iProduce Music

INVESTIGATIONS INTO SIMILARITIES AND DIFFERENCES BETWEEN HARDWARE AND iPAD APPLICATION MUSIC PRODUCTION TOOLS

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Declaration

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Abstract

This research paper reviews current views on music production tools, specifically iPad synthesiser applications and hardware synthesisers. A review of the literature highlights current trends, including the increasing use of iPad digital technology to produce music. The review also highlights strongly opposing views about the quality of music produced with the iPad. It is also clear that there is a lack of empirical research in terms of comparing music produced using iPad and hardware synths.

On the basis of the review, it is argued that it is possible to design an attitudinal online survey and an online listening comparison study to investigate observed differences between differently produced sample sounds. The attitudes of the proposed sample group would be investigated using a Likert scale. Attitudes explored include negative and positive sentiment toward both hardware and iPad produced music. The methodology used to design the Likert scale is reported.

The technical design of the listening test is reported in detail, including individual settings for the synthesisers, settings for Cubase and all control details. The sample sounds are investigated using aspects of timbre based on a recent study analysing musical timbre semantics. Appropriate statistical analysis is suggested.

The discussion suggests that the music production industry would benefit from independent research to offer conclusive evidence about the difference, if any, between music produced by hardware synthesisers and controllers as opposed to that produced using the iPad. Limitations of the technical design of the listening test are also highlighted. Without independent research, there is a possibility that there may be a significant change in how music is produced, and while the advantages of digital technological advances are recognised, there is also concern that the very unique sound produced by hardware synthesisers may be lost.

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Chapter 1

Introduction: The Changing Face of Music Production

For some time now there has been a significant debate about the impact of iPad applications (apps) on the future of home music production (Synthopia, 2012). Moon (2011) quotes Alan Parsons, the famous music producer as saying "why would anyone take recording on an iPad seriously?" There is some evidence that the iPad is not universally welcome across the board. Yet, The Gorillaz, a famous hip-pop band decided to shun the studio to record their fourth album, The Fall, with the iPad in the same year (T3 Magazine, 2011). Perhaps this is a reflection of a generation gap or of a resistance to change. One thing is clear however and that is that the use of digital technology to produce music evokes strong and often opposing views. Perhaps cost is also an issue. The Gorillaz album referred to above cost, for all the apps involved, £63.23 (T3 Magazine, 2011).

With the ever increasing number of technological advances such as the availability of controller and synthesiser apps it seems that anyone can become a music artist. Inevitably, this proliferation of DIY music apps asks many questions of professional music production. Is the use of iPad apps going to creep into professional music production in the studio and if it does will it affect the quality and quantity of music production? Will the shift, which is already evident, lead to a decrease in the number or quality of music studios?

It seems that there may be a tendency in the music production industry to allow significant changes to occur on an ad hoc basis. New technology becomes available and amateurs and professional music producers start to experiment with it and then it appears to become the norm. While this may be a very good characteristic of the industry, there are very few other professions that will allow certain changes to take place without any real attempt to insure an improved quality in the finished product. One could argue that the wide availability of cheap and often free iPad music production apps could lead to an abundance of poor quality production, thereby making it even more difficult, in a very crowded marketplace for the talented artist to stand out.

The DAW has done more than any other technological advance to completely change the landscape of music production. However it hasn't stopped there, and the increasing availability of digital technology has brought even greater innovation to the field of music production.

While there is a multitude of articles and personal opinion pieces about the iPad and music production, it appears that many of them are guides about their use rather than hard evidence about the quality of the music they produce. This makes it difficult for any passionate music producer to make a decision about whether they should use hardware controllers and synthesisers as against iPad apps.

Thus there is a lack of research in Ireland and worldwide on the impact of digital iPad technology and professional music production. There is a lack of research about attitudes towards hardware as opposed to iPad music production tools. There is also a lack of comparative data available on the difference in quality between music produced using one method as opposed to the other, i.e., hardware synthesisers as against iPad synthesisers apps.

The present paper will attempt to address this lack of research by designing a study that would offer such a comparison test. In designing such a study, the focus would be on eliciting information on attitudes to quality of sound produced, negativity or positivity to iPad produced sound and views about the industry becoming saturated. The main research aim is to offer a research design that would examine the quality of sound produced by hardware synthesisers as compared to the quality of sound produced by iPad synthesiser apps. To make this research as relevant as possible, the test would have to be administered to a group of professional music producers.

The remainder of this paper is organised as follows. Chapter 1 gives a brief introduction to the research paper. A history of music production is outlined in Chapter 2, as well as how the advent of technology has influenced the field of music production since the late 1970's. This chapter specifically explores the development of iPad apps and their influence on music production. This chapter concludes with a summary of the main points and outlines the ongoing debate about digital technology in music production.

The design and methodology of the proposed study is outlined in Chapter 3, describing in detail both a proposed attitudinal survey and the listening test. The technical design of the listening test is outlined in Chapter 4. Chapter 5 suggests appropriate statistical analysis. Finally chapter 6 offers discussion and concluding remarks as well as highlighting limitations of the design of the listening test and suggestions for future research. Future directions in exploring the use of digital technology in music production are also explored.

Chapter 2: History of Music Production

2.1 INTRODUCTION

Music production in the context of recorded music dates back to the 1800s. From the time that Thomas Edison first invented the phonograph, which was initially intended to improve the quality of the telephone (Dannenfeldt, 2008) right up to the present day there have been constant advances in technology. The music production field has evolved from a hand cranked Victrola phonograph to compact mobile multi-track recording studios, in essence from analogue to digital studio environments and currently to music production on the move. In relatively few decades, audio technology has progressed from electrical recording and magnetic tape to the multi-track recording studio and finally into the computer era. Today we live in the age of digital technology and the Internet. As with most other aspects of life, audio technologies have been impacted by developments in other industries, none more so than the invention of the integrated circuit by the computer industry (Persson, 2006). This has been a significant milestone, influencing the amount as well as the rate of change on music recording practice.

One of the early key moments in the evolution of music production was the opening in 1900, of the first studio by the New York Phonograph Company and in 1902, the opera singer Enrico Caruso completed his first recording there. This was a momentous event as it made music available to the masses, i.e. anyone with a home record player. Later one vinyl disk could be recorded and duplicated and could then be played by anyone with a gramophone record player. This is an early example of the 'one to many' concept.

