware counterparts are not with issues. The sheer volume of cabling required is a nuisance in itself and the software can benefit by removing the medium altogether. What is clear here is that a strategy has been employed to

better understand flow of information, presence of status (red lights, green lights) and that each of the elements in the system are both tangible and accessible.

Time and portability are also key concerns, which the software does not necessarily accommodate for. While tools like Guitar Pro provide an intermediary tool between the early stages of music composition and eventual production stages, there are further processes involved where software either does not exist or is not easily accessible. Time-essential tools need to exist to enable the user to perform quick actions, such as record a snippet. The load time of Garageband for example, far exceeds that of what the user considers reasonable and this is before any interactions have taken place. Musicians used very few mobile tools and this is also of concern. As people and software become more pervasive, the tools provided to people should model their behaviours and working patterns in order to better accommodate both wants and needs.

Much of the literature supports the findings here, in suggesting that the work of musicians is unstructured and diverse. The Mixed Reality Lab at Nottingham University embarked on a similar research venture, looking to evaluate how traditional music making can be supported (Ahmed et al., 2012.) Other researchers recognise that the social and collaborative issues are the major ones that need to be supported (Benford et al. n.d.) Here, as in the work done by the Mixed Reality Lab at Nottingham, musicians were able to perform and involve the crowd with little, if any, assistance from technology. The findings here in relation to the aims suggest that there is a need to extend the social and collaborative facilities to a point where the technology can either enable these interactions to take place, or support these interactions through a centralised management interface. The tools used are simply too disparate and different to be considered effective. Simple issues like using different ‘standard’ versions of MIDI present with complications when moving between interfaces and this problem has been identified in a variety of systems and contexts.

Explaining social and collaborative needs of users within this environment is a much more varied and broad discussion. In regards to the aims here, many of the social and collaborative requirements of the system are where it fails in terms of usability. Technically, the systems can

provide all kinds of functionality. Beyond the technology is where things become problematic. Previous work (Cunningham et al. 2009) aims to address this issue in an investigation of selection and presentation of music in a social atmosphere. While they choose a party as their main area of focus, the environment is not entirely dissimilar to that of a pub or club venue where a professional musician might play, thus the discussion is certainly relevant within this context. Social music and the idea of applications and software helping to enable this type of activity are at the centre of the discussion here. In spite of the non-structured atmosphere in which the study is conducted, many of the key activities here also model those within a working environment of a musician. Sampling, communication and collaborative decision making are key processes. The study also addresses issues that have not been envisaged through the course of this research, including access control and permissions, event specific information relating to contributions and time management facilitation. Here, even in a soft environment, the social aspects become quite broad and difficult to manage without some kind of centralised repository or interface to control the structure of the evening. It is important to recognise that the study here is only conducted for a maximum of four hours and the investigation is somewhat limited in terms of scope. It does however show the value of ethnographic approaches within novel areas of research, in helping to uncover issues that do not present in a lab setting such as how content is retrieved (Cunningham, Nichols, & Zealand, 2009.)

Previous research in collaboration and communication within a music retrieval environment focuses on the information access and storage aspects of music. Through qualitative research, researchers are able to describe a comprehensive understanding of the environment in which the study takes place (Cunningham et al. 2003)(Cunningham et al., 2009.) The method and findings here are clearly valuable in understanding the usability problems, but also where requirements fail to match the system aiming to encapsulate such requirements. Here, the suggestion is that the requirements are not generated based on real world usage scenarios. The findings of this study show that in real world environments, musicians struggle to organise, collaborate and communicate effectively. While these might not be immediately perceived as ‘usability issues,’ effectiveness and efficiency relating to their job task are facets of usability and certainly relevant in the context of this discussion. While the software seems to work reasonably well when complexity is limited and when communication is facilitated by specialist tools (e-mail, telephone, conversations) the usability of the software could be

improved by adding an additional interface for management, storage, retrieval, communication and collaboration. As these are high level tools that have not been considered essential to the process of songwriting, software vendors have failed to encompass them within their technology. This provides a platform for future research and software development that extends beyond the scope of this paper.

Conclusion

Many of the findings of the work presented here are distinct and personal, though various themes emerge around the discussions, quotes and observations discussed herein. Firstly, problems have been identified relating to the usability of software tools, where visible status needs to be present and the inherent complexity needs to be managed, in order to avoid the software becoming complicated and confusing. Secondly, the software fails to meet some of the basic requirements of the users, such as engaging with audiences using social media, where communication and collaboration are key.

Table 9 and figure 1 highlight a workflow defined across distinct stages and the tools that are used therein. The work here describes problems relating to each of these stages, such as making tools fit a purpose that they are not designed to be used for. We can take the example of social media usage here (SoundCloud, Facebook) for managing content. Here, users are choosing an external tool to work with their content rather than rely on the DAW. The social media phenomenon is something which needs to be encapsulated within this type of system, rather than continuing with a traditional, archaic model. Ultimately, software needs to be designed with an experience in mind (Arhippainen & Hickey 2011), rather than a specific set of tangible goals. Utility is about more than just functionality, but crafting a user experience which encompasses the practices and behaviors of people in this space (Zimmermann n.d.) How to approach this type of problem is, as yet, unsolved in commercial platforms.

Beyond this, there is some discussion around supporting tools and making tools fit purpose. There is clearly a cost to learning new technologies in this environment and a trade-off between time learning to acquire and learn new tools and the utility provided by new technologies.

The tools also do not necessarily reflect the dynamic, shifting working patterns of musicians in this space. Tools are often used across multiple facets of production and performance and their context is not always evident or fit for purpose. The other challenge here is in the large number of commercially available tools and where they fit within this process. The refinement process and collaboration process for instance, are very disparate in nature and a number of tools are evidenced in use within these areas. This presents an interesting challenge in designing a tool that fits multiple purposes in a holistic way and helps to mitigate transitioning between stages in individual workflows. We must consider that composition is a loosely structured process (Söderman & Folkestad 2004) and the necessity for tools to support flow (Vitters Ã¸ 2000.) In terms of what is used and evidenced herein, a variety of tools are used with no clear consensus in which tool fits each dynamic purpose. Ultimately, the lack of flexibility and flow presents the greatest challenge for software developers in this space. Users are expected to learn and interact with a number of distinct software applications, hardware applications and processes in order to achieve their goals. Each tool is used for a specific purpose and even the massively complex digital audio workstations lack the flexibility to move between elements of production, collaboration, communication and supporting processes in a way which models the workflow of contemporary musicians. While tools that exist perform reasonably well, it is clear that the core processes and supporting processes require better support from technology to enable musicians to work more freely and focus on being creative over learning new technologies.

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