A COMPARISON OF FIDELITY, COST AND FUNCTIONALITY OF AN iPAD DIGITAL AUDIO WORKSTATION WITH A DESKTOP DIGITAL AUDIO WORKSTATION

A Document

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

degree of

Master of Music in Music Technology

Production Track

By

George H. Diehl

Valley Forge Christian College

Phoenixville, Pennsylvania

August 2013

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ABSTRACT

This project examines the functionality, fidelity and cost effectiveness of the Apple iPad as a Digital Audio Workstation (DAW) in comparison to that of a traditional desktop computer based DAW configuration. A collection of three original songs, varying in genre, were recorded and produced on each DAW configuration. A website was then constructed to present two versions of each song to listeners along with a survey asking which DAW configuration the listener believed was used for each version to gain insight to whether the listeners could tell the difference between each version and what factors may have influenced their selection. The hypothesis stated that there would be no difference in fidelity of an Apple iPad DAW as compared with a traditional desktop DAW. The cost effectiveness and functionality of both were examined.

The survey results indicated that the majority of participants were unable to correctly identify which Digital Audio Workstation was used for each audio recording. Consequently, the stated hypothesis of the study was met.

ACKNOWLEDGEMENTS

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Chapter 1 - Introduction

Purpose

The advancements in mobile computing technologies provide opportunities for smaller, more affordable and versatile Digital Audio Workstations (DAW), capable of handling tasks that could only previously be accomplished on a more powerful desktop computer. The combination of third-party audio interface peripherals and advanced digital audio recording applications coupled with the iPad's increased processor speed and storage capacity have resulted in a mobile, cost-effective DAW without sacrificing quality. The purpose of this project was to explore the digital audio recording capabilities of the iPad - by combining it with a third-party docking audio interface – and comparing the cost, creative process, user interface experience, and final sound recordings to that of a more traditional desktop DAW setup.

The project was accomplished by recording three original songs using both a desktop DAW and a mobile iPad DAW. Two versions of each song were presented to the general public through a website where listeners were asked to complete a survey that required them to select which DAW they believed was used. The listeners were also provided the opportunity to explain their selection.

Need for Study

The iPhone and iOS were introduced in 2007, and with it came new opportunities in mobile computing. The integration of a basic voice recorder app provided the ability to log, store, sync and share recordings, sketches and ideas at a moments notice. As the iPhone's processor became faster and storage capacity increased, new apps such as *Loopy, Overdub* and Blue Microphone's *FiRe* made use of the iPhone as a stereo mobile

recording and multi-track device. However, the iPhone's small screen, storage capacity and processing speed were not capable of simultaneous multi-track recording.

The introduction of the iPad in 2010 allowed App developers and third party peripheral developers to explore new possibilities that would allow a musician to compose, record and perform complex multi-track arrangements. The producing capability of the iPad and iPhone were brought into the spotlight when Apple made its popular recording software, GarageBand. This software became available on the iOS platform and was capable of performing many of the same tasks as the desktop version but, with the added ability of *Jam Session,* allowing up to four iOS devices to link and record simultaneous instruments. The iPad's potential as a DAW gained more validity in 2011 when Alesis developed their I/O Dock. This audio interface turned the iPad into a mobile multi-input DAW with two XLR and 1/4" inputs with phantom power, monitor output, MIDI input and output, and video out capabilities. App developers now had the ability to create recording platforms that could perform the same tasks as desktop DAWs such as Avid's *Pro Tools*, Steinberg's *Cubase* and Apple's *Logic Pro*.

Recent changes and technical developments within the music industry have brought new opportunities to the increasing number of recording artists and independent musicians. These include potential marketing opportunities through Internet Music Networks (Indaba Music, SoundCloud, etc.…), the inexpensive cost of hardware/software, and the ease of selling original material online (CD Baby, iTunes, and Google Play). However, a search for past studies that compared the functionality, quality or cost of an iPad DAW with a Desktop DAW did not exist, confirming the need for this study.