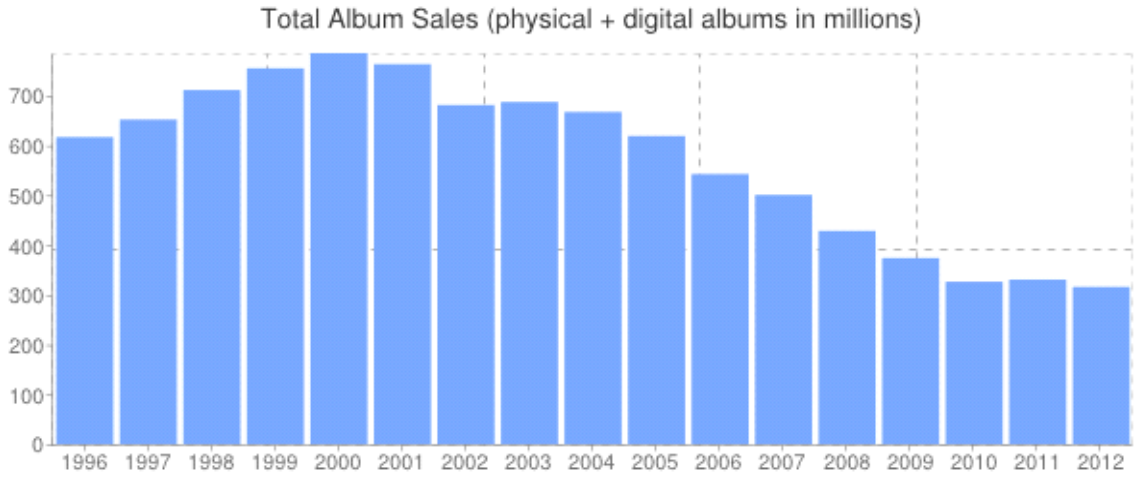
The next key event was the advent of the computer and particularly the networking of computers. Networking of computers is the defining characteristic of the information age or as we more familiarly call it, the Internet: 'this mediated network will be unconstrained by miles or kilometres' (Gates et al., 1996).

There has been another significant comparable event in the recorded history of communications i.e. the printing press. It was one of the first true 'one-to-many' communications medium. The impact of the printing press on its era was profound in breadth and depth, and was directly related to its 'one-to-many' communications capability (Eisenstein, 1979). Drawing this parallel to the printing press is valuable in that the change from typesetting for the printing press to computer aided publishing is more than akin to what is happening in the music recording industry. As a massive change has taken place in the transition from typesetting to desktop publishing, so too the transition from the recording studio with its banks of equipment to mobile devices may well have the same significant impact on the music production industry into the future.

In some ways that is exactly what is happening again today, with the advent of mobile devices adding to developments in music production where it is actually becoming much more accessible to anyone interested in producing their own music.

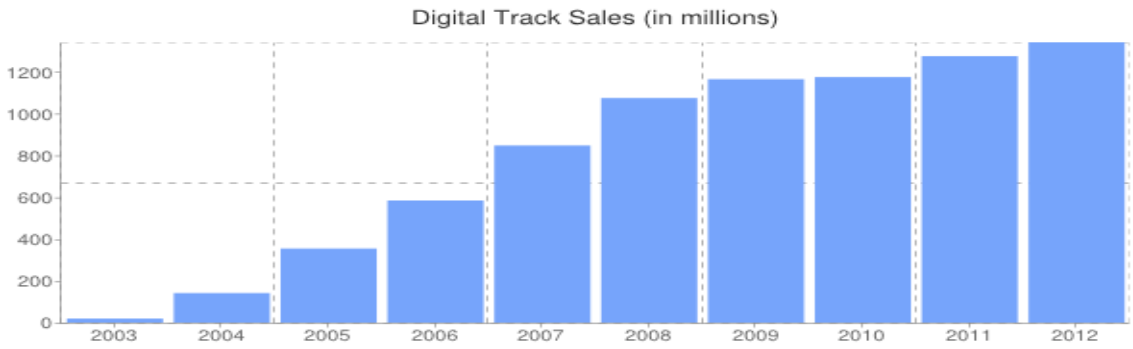
There are multiple mobile devices widely available, including popular Google Android tablets and smartphones. However, they have not had the same impact as the iOS operating system. There are a number of reasons for this, primarily the fact that the Apple iTunes store is comparatively secure for developers (developer.apple.com, 2014). This means that app piracy is less of a problem than that which applies on some competing platforms. Also the fact that Apple makes a small number of devices with a set number of configurations allows users to test for compatibility in a relatively easy manner. For this reason, this literature review is primarily focused on the emerging influence of controller and synthesiser apps for the iPad as there is "huge fragmentation" in the Android operating systems and devices. (Jones, 2013).

Who has facilitated this advance in music production? The consumer, of course, has been a major buyer of music recordings, as the graph below (Figure 1) indicates (Brown, 2013).



(Figure 1: Total Album Sales physical + digital albums in millions. Source: gloriousnoise.com)

An in-depth analysis of the data highlights that album sales reached a peak in 2000 and have been steadily declining since then. This coincides with the emergence of single track downloads which has rocketed from over 1.9 million in 2003 to over 1.3 billion in 2012, as the graph below (Figure 3) illustrates (Brown, 2013).



(Figure 2: Digital Track sales (in millions). Source: gloriousnoise.com)

Consumers want music faster and cheaper (Tschmuck, 2013). They are one of the key influences on how music is produced. Music producers have to respond to this trend and are increasingly being influenced by the availability of a wide range of technological advances to make music cheaper, mobile and ever more speedily accessible. The downside for music producers is that these advances in technology have also led to the rise of illegal file sharing which has a direct financial impact on every single sector of the music industry. (Budden, 2012).

The third group that have had to respond to this change are music artists themselves who have had to adapt to the ever changing face of the music industry. Traditionally artists performed to promote their music thereby leading to album sales, so for example in 1970's and 1980's Queen did multiple tours to promote their music (Queen, 2012). In the early 2000's there was a notable decline in the number of tours done by major artists, mainly due to a boom in record sales. In other words they didn't need to tour as much to be successful. With the advent of the digital age album sales, as shown in figure 1, have plummeted, thereby necessitating an increase in music tours again. As music becomes more accessible, the artist has to work harder to become more visible in an overcrowded digital music market. To some extent, music artists have always had to find innovative ways of making their product available to the public and it is interesting to trace this back to the early days of music production.

2.2 EARLY HISTORY OF MUSIC PRODUCTION

The hand cranked Victrola recordings were produced on thick wax disks. Although innovative at the time, the quality of this music reflects the equipment on which it was recorded. From that time onwards music production has constantly advanced to strive to produce as authentic, as possible, a representation of the original recording session, in other words as if the listener was in the studio with the artist. One of the major landmarks was the invention in 1904 by Lee de Forest of the Triode Foreshadowed, which was what became known as the vacuum tube (Dannenfeldt, 2008). This directly led to electronic music production.

The condenser microphone was developed in 1916 by E. C. Wente at Bell Labs (Schoenheer, 2003). It evolved over the next decade into the Western Electric 394-W microphone used to produce the first generation of multi microphone studio recordings. This was important because prior to this, performers in a music studio had to sit very close to the bell of a horn to record. This resulted in overcrowding if a large band or orchestra was being recorded as they were squeezed into a small space, without any way to balance the volume of individual performers. This led to poor quality recordings, as there was no distinction between various instruments.

The new technology was revolutionary because when it became available in 1925, it meant that large groups could sit in their normal positions and the volume of the individual could be manipulated for a more unique precise recording. With the late 1940s came the editing of music facilitated to some extent by the development of magnetic-coated sound recording tape instead of the wax disks.

Music production was further enhanced in the 1950's when multi-track recording became available. This allowed studios to take cutting and mixing music a step further by taping and then combining separate tracks recorded at different times into one master mix. More developments came in the late 1960s when stereophonic sound became available thus allowing studio engineers to further experiment with different effects like echo and reverb (Dannenfeldt, 2008). With the advent of cassette tapes in the 1970s, followed by the development of compact disks in the 1990s, the music industry came into the digital age. By the mid-1990s these developments led to music production becoming much more experimental.