Hypothesis

There will be no difference in fidelity of an Apple iPad DAW as compared with a traditional desktop DAW. The cost effectiveness and functionality of both will also be examined.

Chapter 2 – Review of Related Literature

Creativity is a never-ending process that is inspired and cultivated by external experiences. With the integration of currently-available technology, more people are provided opportunities, tools and outlets to explore their creativity, especially in music (Williams, 2006). The introduction of Apple's iPad and the availability of the iOS platform to app developers, has supplied all musicians, ranging from hobbyist to amateur to professional, with an ever increasing music application tool box. From synths and sequencers, to samplers and multi-track recorders, the process of mobile music making has never been easier (Jones, 2012).

The popularity, acceptance and integration of the iPad into the business industry, public and private educational institutions, and music recording industry have seen a consistent increase. A growing number of schools across the United States are embracing the iPad as an instructional tool that encompasses a variety of disciplines including Math, History, Science, Physical Education and the Arts. This new technology movement is allowing students to extend beyond the classroom walls by allowing them to correspond with teachers via email and Face Time, complete and turn in papers and homework assignments, preserve a record of student work in digital portfolios, and provide access to text books and classroom materials online (Hu, 2012). The versatility of the iPad offers a compact and intuitive user interface to which today's tech savvy students can relate. The adoption of the iPad within public schools has also aided in school districts' efforts to cut costs by reducing paper needs, rebinding and purchasing textbooks, and by making use of basic applications that replace calculators, charts and maps (Walsh, 2011).

In the field of Music Education, the iPad offers endless creative, music making, and learning possibilities. Students can now participate in classes that include music composition, production and recording, multimedia web design and video production due to applications such as GarageBand, Tabletop, iMovie, Gusto, Storyboard Composer, and Sketchbook Pro. This new branch of music technology can provide the essential outreach to the non-traditional music student (NTM) – a student in grades 7-12 who does not participate in a school's performing ensembles – by providing new experiences in musical creativity and expression that are accessible to a non-performer and non-reader (Williams, 2007). In support of the iPad, the NTMs may stand to benefit the most from the use of tablet classroom computers that allow the user to be expressive and successful at creating a 'catchy' song without requiring an understanding of notation and other music composition formalities (Criswell, 2011).

The iPad's capability and versatility can assist all users in developing performance skills, along with furthering their musical knowledge and understanding through apps that incorporate theory, notation, and even complex sound patching (Table 1). A well-designed app can lead and motivate a user to further explore specific or related subject matter with a few simple 'taps' of the screen. The iPad then becomes a tool for self-directed, independent learning by offering applications such as iBooks, iTunesU and Khan Academy that help to cultivate a life-long and independent learner (Titlow, 2012)

Table 1: iPad Music Application Examples			
Performance	**Practice**	**Recording & Production**	**Music Education**
Amplitude Beatmaker2 GarageBand iMPC Loopy MadPad Miso Rhythm Studio Studio.HD Traktor DJ Ultimate Guitar Tabs	Anytune 3 Music Journal Music Practice App PianoMan Piano Tutor SmartMusic SyncSing	AudioBus Auria FL Studio HD iSequence HD MultiTrack DAW MusicStudio NanoStudio Steinburg Cubasis studio.HD Tabletop TNR-I	Ear Trainer GuitarLab Improvox Karajan – Music & Ear Trainer Learn Guitar Theory Learn Piano HD Lick of the Day Nota Piano Apprentice Theory Lessons Tab Toolkit

Jordan Rudess, keyboard virtuoso for the band *Dream Theater*, commented on the iPad's music potential in a July 10th interview with Electronic Musician by stating, "*I'm so happy that a device came along, not only for me to see my vision through, but to allow people to experiment with musical concepts that they would have never had the chance to touch before*." Says Rudis, "*If I can give someone who's never played music before an iPhone or an iPad and say, 'check this out, just put your finger on this,' and they can do something that sounds cool and inspires them, that sounds musical, there's a lot of joy there. How can you say that's not the greatest thing in the world?"* (Alexander, 2011).

For years the various commercial desktop DAWs have offered musicians the ability to record and create music using professional level software. However, that experience comes with a large price tag – with DAW software programs ranging from $150 to over $500 – and normally requiring the user to become well versed with the program's manual through hours of reading and training. The development of powerful DAW apps (e.g., GarageBand, Auria, Music Studio, and Nano Studio) for the iPad offer a

user experience that mirrors desktop music making in many ways (Boas, April 2012). The fact remains that music production on iPads and iPhones are years behind the technology available on a desktop DAW, but the future of home music production may lay completely in the iPad specifically due to the processing power, mobility, versatility and music application development for current iOS devices (Boas, February 2012).

Music creation and production on the iPad has clearly made an impact on both the amateur and the professional markets. The music industry is currently at the point where full albums are being recorded and released through the iPad, quickly blurring the lines and accessibility between signed and independent artists with groups including Gorillaz and the Ultramods. However, the final outcome of the iPad's acceptance as an equal to a desktop DAW hangs on the quality of an indistinguishable end product.

Today's advanced desktop DAW may also be stifling an artist's creative process. The music creation process in the studio during the analog age required musicians to be present with their physical instruments to record their performance and then studio engineers took care of the production aspects of the recording after the fact. Today's digital processes open new opportunities as well as distractions for the independent musician when faced with numerous software instruments, studio-editing tools, effects and after market add-ons (Computer Music, December 2012). These distractions can have an impact on the music writing process, possibly diluting the quality of the end product. More of today's pop music is seemingly over-produced with much of the focus on multiple synth layers and saturated bass, heavy rhythmic ostinatos and seemingly less attention to melodic or harmonic design and lyrical meaning (Computer Music, December 2012).

As iOS devices became a viable platform for recording music, many musicians have cited the benefits of having the ability to jam, create/compose, record and produce anywhere at any time using an iPhone or iPad. iOS music apps require the artist to focus their attention on one musical task at a time, whether it is developing a series of chords in an app like *SoundPrism,* or recording a live bass part in an app like *BassLine* (Boaz, January 2013). This interface provides fewer distractions for the artist and keeps the focus on music creation while still providing the ability to produce the song within a DAW.

On December 24, 2010, the "virtual band" named Gorillaz made music history when their fourth album, *The Fall*, was released. This marked the first ever album to be completely created, recorded, mixed, produced and distributed using an iPad. Gorillaz stated on their website that "The Fall" was recorded over a 32-day period while the band was on a North American tour in 2010. The band's creator, Damon Albarn, expressed his fascination with the iPad and its potential as a mobile digital audio workstation stating, "Recording while we're out makes financial sense, especially given the average chart album costs upwards of $400,000." (Olivarez-Giles, December 2010) The final cost of "The Fall" was roughly $879.00, which includes twenty Apps, an iRig audio interface and an iPad2 (Hathaway, December 2010).

The musicians and educators cited within the chapter have recognized the potential of the iPad in education and production. Advancements in music applications and audio interfaces continue to further the acceptance and validity of the iPad as a professional Digital Audio Workstation. It is likely that there will be a growing number of professional and independent artists incorporating the iPad and iPhone into their music creation and recording process.