2.3 THE ADVENT OF THE COMPUTER

When Steve Wozniak and Steve Jobs set up apple computers in 1977, leading to the development of the Apple II, no-one could have foreseen the rise and rise of the computer industry. This was the world's first Personal Computer to offer colour graphics and it was a starting point for third-party computer developers to create music synthesis software and hardware. So the so called "Studio in a Box" was created, essentially a Digital Audio Workstation (DAW),

According to Mel Lambert in an on-line article in 2011, (Lambert, 2011) a DAW is best defined in the following way: 'A Digital Audio Workstation is a computer-controlled system or network collection of components that allows all of the major digital recording, processing, editing and replay functions to be controlled from a central location. It also enables companion audio production tasks and functions including, for example, the integration of MDI information, or time code/sync data from an editing or synchronization system to be coordinated from the same control surface' (Lambert, 2011). In other words music production became a one stop shop. Sample-accurate editing, multi-channel mixing and signal processing could be added to basic digital recording.

The development of the DAW has influenced the move from analogue to digital recording and without the DAW, it is likely that there would be no debate about the iPad as a music production tool today. The DAW has done more than any other technological advance to completely change the landscape of music production. And of course the refinement and the development of the DAW has continued unabated over the last two decades. Micro Technology Unlimited, in a major collaboration with Apple computers began to produce music synthesis software for the Apple II. They further developed the Delplay-12, now considered to have been the world's first pro quality 'direct to disk' DAW.

The New Digital Synclavier began its life as the first real time digital synthesiser. As technological advances continued it was transformed from being a musical instrument into a multi-functional digital production unit. The combination of sampling/digital synthesis and disk-based recording and instant playback was revolutionary.

Since the first apple computer, there has been constant development and upgrading in the computer industry. Contrast the Series-1 Computer Musical Instrument developed by Fairlight, which was specialised and expensive, to the Commodore C-64 which was much cheaper and above all else offered the powerful MIDI based functions. Musical Instrument Digital Interface (MIDI) is a standard protocol for the interchange of musical information between musical instruments, synthesizers and computers (PCmag.com, 2012). MIDI controllers come in two different forms. Performance controllers that generate notes are used to perform music and secondly controllers that may not send notes but transmit other types of real-time events. Many controllers available today are a combination of the two types. This suddenly enhanced the versatility of the DAW, making it widely available and most importantly much more economical.

In 1985, in a collaboration between Lucasfilm and Convergence, a new company was created called The Droid Works which released a workstation called SoundDroid (Lambert, 2011). Although it was invented primarily for editing film, it had one seminal feature in that it had an outstanding interface that incorporated touch sensitive graphics, programmable functions and servo faders. For the first time, here were all the functions in one workstation.

In the same year, Digidesign released Sound Tools, the precursor of what is now a household name and industry standard music production software and that is Pro Tools (Musicradar.com, 2011). This was to become a juggernaut and a market leader because the quality and consistency of the software was of such a standard, it became the software of choice for many studios and music producers.

Other companies similar to Digidesign followed the same trend as Pro Tools such as Steinberg's release of Cubase (Musicradar.com, 2011) and Apple's own Logic Pro (Lambert, 2011). These are DAWs that have evolved over time with the advancement of computers. As of today, an unlimited amount of tracks

and an unlimited amount of instruments and effect plug-ins can be used to record, edit and mix, as long as the computer system has the capacity to produce it.

As computers have become smaller, cheaper and more mobile, they have transformed the world we live in today. Specifically this review is concerned with the development of the IPad, and how it has revolutionised mobile music production. When Steve Jobs set up Apple in 1977 and released the Apple II computer he probably had no idea how far his company could go in respect of mobile technology.

2.4 THE DEVELOPMENT OF THE iPad AND iOS OPERATING SYSTEM

When Apple began experimenting with the idea of a tablet as a graphics accessory to the Apple II, it was created to allow artists to draw on a canvas. Although Steve Jobs was forced out of Apple in 1985 (Block, 2006), Apple continued to experiment with hand held mobile devices, leading to the release of the Newton Message Pad, essentially a personal digital assistant. Who could have envisaged that over 1.1 million households in Ireland, would own a tablet by the end of 2013 and a significant proportion of these would be iPads (Kennedy, 2013). While this gives people access to instant information, entertainment and endless opportunities for creativity, it also removes the elitism that was previously a feature of many aspects of the creative arts, none more so than in music production.

The development of the iPod quickly transformed how music is accessed. The iTunes music store opened in early 2003 (Block, 2006) giving iPod owners the ability to buy music online and download it to their iPod. Although there was a lot of opposition on the part of record labels to this development, they eventually had to accept that the music industry had arrived into the digital age. In 2007, the iPod was followed by the iPhone which was essentially a combination of the iPod and a smartphone. But of course, Apple had a much bigger plan in terms of technology and went on to create iOS, an integrated operating system across the three platforms of the iPhone, iPad and iPod touch. For iOS to achieve the status and influence it has today, the opening of The App Store was the ultimate creation.

Apple was constantly refining their technology in relation to mobile and handheld devices and the release of the second-generation iPhone in 2007 led to persistent rumours about the iPad's release. Essentially the iPad is a bigger version of the iPhone and when it was released initially, it had much more processing power. Although the iPad grabbed headlines for its price on release in 2010, the real magic was the availability of third party apps for every aspect of life. By January 2011 there were 13,912 music apps (Davenport, 2011) available from the app store and a significant number of these were music production apps. Since that time, music production apps have gone from being very basic, almost hobby like, to very sophisticated state of the art professional studio quality tools.

For the purposes of this paper, controller and synthesiser based apps are the main focus of interest. Before controllers can be discussed, it is important to refer to MIDI to further explore controllers for

music production. As mentioned previously, MIDI controllers come in two different forms. One form send musical note data and the other form sends real time events. There are many different types of musical performance products on the market, in different shapes and sizes, for example, a piano keyboard (see figure 3), a drum kit and even wind instruments. These can be used to control hardware or software synthesisers.

(Figure 3, Akai Max 49 MIDI Keyboard and Software Controller: Source: akaipro.com)

In addition non-performance controllers which are the ones used to control the DAW, usually contain faders, knobs and a transport bar for recording and playback controls. These types of controllers control virtually every aspect of the software DAW (see figure 4).

(Figure 4, Tascam US 2400: Source: musiciansbuy.com)

With the advancement of touch screen technology certain companies released touch screen MIDI controllers such as Liine's Lemur and Slate Pro Audio's Raven MTX (Jones, 2013). It was only a matter of time before third party developers started releasing controller apps for the iPad at a much more affordable price. For example, the Lemur today will cost approximately $500 whereas the iPad app for the lemur costs approximately just $25. One of the most impressive apps is TouchOSC (Jones, 2013) which offers amazing versatility as both an instrument and DAW controller and only costs $3.50.

There are other apps that are software specific such as Steinberg's iC Pro (Scarth, 2013) which is an advanced remote control app for Cubase. One of the unique aspects of using an iPad is that it eliminates

the need for cables and from an ergonomics stand point, makes a studio a much cleaner, efficient and neater space. In addition it also offers the option of mobility thus leading to the opportunity to mix from different areas of the recording space. It has a possible additional use in that it can be used for a live gig to control the mix from anywhere in the arena as long as there is a Wi-Fi connection available. If there is no Wi-Fi connection available, it is possible to connect using a USB cable but for this an Apple camera connection kit is necessary which comes at a cost of approximately $40. There are useful products coming on the market like the MIDI Mobilizer which enables MIDI data to be sent and received by an iPad as long as the app supports a MIDI feature.