Chapter 3 – Design and Implementation

Recording

The project incorporated use of a traditional desktop DAW and a mobile iPad DAW setup. The desktop DAW was made up of the following hardware and software components: 21.5" iMac – running the Mountain Lion 10.8.4 operating system - containing a 2.8 GHz Intel Core i5 processor with 16 GB of RAM, Logic Pro 8 recording software, and a Focusrite™ Scarlet 2i2 USB recording interface that featured two high quality preamps that allowed for simultaneous input. The mobile iPad DAW consisted of a 32 GB Apple iPad 3 – running the iOS 6 operating system – containing a Dual-core Apple A5X processor with 1 GB of RAM, an Alesis I/O Dock that featured two combo XLR-1/4" inputs with phantom power that allowed for simultaneous input, and the combination of Apps including: Auria 48 Track Recording application, GarageBand for iOS and Audio Bus.

The iMac DAW possessed a significant post-production advantage given that Logic Pro 8 contains a bundle of over 4500 presets for plug-ins, 1700 sampled instruments, and more than 15,000 royalty free Apple loops. Due to this advantage, the iPad DAW made use of the wide range of music Apps and 'In-app' purchases. Although professional recording on the iPad is fairly new, there are currently a handful of DAW applications including GarageBand, Music Studio, Multitrack DAW, and Nano Studio – each offering unique features at a variety of price points.

In order to keep a specific hardware control group throughout the recording process, all microphones, cables, and microphone stands used for each song remained

constant throughout, assuring a consistent and controlled audio input to each DAW. All compositions included combinations of the following hardware:

a) 2 Audio Technica AT2020 Side Address Cardioid Condenser Studio Microphones
b) 2 Shure SM58 Cardioid Dynamic Microphones
c) 2 Shure SM57 Cardioid Dynamic Microphones
d) 2 Shure SM81 Instrumental Cardioid Condenser Studio Microphones
e) Live Wire Solutions PDI Heavy Duty Passive Direct Box
f) 2 Sterling Audio STPF1 Professional Pop Filters
g) Pro Co Excel lines Microphone Cables
h) Pro Line Microphone Stands

The audio portion of the project consisted of two original compositions entitled *Did Ya Like My Status* and *Oh, Sun!* and one arrangement of a motet that was available in the Public Domain entitled *Spacey Sicut*. Each composition also offered a unique recording need in terms of acoustic or electric instrument microphone placement and/or the incorporation of virtual software instruments as opposed to a basic guitar, bass, vocal, and drum kit recording session for all three compositions.

The recording sessions for the compositions were conducted over a period of three days, with only one song recorded each day. All of the recording sessions started by laying down multiple takes of each track on the iMac DAW first and then the process was repeated once again on the iPad DAW. All of the musicians were present during the recording session for *Oh, Sun!*. Although the recording sessions for *Did You Like My*

Status and *Spacey Sicut* were completed in a single day, the musicians were recorded during separate sessions, two of which overlapped, due to schedule conflicts.

Did You Like My Status and *Spacey Sicut* made use of software instruments and royalty-free MIDI-based loops. Logic Pro 8 had the capability of recording and reading both MIDI and audio samples. However, Auria only possessed the capability of recording and manipulating audio; therefore, Apple's iOS GarageBand was used to input any MIDI loops and instruments which were then sent to Auria in real time via the app Audio Bus which then recorded the MIDI as an audio sample into the iPAD DAW.

Great effort was taken during each session to ensure that the tracks were recorded in the same order each time with the same microphone that was used on the previous DAW and that the artists were encouraged to maintain consistency throughout the recording process. There was one instance where a lyric in *Did You Like My Status* was slightly different from one version to the other, but that was not realized until the production stage and it was not felt that it would sway the listener's selection.

Post-Production

Post-production and mixing of each selection was done on M-Audio BX5 active studio monitors by first listening through the various takes and selecting the one that was performed the best by the artists. This task was extremely fast and versatile using Logic Pro 8 on the iMac given its ability to create a compilation from multiple takes by simply highlighting the desirable sections and then merging the selections together with a click of a button. Perusing multiple takes in Auria on the iPad DAW was quite cumbersome as it did not allow for the capability of creating a compilation of multiple takes and

combining the best sections into a single merged audio file. Therefore, each take was reviewed, split, crossfaded and then merged when multiple takes needed to be combined.