Using the iPad as a controller can be very intuitive and can create very precise mixing and editing as a producer, allowing a very tangible experience where the interface allows for a high level of control and precision. However when it comes to using the iPad as a MIDI keyboard, it could be argued that it originally lacked that real feel that comes from playing the keyboard. But even this issue has been addressed as Akai have developed a MIDI controller just for the iPad (see Figure 5) allowing the iPad to be used like a hardware synthesiser.

(Figure 5, The Akai Synthstation 49. Source: Akaipro.com)

2.5 FROM ANALOGUE TO DIGITAL SYNTHESISERS

Before digital synthesiser for the iPad and desktop computers can be discussed, the influence of analogue synths needs to be highlighted. There has always been a debate with regard to whether analogue synthesisers are better than digital synthesisers and the debate rages on (Dobos, 2012).

An analogue synthesiser combines voltage controlled circuits, such as oscillators, filters and amplifiers to generate and shape sounds (documentation.apple.com, 2014). With an analogue synthesiser, the sound begins as an analogue circuits, followed by processing with more analogue signal and finally it is delivered from an output socket. The first synthesisers were made from various electronic test equipment like signal generators, processors and filters. These were used to create early electronic music (Sherriff, 1999).

However the size of the early synthesisers was quite problematic in that they tended to take up entire walls like the Modular Moog synths used by Keith Emmerson as shown in figure 6. (Jenkins 2013).

(Figure 6, Modular Moog Synthesiser: Source: llg.cubic.org)

To address their lack of portability, they were adapted so that modules were put into one single box and hardwired. One of the negatives about this development was that these synthesisers were less flexible in the sound created but the advantage was that they were more portable and easier to use. A musician did not need to learn what every module did and how to connect each module with wire to get a sound. Instead it was a simple matter of pushing the 'on' button, using pre-sets that were built-in and then using certain filters and oscillators to get the desired sound (See Figure 7).

(Figure 7, Mini Moog Synthesiser Source:vintagesynth.com)

In spite of the disadvantages highlighted above, the reality is that for many musicians and music producers, their loyalty to analogue production remains, believing that no other process can rival it. They believe that analogue synths are warmer, more natural and offer a 'soft-saturated-rich sound'. They are critical of digital synths because of a belief that the almost human feeling produced by an

analogue synth is lost and sound produced from a digital synthesiser is lifeless and therefore undesirable for many musicians and producers (Dobos, 2012).

In spite of their reservations, the advent of digital synthesisers has brought a world of versatility. What is a digital synthesiser? Simply put, in a digital synthesiser, the signal flow is digital. Binary descriptions of the signal, i.e. a string of zeros and ones are fed from one algorithm to another and then transformed into an analogue signal so they can be played and heard.

The first digital synthesisers arrived on the scene in the early 1980's and the most notable around this time were the New England Digital Synclavier and the PPG Wave. These synthesisers were not cheap. However they offered a glimpse of the future as they utilized Frequency Modulation (FM) synthesis and also sample playback (Audio State of Mind, 2012). With the release of the Yamaha DX7 in 1983, the floodgates opened and a range of digital synthesisers, mostly produced in Japan, ushered in the digital era (Fukad, 1985).

Due to the fact that digital technology was finally at a low price, the 1980's became a decade of experimentation in that companies realised that profit was to be made. This experimentation brought developments in music production that would have a serious impact in decades to come, yet the spirit of exploration did begin to fade as the 1990's was ushered in.

There was only one very significant development in the late 1990's that would change the future of the synthesiser forever. The old analogue world collided with the new digital one to produce the Virtual Analogue synthesiser (Pekonen & Valimaki, 2011).

The Yamaha VL-1 was the first synthesiser that used physical modelling technology which created sounds based on mathematical models of a real instrument (Nomer, 2008). Physical modelling is a synthesis method for virtual analogue synthesisers, which uses mathematical recreation of moderately simple models used in analogue subtractive synthesis. Virtual analogue synthesisers use the old style of an analogue knob-per-function interface with a fully digital sound engine (Vail, 2014). It also offers instant gratification because the ease of use and the built in pre-sets made life easy for many musicians and producers. This means that time is not wasted setting up the synthesiser for the required sound. Simply turn it on and it is ready to go.

From the point of view of the topic of this research paper the next step in the evolution of the digital synthesiser was very important. This was the move from hardware to software interfaces for synthesisers (Audio State of Mind, 2012). In the early 2000's computers hit a power to price ratio that meant people could own a powerful PC at a much lower price than was previously possible. This meant that software synthesisers (softsynth) came into direct competition with hardware synthesisers. Software synthesisers have become more and more refined, striving to emulate the sound produced by

an analogue synthesiser. For instance the MinimoogV which is a software version of the real physical synthesiser, tries to mimic the behaviour of its analogue counterpart, the Minimoog. It does this by attempting to follow the same signal path digitally as the Minimoog. The signal path starts with three oscillators, the signal then goes through the filter and finally onto the amplifier. The Minimoog is monophonic, meaning only one note can be played at a time and the MinimoogV also adopts this style. Access Virus synthesiser also has a softsynth version which is said to be one of the closest representations of a hardware synthesiser.

In spite of the above comments, the main difference between analogue synthesiser and softsynths is that the analogue synthesiser has its own unique characteristics. Every time it is used, it can sound different whereas a softsynth will always sound the same from one use to another because the parameters and settings are saved.

There are now a vast amount of softsynth apps available for the iPad. However, the general consensus is that the quality of possibly up fifty per cent of iPad apps is very poor. What is meant by sound quality? Sound quality is typically an assessment of the accuracy of audio output from an electronic device across five sound quality metrics: Clarity, Focus, Envelopment, Dynamics and Response (Mellor, 2012). Several iPad apps would not meet these criteria listed by Mellor such as EDKeyz and Air Synth (App Store, 2013). In contrast, like softsynth trying to emulate their analogue counterparts on a desktop or laptop computer, there are also apps on the iPad, such as Filtatron by Moog, which like the MinimoogV try to closely mimic the Minimoog analogue synthesiser. (Cooper, 2014).

2.6 SUMMARY

This review has traced the evolution of music production from a single item, hand cranked Victrola in the late 1800's to vast amounts of stationary equipment in the late 1900's with now a return to very small handheld devices such as the iPad, which with the appropriate apps, are capable of producing high quality studio sound. One of the most frequent criticisms of the new technology is that some music producers believe that it may be taking away from the quality of the sound. Examples of these debates over the last decades are vinyl versus CD, analogue versus digital recording and analogue versus digital instruments. These are still ongoing today.

In 2014 computers have come a long way, from taking up a full room to now being so mobile and convenient that they can be handheld. This has led to the iPad becoming such a powerful tool for music production in that it is essentially a 'studio in a palm' rather that a 'studio in a box'. It now offers a new A7 64 bit chip. This even outshines some laptops and Desktop PC's. Cubase can be run as an app on the iPad now and theoretically it gives the option for unlimited tracks. It just shows where advances with the iPad are going. With more processing power becoming available all the time, it is now becoming possible to have a range of apps on the iPad, from powerful virtual analogue synthesisers, to

full Digital Audio Workstations to very intuitive control interface apps for both DAW's and hardware synthesisers.

The consumer plays a major role in this evolution, demanding ever more enhancements. For example is seems devices are just becoming interfaces with the software contained in the cloud. An ordinary example of this is Google Docs for word processing. Hardware may be stripped down to the essentials, leading to an empty environment but with perhaps more possibilities. What are these possibilities? Musicians may not have to pay out hundreds or possibly thousands of euros to record in a studio but instead may opt to stay in their own space and employ a simple to use interface on the iPad and get what they consider quality recordings without, possibly, a studio producer present. Once the session is mixed, the tracks could be uploaded to the web in a matter of minutes, successfully bypassing the record companies and possibly keeping any profit from the production. This may be a positive for some DIY musicians who might take advantage of this new technical era. The recording of albums, by the Gorillaz and Mark Jenkings, using the iPad have been referred to above (T3 Magazine, 2011and Jenkins, 2013).

On the other hand this may possibly lead to very little need for music studios and therefore lead to less opportunities for sound engineers and music producers. Also since it is becoming easier for artists to upload music online and to market it themselves, the fear is that a generation of generic, uncreative music will ensue and artists with more creativity and experimentation will fall by the wayside. How does a producer stand out in a crowded market place, particularly if they don't have the resources to market themselves online?

Another criticism of the iPad is that when using it as a DAW controller, it lacks the size of a full mixing desk. For example if a song with 24 tracks was to be mixed, it would be impossible to fit all these on to an iPad screen, causing a scenario where the producer would have to scroll through all the tracks to locate the one that needed manipulation. In this case, the advantage of a mixing console becomes obvious where, with 32 tracks to control, it is simple to go to track 24 immediately. A search for the track is unnecessary as they are all visible.

The debate with regard to using the iPad as a synthesiser continues without any real conclusion. There is much controversy about the benefits of hardware versus software synthesisers or are they on an equal par. The iPad is cheaper and more efficient. There can be a quite a number of synthesisers on one device at a price that is not out of the range of most musicians and producers. No longer does a studio space need to be full of hardware synthesisers that are substantially more expensive than their app counterparts. The only possible area of controversy with using an iPad as a synthesiser on a music track is the sound quality. Technology has come far enough to closely emulate what hardware digital and analogue synthesisers produce. Professional and amateur music producers are not looking for the iPad apps to be better quality than hardware synthesisers but rather for them to offer the same sound quality

they have been used to for years. The concern is that if the sound quality was to overtake hardware synthesisers it would surely be the death of the hardware synthesiser and thus the demise of an iconic part of the music production industry.

However, the jury is still out and more research is needed to finally prove the advantage or otherwise of controller and synthesiser apps for the iPad. There appears to be a significant lack of research that attempts to compare the quality and timbre of music traditionally produced with that produced using iPad controller and synth apps. It is very important that music production does not allow itself to slide into a very significant change in how music is produced without first examining the pros and cons of these new developments.

CHAPTER 3

METHODOLOGY AND IMPLEMENTATION

Based on the literature review, it seems that there is a lack of independent evidence regarding the quality of music produced using hardware synths in comparison to music produced using iPad synth apps. The first part of the research would look at attitudes towards the use of iPad synthesiser apps in music production. The second part of the study is designed to look at possible differences between sounds produced by two production methods, i.e. iPad production versus hardware production. This chapter describes the design of the study, and how the study would be implemented. The first section describes the steps involved in setting up and carrying out an online survey on attitudes to the use of hardware synthesisers and iPad app synthesisers. The second part describes the studio production of sound samples and how an online listening test would be conducted. The production of the sound samples is illustrated and reported in detail, in Chapter 4.

Two main hypotheses would be investigated:

(i) Age, skill and current use of iPad music production would predict perceived cost effectiveness, efficiency and positive and negative impact on production.

(ii) It is predicted that there would be no significant perceived difference between iPad produced sound and hardware produced sound.

3.1. ONLINE SURVEY ON ATTITUDES TO iPAD SYNTHESISER APPS AND HARDWARE SYNTHESISERS

3.1.1. SAMPLE GROUP

Proposed participants would be professional music producers. Ideally the sample size should be at least one hundred participants.

It is absolutely essential that participants would have considerable expertise in music production. The possibility of accessing such a sample was investigated. SurveyMonkey.com did not have an immediately available database of professional music producers and given the timescale of the research paper it was not possible to carry out the surveys of the scale and depth required to investigate the hypotheses. That is why the main focus of this research paper is to produce a comparison listening test that can be used in future research.

3.1.2. METHOD

The first part of the survey would cover the participant's demographic background and their music production experience. There would be six questions in the online survey (*see appendix 1)*. These questions would be generated to focus on a key aspect of the research, i.e. the impact of controller and synth apps on music production in the studio. A Likert scale would be used to measure attitudes to the use of controller and synth apps in music studio production, including, usability, cost effectiveness, efficiency and attractiveness of these apps to would be participants in the online survey. (Likert, 1932).

This survey would be made available through SurveyMonkey.com (Finley, 1999). The data would be collected and analysed retrospectively. Descriptive statistics would be computed for participants' attitudes to the use of controller and synth apps on the iPad.

3.2. STUDIO PRODUCED LISTENING TEST USING BOTH TRADITIONAL HARDWARE SYNTHS AND iPAD SYNTHESISER APPS

3.2.1. SAMPLE GROUP

Participants for this survey would be professional music producers. They would ideally have many years of experience so they can properly assess the sound samples that are going to be created during the proposed experiment. They would have access to an acoustically treated room, i.e., a music studio with professional sound monitors Participants would be asked to confirm that they did not have hearing loss as this would interfere with the outcome of the survey.

3.2.2. METHOD

The first part of the listening survey would collect data on the participants' demographic background and their music production experience. The second part of the survey would be a listening test. For this, five sets consisting of two tracks each, one produced using hardware synthesisers and one produced using iPad synthesiser apps will be created in order to ensure that there would be sound samples available for comparison. These questions would be concerned with characteristics of the sound, specifically aspects of timbre. Participants would be asked to compare the two tracks on each set on the following characteristics: rough, bright, harsh, deep, thick, hollow and degree of warmth. These descriptions of sound are based on an analysis of musical timbre semantics (Zacharakis, Pastiadis et al, 2012). The choices are designed so that tracks could be compared to ascertain if there is any difference between sounds produced using hardware synths and iPad synth apps and if there was a difference as to which would be superior, inferior or would they be equal. So for the purposes of this research paper ten sound samples would be produced. The technical details in relation to the production of the samples will be discussed in Chapter 4.

3.3 ETHICAL CONSIDERATIONS

Due to the fact the survey would be carried out online, ethics approval is required for both of the online surveys. This is because participants need to give informed consent. In particular, consideration would have to be given to any possible conflicts of interest on the part of participants, for example, they may have a vested interest in promoting one method of music production over another. The listening test is presented in such a way as to ensure random presentation of the tracks.