Once final audio tracks were selected for use in each song, track levels, panning levels, audio effects and automations were then added to various tracks. All effects incorporated throughout each song were selected from stock inserts that were included within each DAW. This process was completed simultaneously between DAWs to ensure consistency between song versions. Although the majority of the track decibel (dB) levels were carefully mixed at similar levels, within 1.5 dB between DAWs, three of the software instrument tracks within *Did Ya Like My Status* required a much lower dB on the iPad DAW.

After mixing and effects were consistent between each DAW version, the songs were then exported in both 24 bit AIFF (Audio Interchange File Format) and 16 bit MP3 (Motion Picture Experts Group –Audio Layer 3) formats. Each format was then reviewed on the studio monitors to check for quality and volume consistency between versions. It is important to note that *normalization* – a standard feature in Logic 8 – was not available in Auria, so it was not used. The final MP3 version of each song was then uploaded to SoundCloud using a general label – *SongTitle* Version 1 or 2 – and embedded onto a website dedicated to the project.

Data Collection

In addition to the recording and producing process of this project, final versions of each recording – iPad and iMac – were made available on a website designed using Google Sites. All participants were contacted through the use of social media such as Facebook, Twitter and Google+. A general email was sent out to friends, family,

colleagues and students providing a link to the website homepage where they were greeted by a video introduction. Each song was given its own dedicated page where both DAW versions were available via a *SoundCloud* plug-in. Each participant was asked to listen to each version and then complete a brief survey located directly under the examples.

The survey, created in Google Forms, explored (a) which Digital Audio Workstation the listener believed was used to record, edit and produce each version; (b) what factors about each recording influenced their decision; and (c) whether or not the quality of the iPad DAW recordings were less than or equal to that of the iMac DAW. The results of the listening survey were then tallied for each song by version and total responses.

A final financial comparison of both DAWs and the researcher's personal reflections of each user-interface experience were also taken into account to present an overall answer to the proposed hypothesis. It is the hope of this researcher to also offer insight into the potential uses the iPad can offer educational institutions – at an affordable cost – so that more students can experience the joy and satisfaction of music, whether or not they play an instrument in an ensemble or sing in a choir. This will enable public music education to reach out to the other "80 percent" of the student population." (Williams, 2006)

Chapter 4 – Results

A total of seventy-five participants completed a survey for *Did Ya Like My Status*. Of those seventy-five, fifty-three percent correctly identified Version 1 as having been recorded on the desktop DAW and fifty-two percent correctly identified Version 2 as having been recorded on the iPad DAW. Sixty-nine participants completed a survey for *Oh, Sun!* which resulted in forty-nine percent correctly identifying Version 2 as the desktop DAW and forty-eight percent correctly identifying Version 1 as the iPad DAW. Finally, sixty-seven participants completed a survey for *Spacey Sicut*, of which only thirty-five percent correctly identified Version 1 as the desktop DAW and thirty-nine percent correctly identified Version 2 as the iPad DAW. Table 2 summarizes these results.

Table 2: Song Version Results

Song Title		**Sample Size**	**Desktop DAW**		**iPad DAW**	
			No.	**%**	**No.**	**%**
Did Ya Like My Status		N=75				
	Version 1		40	53%	35	47%
	Version 2		36	48%	39	52%
Oh, Sun!		N=69				
	Version 1		35	51%	34	49%
	Version 2		33	48%	36	52%
Spacey Sicut		N=67				
	Version 1		24	35%	43	64%
	Version 2		41	61%	26	39%

Red = Correct Answer

Participants were given the task of selecting which DAW they believe was used to record each song version, resulting in two entries per song and allowing the possibility to select the same DAW twice. When focusing on the total number of correct and incorrect

answers each sample set was doubled to account for all versions (Table 3). Fifty-three percent of participants correctly identified the DAWs used to record *Did Ya Like My Status,* forty-nine percent correctly identified the DAWs used to record *Oh, Sun!,* and only thirty-seven percent of participants were able to correctly identify the DAW used in *Spacey Sicut.*