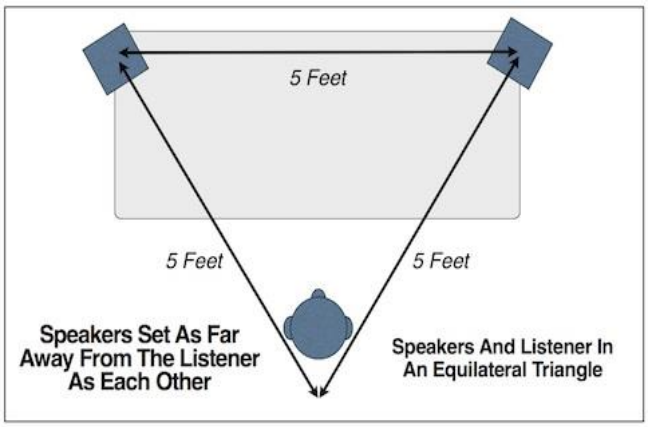
CHAPTER 4

TECHNICAL DETAILS OF DESIGN

One of the main aims of this research is an attempt to professionally produce sounds using hardware synths and iPad synth apps so that they can be presented to music professionals for comparison purposes. Therefore the production of the sounds is of primary importance. The following is a description of the actual studio work which was carried out.

4.1. PROFESSIONAL STUDIO DESIGN

As part of the design, the tracks were actually produced in a professional music studio i.e. the room being used was acoustically treated, the equipment was of professional grade and the monitors were set up in the right configuration as shown in figure 8.



(*Figure 8, Monitor Setup, Source, Owsinki & Moody 2011)*

4.2. PRODUCTION OF THE TRACKS

The aim was to create ten short samples of different sounds, each consisting of ten seconds duration. Five of the tracks were produced using traditional hardware drum machines, phrase synthesisers and oscillator synthesisers. Five of the tracks were produced using synthesiser apps. Three of the tracks were created using identical app versions of the hardware synthesisers, while two of the tracks were created using an app that had almost identical characteristics to the hardware version. The following conditions were controlled in the studio in the production of all tracks:

- Computer
- Acoustically Treated Room
- DAW (Cubase)
- Audio Interface (Focusrite Saffire 10 I/O)
- Monitors (Samson Rubicon R8A)
- MIDI data will remain the same so the identical notes will be played by each type of synth,

thereby creating conditions for proper comparison.

A studio session was set up using Steinberg's Cubase recording before any track was created. As soon as Cubase was started, a new blank project was created, followed by setting up audio inputs from the Focusrite audio interface. In addition, the MIDI output from Cubase through the Focusrite Interface was set up. Common to all hardware synths used in this research, a MIDI cable from Focusrite was used to control that played by the synthesiser.

In contrast, tracks produced by iPad apps, were created by using a MIDI Mobilizer II by Line6. This allows MIDI data to be sent and received by the iPad. In order to record sound into Cubase a stereo track was created for each sample recorded. The stereo output from the synths was sent to the Focusrite audio interface and received in Cubase.

The first four tracks, i.e., the first two sets, did not have a MIDI input but instead the drum sequence was programmed into the Korg Electribe ESX-1 and the iPad version of the Korg iElectribe. This was a simple drum beat in 4/4 time and had 16 beats per bar. The beat was mapped out with a kick drum, snare drum and a hi-hat.

For the remaining six tracks, i.e., the last three sets, a simple musical melody was used. This was drawn out with MIDI and the data was sent to the synths and then the sound created from them was recorded. The volume was also closely monitored to make sure the levels of each track remained the same and did not change the end recording of the listening test.

See Table 1 for details of the order in which the tracks were recorded as well as the common settings used across the various tracks.

4.3. DETAILS OF THE RECORDINGS IN CUBASE (Table 1)

Track	Device	Channels Recorded into Cubase	Settings	MIDI	Track Recorded onto	Time recorded	Average Db level
1A	Korg ESX-1	1 and 2	Drum Beat	No	Stereo Track 1	20 Seconds	-6dB RMS
1B	iPad iElectribe	1 and 2	Drum Beat	No	Stereo Track 2	20 Seconds	-6 dB RMS
2A	Korg ESX-1	1 and 2	Drum Beat, Tube Gain at 110	No	Stereo Track 3	20 Seconds	-6 dB RMS
2B	iPad iElectribe	1 and 2	Drum Beat, Tube Gain at 110	No	Stereo Track 4	20 Seconds	-6 dB RMS
3A	Korg Kaossilator Pro	1 and 2	MoodySax Pre-set	Yes (A Dorian scale)	Stereo Track 5	20 Seconds	-6 dB RMS
3B	iPad iKaossilator	1 and 2	MoodySax Pre-set	Yes (A Dorian scale)	Stereo Track 6	20 Seconds	-6 dB RMS
4A	Korg EMX-1	1 and 2	Dual Osc, Triangle, Saw wave	Yes (4 notes D,G,F, A)	Stereo Track 7	20 Seconds	-6 dB RMS
4B	iPad iMS-20	1 and 2	Dual Osc, Triangle, Saw wave	Yes (4 notes D,G,F, A)	Stereo Track 8	20 Seconds	-6 dB RMS
5A	Korg EMX-1	1 and 2	Dual Osc, Triangle, Saw wave Tube Gain at 110	Yes (4 notes D,G,F, A)	Stereo Track 9	20 Seconds	-6 dB RMS
5B	iPad iMS-20	1 and 2	Dual Osc, Triangle, Saw wave Tube Gain at 110	Yes (4 notes D,G,F, A)	Stereo Track 9	20 Seconds	-6 dB RMS

4.4. TECHNICAL DETAILS ON THE PRODUCTION OF EACH TRACK WITH FEATURES IN COMMON

4.4.1. THE FOLLOWING TABLE ILLUSTRATES THE SETTINGS OF THE FIRST FOUR TRACKS (1A, 1B, 2A, 2B)

(Table 2)

Track/ Device/ Software	Kick drum	Snare drum	Hi-hat	Percussive Bleep	Tube Gain
1A/ Korg ESX-1	**Amp Settings** Decay = 87 Pan = centre Low boost = 62 Level = 127	**Amp Settings** Decay = 127 Pan = centre Low boost = 0 Level = 10	**Amp Settings** Decay = 127 Pan = centre Low boost = 71 Level = 121	**Amp Settings** Decay = 51 Pan = centre Low boost = 69 Level = 77	Analogue Tube Gain = 0
	Osc Settings Wave = Sine Pitch = 12 Mod Type = Envelope Mod Depth = +18 Mod Speed = 86	**Osc Settings** None	**Osc Settings** None	**Osc Settings** Wave = Sine Pitch = 0 Mod Type = Envelope Mod Depth = +57 Mod Speed = 114	
1B/ iPad/ iElectribe	**Amp Settings** Decay = 87 Pan = centre Low boost = 62 Level = 127	**Amp Settings** Decay = 127 Pan = centre Low boost = 0 Level = 10	**Amp Settings** Decay = 127 Pan = centre Low boost = 71 Level = 121	**Amp Settings** Decay = 51 Pan = centre Low boost = 69 Level = 77	Digital Tube Gain = 0
	Osc Settings Wave = Sine Pitch = 12 Mod Type = Envelope Mod Depth = +18 Mod Speed = 86	**Osc Settings** None	**Osc Settings** None	**Osc Settings** Wave = Sine Pitch = 0 Mod Type = Envelope Mod Depth = +57 Mod Speed = 114	

2A/ Korg ESX-1	**Amp Settings** Decay = 87 Pan = centre Low boost = 62 Level = 127	**Amp Settings** Decay = 127 Pan = centre Low boost = 0 Level = 10	**Amp Settings** Decay = 127 Pan = centre Low boost = 71 Level = 121	**Amp Settings** Decay = 51 Pan = centre Low boost = 69 Level = 77	Analogue Tube Gain = 110
	Osc Settings Wave = Sine Pitch = 12 Mod Type = Envelope Mod Depth = +18 Mod Speed = 86	**Osc Settings** None	**Osc Settings** None	**Osc Settings** Wave = Sine Pitch = 0 Mod Type = Envelope Mod Depth = +57 Mod Speed = 114	
2B/ iPad/ iElectribe	**Amp Settings** Decay = 87 Pan = centre Low boost = 62 Level = 127	**Amp Settings** Decay = 127 Pan = centre Low boost = 0 Level = 10	**Amp Settings** Decay = 127 Pan = centre Low boost = 71 Level = 121	**Amp Settings** Decay = 51 Pan = centre Low boost = 69 Level = 77	Digital Tube Gain = 110
	Osc Settings Wave = Sine Pitch = 12 Mod Type = Envelope Mod Depth = +18 Mod Speed = 86	**Osc Settings** None	**Osc Settings** None	**Osc Settings** Wave = Sine Pitch = 0 Mod Type = Envelope Mod Depth = +57 Mod Speed = 114	

When the settings in the table were inputted into the hardware and iPad drum synths, each track was recorded for 20 seconds and the average dB level was monitored and kept at -6dB RMS. Unlike the rest of the tracks for this listening test, no MIDI data was needed as the drum beat was programmed into the sequencer. Each track was recorded using the stereo output of the hardware and the iPad. After the four tracks were recorded they were edited to each be 10 seconds long with a gradual fade-out at the end to indicate to the listener that the sample will be coming to an end.

4.4.2. THE FOLLOWING TABLE SHOWS THE SETTINGS FOR THE THIRD SET OF TRACKS (3A, 3B) SETTINGS

(Table 3)

Tracks	Device/Software	Pre-set	MIDI
3A	Hardware Korg Kaossilator	MoodySax	A Dorian scale (A, B, C, D, E, F#, G, A)
3B	iPad IKaossilator	MoodySax	A Dorian scale (A, B, C, D, E, F#, G, A)

For these two tracks, the set up was simple as they both required a pre-set to be loaded and neither synthesiser allows the pre-sets to be modified in anyway. After this the MIDI data was sent to each device and the stereo output was recorded for 20 seconds and their dB level was monitored and kept at an average of -6dB RMS. After the two tracks were recorded they were edited to each be 10 seconds long with a gradual fade-out at the end to indicate to the listener that the sample will be coming to an end.

4.4.3. THE FOLLOWING TABLE SHOWS THE SETTINGS FOR THE LAST TWO SETS OF TRACKS (4A, 4B, 5A, 5B)

(Table 4)

Track/ Device/ Software	**Osc Settings**	**MIDI**	**Tube Gain**
4A/ Korg EMX-1	Wave = Triangle+Saw Pitch = 0 Mod Type = Cut-off Mod Depth = +18 Mod Speed = 86	Four Notes (D, G, F, A)	Analogue Tube Gain = 0
4B/ iPad/ iMS-20	Wave = Triangle+Saw Pitch = 0 Mod Type = Cut-off Mod Depth = +18 Mod Speed = 86	Four Notes (D, G, F, A)	Digital Tube Gain = 0
5A/ Korg EMX-1	Wave = Triangle+Saw Pitch = 0 Mod Type = Cut-off Mod Depth = +18 Mod Speed = 86	Four Notes (D, G, F, A)	Analogue Tube Gain = 110
5B/ iPad/ iMS-20	Wave = Triangle+Saw Pitch = 0 Mod Type = Cut-off Mod Depth = +18 Mod Speed = 86	Four Notes (D, G, F, A)	Digital Tube Gain = 110

When the settings in the table were inputted into the hardware and iPad synth, the MIDI data was sent to each device and the stereo output was recorded for 20 seconds and their dB level was monitored and kept at an average of -6dB RMS. After the four tracks were recorded they were edited to each be 10 seconds long with a gradual fade-out at the end to indicate to the listener that the sample will be coming to an end.

4.4.4. ADDITIONAL FEATURES OF THE PRODUCTION

During the production of these samples, features of the ergonomics of synthesisers were also noted. This will be discussed in Chapter 6, the discussion section of the paper.

The tracks were then exported from Cubase as 16 bit, 44.100 kHz wav files. These would then have been added to the listening test in the following order to ensure random presentation of the differently produced tracks: 1B, 1A, 2A, 2B, 3A, 3B, 4B, 4A, 5A, 5B.

This completes the production of the sound samples.

CHAPTER 5

ANALYSIS OF RESULTS

5.1 INTRODUCTION

Results from the study include descriptive statistics relating to part 1 and part 2 of the study: the online survey on attitudes to iPad synthesiser apps and hardware synthesisers.

5.2. DATA ANALYSIS

SPSS for Windows Version 21 would be used to analyse the data.

5.3. PART ONE: ONLINE SURVEY ON ATTITUDES TO iPAD SYNTHESISERS APPS AND HARDWARE SYNTHESISERS

Descriptive statistics would be computed for participants' age, skill, current use of iPad in music production, likely use of controller synthesiser apps in music production, perceived cost effectiveness, perceived efficiency, perceived negative impact of wide availability of controller and synthesiser based apps on companies manufacturing sound production technology, perceived positive impact of wide availability of controller and synthesiser based apps on companies manufacturing sound production technology. In order to investigate hypothesis (i) a multiple regression analysis would be conducted to investigate the relationship between variables.

5.4. PART TWO: ONLINE SURVEY COMPARING RESPONSES TO SOUND SAMPLES PRODUCED USING BOTH TRADITIONAL HARDWARE SYNTHESISERS AND iPad APPS

Descriptive statistics would be computed for participants i.e. age, skill and their response to the sound samples across a number of different criteria, including degree of roughness, harshness, depth, thickness, hollowness, brightness and warmth. In order to investigate hypothesis (ii), an ANOVA would be conducted.

5.5. ERGONOMICS

During the production of the tracks it was noted how the iPad compared ergonomically to the hardware to which it was being compared. Comparisons in this regard were easy as the hardware synthesisers used had exact iPad app versions so it was easy to compare them. The first synthesiser used was the Korg ESX-1 and iElectribe was the iPad version. There is no difference in the appearance of both except that the iPad version is 2D. However, there is one drawback when it comes to using the iPad and that is the lack of a MIDI input which most hardware synthesisers would have as standard. But this is not an

insurmountable problem, as it is possible to purchase products like the MIDI Mobilizer II which enables your iPad to receive and send MIDI data.

The design of the iKaossilator compared to the Kaossilator Pro was actually better as the iPad app offered more options and insight into the sounds, the key, scale and also the recording and playback process. It was also more visually appealing.