Table 3: Total Responses Correct Vs. Incorrect

Song Title	**Sample Size**	**Correct**		**Incorrect**	
		No.	**%**	**No.**	**%**
Did Ya Like My Status	N=150	79	53%	71	47%
Oh, Sun!	N=138	67	49%	71	51%
Spacey Sicut	N=134	50	37%	84	63%

The data collected from Table 3 indicates that the quality (fidelity) of each recorded version was very consistent across the two DAW configurations given the fact that the total combined number of participant answers (either iMac or iPad DAW) came to 196 correct selections, resulting in only a forty-six percent success rate. These results indicate that the participants had difficulty determining which DAW was used based on listening alone.

For the aggregate data including all songs and versions, a chi-squared test at the .05 level was performed, and it was found that subjects were not able to determine which song was recorded using the iPad or desktop. This leads to the acceptance of the null hypothesis, there is no difference in the fidelity of an Apple iPad DAW as compared with a desktop DAW with 95% certainty. The data was also compared for each song and version individually, and this was true for all except version one of *Spacey Sicut*. In this case, subjects more often guessed incorrectly than correctly. It is speculated that subjects constantly linked what they felt were 'positive traits' as having been recorded on the

desktop DAW but more investigation would be required to be certain. The second version *Spacey Sicut* piece was also close to, but just under the threshold of statistical significance with subjects more often guessing incorrectly, presumably for similar reasons.

Survey participants also offered insights describing what factor(s) helped to influence their DAW selections. A number of the participant's responses consistently referred to the desktop DAW when describing what they deemed as a positive trait. According to one participant, *"Version 2 seemed to have much more ambient 'space' in the sound - greater separation and clarity of tracks, and a little better balance between treble and bass. Because I associate these with greater processing power and a wider range of options provided by a desktop workstation, I chose to answer as above."*
A second participant seems to associate a possible negative trait with the iPad stating, *"The pause at the beginning of the first made me think it was made with the iPad, but the quality of both songs sounds exactly the same."*

The financial requirement for each DAW configuration was derived from current pricing options as of July 2013. When comparing the price of each configuration, only the CPU, audio interface and software were taken into account due to the fact that all microphones, cables, direct boxes and pop filters would be purchased separately and are interchangeable between DAWs.

The updated desktop DAW pricing consisted of a 25.5-inch iMac computer, containing a 3.9 GHz quad-core Intel i5 chip with 16GB of memory, running Logic Pro X (Logic Pro 8 is no longer available) and incorporated a Focusrite™ Scarlett 2i2 USB audio interface totaling $2048.98 (Table 4).

Table 4: Desktop Digital Audio Workstation Expenses	
iMac Computer 21.5 – inch 2.9 GHz 16GB memory	$1,699.00
Logic Pro X	$199.99
Focusrite™ Scarlett 2i2	$149.99
TOTAL	**$2,048.98**

The updated iPad DAW configuration pricing consisted of a 32GB iPad (4th Gen), containing a 1.4 GHz Dual-core A6X chip with quad-core graphics and Retina display with 1GB of memory, running Auria 48 Track, GarageBand and Audio Bus application and incorporated the Alesis I/O Dock totaling $806.98 (Table 5).

Table 5: iPad Digital Audio Workstation Expenses	
iPad 32 GB Dual-core A6X	$599.00
Alesis I/O Dock	$149.99
GarageBand App	$4.99
Auria App	$49.99
Audio Bus App	$4.99
TOTAL	**$806.96**

With a total difference of $1,242.02, the iPad DAW configuration appears to be a better financial investment. However, it is important to note that Logic Pro X came pre-bundled with over fifteen thousand royalty free loops, software instruments and plug-ins, whereas Auria did not include any loops and a limited amount of plug-in effects. Auria did allow for a variety of In-App purchases ranging in price from $5.99 - $39.99. This allows the user to only select the loops and effects needed for production with new plug-ins being introduced and updated frequently. Although the basic Auria package was used for this project, the total In-App cost would have totaled an additional $649.53 at the time of this project. Bringing the final cost of the Auria App to $699.52 (Table 6).