The last synthesisers compared were the Korg EMX-1 and the iPad app iMS-20. It is more difficult to compare these synthesisers in terms of visual appearance as they are completely different. However when it comes to comparing their ability to create fully sequenced tracks, the iMS-20 offered better functions such as separate windows for the synthesiser, drums and mixer. The fact that it also has its own full mixer window, offers better mixes as everything can be mixed at the same time thereby negating the need to go between different sounds, setting the level and then switching back to another sound to manipulate it, which is the process required to mix on the Korg EMX-1.

CHAPTER 6

DISCUSSION AND CONCLUSION

'I believe the iPad has opened up an amazing world of expressive musical possibilities. When I first touched an iPad, I knew that things were going to change forever in the creative world' (Rudess, 2012).

This recent quote from an authority in the field highlights the impact of digital iPad technology not just in terms of music production but also in creativity, opening up an array of possibilities limited only by the imagination of the user.

This research paper focused on the future of music production, paying particular attention to the impact of iPad synthesiser applications on the quality of music. It is reasonable to say that there are vastly opposing views, to quote Alan Parsons and the Gorillaz.

When one reflects on the literature, two major issues are highlighted. Firstly, there is an ongoing debate about whether the iPad is a viable and valuable music production tool and secondly there is a lack of empirical research in this area. Many of the strongly held views are based on personal experiences of using hardware synthesisers and iPad synthesiser apps to produce music. It appears that there is little or no evidence available where the same music produced using iPad synthesisers has been compared with music produced using hardware synthesisers to ascertain whether they produce the same quality sound, or sound of an inferior or superior quality.

In order to progress the debate on the viability and value of iPad digital technology, it is quite clear that independent research is needed using the two different production methods. The iPad controller and synthesiser apps need to be compared to hardware such as analogue synthesisers, virtual analogue synthesisers or a mixing control console for a DAW. The lack of research is regrettable as it is holding back what might be a powerful tool according to Titlow (2013) who said 'I realized the iPad may not be much of an instrument -but it could be the most versatile musical 'brain' ever created'.

What would be the opinion of professional music producers if they were to complete the listening test as outlined in this paper? It is postulated that for the majority of the sets of tracks it would be very difficult to actually ascertain the difference between the two different production methods. The reason for this is that iPad synthesiser apps have advanced so much in development over even the past two years that they are able to very closely emulate their hardware counterparts. In addition the progression in iPad companion hardware, such as the Synthstation 49 and the Alesis IO Mix has greatly enhanced the quality of sound produced by iPad technology. With the rate of advancement to date and the future pace of development, the reality is that this technology will equal or surpass hardware synthesisers. The question is whether this is good for music itself or indeed for music production. While the access to this technology has many advantages, there is also concern that it will saturate the music production scene.

This is why it is absolutely crucial to carry out independent research in order to verify the quality or otherwise of these two production methods.

It is the view of the author that it should be possible to design an attitudinal survey to investigate attitudes to the use of iPads in music production as opposed to using traditional hardware synths. However, more importantly, it should also be possible to design a listening test that will enable comparison of sample sounds using hardware synthesisers with sample sounds using iPad synthesisers apps. The present study is designed in such a way as to at least offer this comparison on five different sets of two tracks each. Several conditions would need to be controlled, including the use of a professional music studio. However to be meaningful to the music production industry this research will have to be carried out with a sizable sample of professional music producers.

The production of the sample sounds for the proposed listening test posed different challenges. Being very familiar with the hardware synthesisers, the sample sounds were relatively easy to produce. While this applied to the hardware synthesisers used in this research, other hardware synthesisers may pose greater challenges. One of the advantages of hardware synthesisers is that the majority of them have MIDI inputs and outputs built in, enabling immediate connection of MIDI keyboards and controllers.

This design offers a possible road map to empirical research involving qualified and experienced music professionals to bring some conclusion to the ongoing debate. Conducting a listening test, using sound samples produced randomly with hardware synthesisers and iPad synthesiser apps may add to current knowledge in an independent way.

There are some limitations with this design. A wider range of hardware synthesisers and controllers should be compared with a wider range of iPad synthesiser and controller apps. To further enhance current knowledge, an experiment in a professional music studio, with integration of the iPad into everyday music production tasks, such as editing and mixing would be a very good addition to current opinion and debate.

The production of musical pieces and songs, i.e. longer productions would also enhance knowledge and practice in this area. It is clear from this research design, that it should be possible to design a research project to adequately compare music produced using hardware synthesisers with music produced using iPad synthesiser apps.

Although change in music production is happening on a daily basis, it seems worthwhile that there should be some systematic attempt to actually compare in a controlled way, music produced using hardware synthesisers with music produced using iPad synthesiser apps. It is very important that music production does not allow itself to slide into a very significant change in how music is produced without first examining the advantages and disadvantages of these new developments. To this end, it appears that research is needed to begin to answer at least some of the arguments.

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APPENDIX 1

ONLINE SURVEY ON THE USE OF IPAD SYNTH APPS VERSUS HARDWARE SYNTHS

1. What is your age: 18 – 24, 25 – 34, 35 – 44, 45 – 54, 55 – 64, 65 – 74?

2. How skilled in music production are you: Novice, Enthusiast, Amateur, or Professional?

3. Do you currently use an IPad in music production? Yes or No.

Please answer the following questions on a scale of 1 – 5 with 1 being the lowest rating and 5 being the highest rating:

1 = 'very unlikely', 2 = 'somewhat unlikely', 3 = 'possibly', 4 = 'likely', 5 = 'very likely'

4. How likely would you be to use controller and synth apps in a music production studio?

5. How cost effective do you think it would be to move from a traditional music studio e.g. a mixing console, to using controller and synth apps in the studio?

6. In your opinion how efficient would the IPad be in music production?

7. In your opinion, will the wide availability of controller and synth based apps have a negative impact of companies that manufacture sound production technology?

8. Will the wide availability of controller and synth based apps have a positive impact on home music production?

APPENDIX 2

ONLINE SURVEY ON THE USE OF IPAD APP SYNTHS VERSUS HARDWARE SYNTHS

1. What is your age: 18 – 24, 25 – 34, 35 – 44, 45 – 54, 55 – 64, 65 – 74?
2. How skilled in music production are you: Novice, Enthusiast, Amateur, or Professional?
3. What type of headphones are you using for this test?
4. Do you suffer from any hearing loss?
5. In relation to Track 1(a) and 1(b), 2(a) and 2(b), 3(a) and 3(b), 4(a) and 4(b) and 5(a) and 5(b), please answer the following questions:

A. Is there any difference between these two sounds?

B. Which track 1(a) or 1(b) has a rougher sound?

C. Which track 1(a) or 1(b) has a harsher sound (i.e. which sound would be hardest to listen to for an extended period of time)?

D. Which track 1(a) or 1(b) offers a deeper sound (i.e. is the kick drum clearly distinguishable)?

E. Which track 1(a) or 1(b) has a thicker sound (i.e. which one does not sound weak and thin)?

F. Which track 1(a) or 1(b) has a hollow sound?

G. When listening to the sound of each track 1(a) and 1(b) which one sounds warmer (i.e. which one is not cold and sharp and is easier to listen to)?

H. Which track 1(a) or 1(b) has a brighter sound?

In relation to track 3(a) and 3(b) an additional question was added:

Which track 3(a) or track 3(b) is a closer match to a natural sounding saxophone?