Table 6: Auria In-App Purchases	
Plug-In Effects	$420.78
Loops	$183.82
Impulse Response Library	$39.94
Video Import Add-On	$4.99
TOTAL	**$649.53**

Chapter 5 – Summary and Conclusions

The overall goal of this project was to explore the potential of the iPad as a Digital Audio Workstation and investigate whether it could produce an equal final audio product comparable to that of a desktop DAW while offering a more cost effective alternative. The results from the listener survey indicated that a majority of the participants could not correctly determine which DAW configuration was used. In addition, many of the participants who did select the correct DAW still indicated that the audio fidelity between versions was difficult to detect. One respondent stated,

"*The first version seems to sound just a bit cleaner, especially on the main vocal. However, that said, the overall sound quality between the two is very close."*

In addition, the iPad configuration provided a truly mobile DAW that is capable of being set up in any recording environment while offering a high quality final product that is under a $1000 investment. The financial difference also offers the user the ability to purchase higher-end audio microphones, filters and cords to further enhance the overall quality of the recording. Finally, the recording software applications available for the iPad ranged in a wide variety of price points allowing the user to tailor the DAW to meet their specific audio and financial needs.

The researcher found the overall functionality and user interface experience between the DAW configurations to be quite different. The iMac DAW offered an interface making use of a keyboard, mouse and larger screen size. Given the fact that this is a common desktop configuration, the recording, editing and mixing processes were completed quickly and with little frustration. The researcher had been using Logic Pro 8 for some time and was familiar with the many features, shortcuts and nuances of the

software. This resulted in little frustration and faster completion. The task of blending recorded takes, adding plug-ins and mapping effect automations were completed with relative ease. Overall, the desktop DAW offered a familiar computer experience but still contains a medium-level learning curve as a user explores the vast number of tools and interfaces available within the DAW software.

The iPad DAW required more time for the researcher to learn the various gestures and how to manipulate the visual interface. The process of setting up the hardware for both DAWs was very similar and was completed with little difficulty. However, the iPad's smaller screen size and touch interface took time to develop a natural workflow. The desktop DAW allowed the capability of having multiple windows opened simultaneously, whereas the iPad DAW required the user to flip between applications via a 'double-tap' on the home button and then selecting the desired application. This hindered the production pace but become faster as editing continued.

The Auria application software had a very similar look and feel to Logic Pro8 and offered detailed Mixer and Edit views that were clean and clear. The biggest obstacle with the iPad DAW was the need for multiple applications to be used in order to incorporate a MIDI interface. As stated earlier, a combination of the apps GarageBand, Audio Bus, and Auria was used for MIDI based loops and software instruments. This process did require more steps than in Logic Pro 8. However, the use of multiple apps gave a constant reminder of the signal flow, something that can get lost while in Logic Pro 8. Overall, the iPad DAW was capable in recreating the same user interface experience as the desktop DAW but did require a higher learning curve from the beginning due to the touch-based interface.

Conclusion

The stated hypothesis of this project was that there would be no difference in fidelity of an iPad DAW as compared with a traditional desktop DAW. Results from the survey indicated that this was the case, and the hypothesis was confirmed (at the .05 level). A second purpose of the study was to examine the financial difference between the DAW configurations to provide evidence that the iPad DAW would offer a more cost-effect option without sacrificing quality. As of this writing, this proved to be true as the iPad DAW was roughly one-half the cost of the desktop DAW.

The final purpose was to explore the functionality of the both DAWs through the user's experience. The researcher found the desktop DAW had the advantage for power and ease of use, but the iPad was equally capable of accomplishing all tasks necessary for the recordings. New developments and cost efficiencies in iPad and tablet computing are likely to make recording technology available to a larger audience of end users. It is hoped that this will place additional power and design into the hands of artists and will lead to the cultivation of new sounds and ideas. The researcher concluded that although the desktop DAW's interface provided a familiar computing experience, the iPad DAW was capable of accomplishing all tasks in a similar manner as the desktop DAW while maintaining an equal level of audio fidelity within the final products.

Appendix A

Visual Data By Song

Did You Like My Status

Version Breakdown
N=75

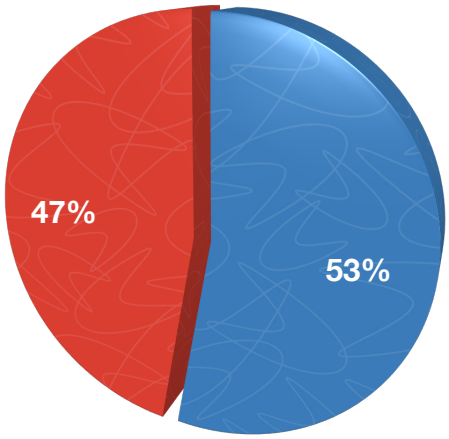
	Desktop DAW		iPad DAW	
	No.	%	No.	%
Version 1	40	53%	35	47%
Version 2	36	48%	39	52%

Red = Correct Answer

Did You Like My Status

Total Responses
N=150

Correct		Incorrect	
No.	%	No.	%
79	53%	71	47%



Spacey Sicut

Version Breakdown
N=67

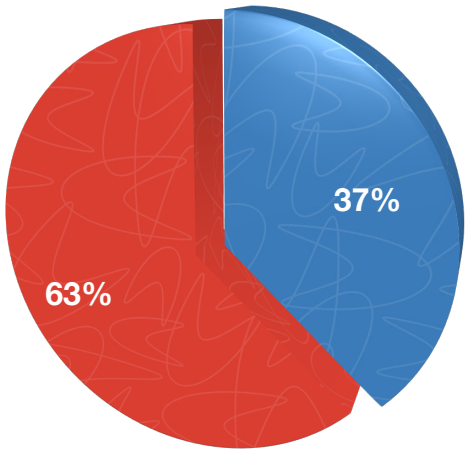
	Desktop DAW		iPad DAW	
	No.	%	No.	%
Version 1	24	35%	43	64%
Version 2	41	61%	26	39%

Red = Correct Answer

Spacey Sicut

Total Responses
N=150

Correct		Incorrect	
No.	%	No.	%
50	37%	84	63%



Oh, Sun!

Version Breakdown
N=69

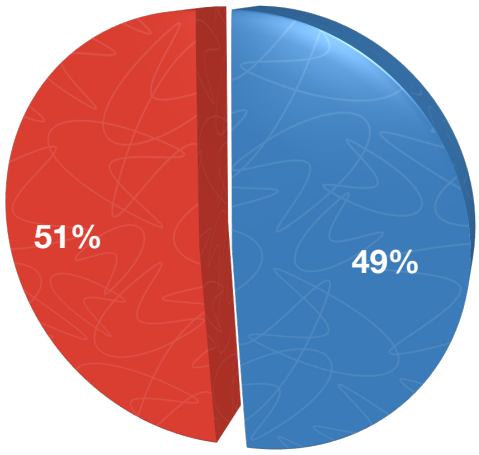
	Desktop DAW		iPad DAW	
	No.	%	No.	%
Version 1	35	51	34	49%
Version 2	33	48%	35	52%

Red = Correct Answer

Oh, Sun!

Total Responses
N=138

Correct		Incorrect	
No.	%	No.	%
67	49%	71	51%



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