

# Martin K. Koszolko: The Tactile Evolution —

## Electronic Music Production and Affordances of iOS Apps

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### Abstract

In this paper, grounded in my music production practice, I investigate the various affordances of iOS apps in the field of electronic music production. Drawing on affordance theory and notions of portability and performativity, I consider how contemporary technologies have generated renewed approaches to electronic music production and performance. My analysis shows that portable, touchscreen technologies offer new ways of interaction and musical expression, and facilitate experimentation, which empower producers to redefine their methods of music creation in the contemporary digital space.

### *Introduction*

A growing trend among the community of music producers is a return to the tactile experience of music creation tools and a focus on hardware that reduces the reliance on desktop systems. The different feel of mobile technologies impact upon the way producers choose to engage with particular formats. This paper explores an area of the contemporary digital landscape that is significantly changing the creative practice of music producers around the world. I investigate the various affordances of Apple iOS-based mobile music technologies in the field of amateur as well as commercial electronic music production. In doing so, I examine selected aspects of iOS music apps and discuss various ways in which they impact on practices of contemporary music producers. I also discuss how selected music production apps facilitate particular methods of performance and production.

The launch of the iOS App Store in 2008 signalled a significant moment for enthusiasts of mobile music creation as it allowed access to a growing range of tactile music making and sound production apps. The store features apps that are priced significantly lower than typical plugins or Digital Audio Workstations (DAWs) for macOS or Windows and can be utilised on mobile devices such as iPads, iPhones and iPods. Relatively low prices of iOS apps encourage musicians to experiment with various approaches to sound pro-

duction inherent to the platform and deepen the process of democratising music creation.

In my creative practice, over the last five years I have been incorporating two models of iPads (3 and Air 2) as well as an iPhone 5s. This included my live performances as well as studio recordings where iOS software has been used standalone or alongside desktop computer programs. My practice is the key aspect informing this paper and the selection of discussed affordances. My work has been documented in the form of recordings, blog posts (Philosophy Of Sound 2018), screenshots and interviews given to international media outlets, such as radio and press. I drew on this documentation in gathering evidence for this paper.

In addition to grounding in my creative practice, my research also incorporates ethnographic methodology and draws upon interviews and data gathered through my participation in several online communities, of which the most important is the iPad Musician Facebook group with the current membership of over 9000 users. I used group posts to ask what affordances are important to the members as well as what specific setups they use. A selection of these setups is visible throughout the paper. In addition to discussion in group posts, I followed up with private Facebook messages, email and in one instance, a face-to-face interview (Haq 2018). Overall, I received responses from approximately 50 group members. My interaction with the group, over the five years of my memberships, indicates that a large number of members are mature age users with a wide range of musical experiences: beginners as well as substantially experienced musicians who work across electronic and non-electronic music styles and play variety of instruments.

Most of the participants interviewed for the purpose of this study can be classified as bedroom music producers. The producers discussed here undertake multiple roles reflected in Burgess's understanding of a producer as an auteur, a self-produced artist leading the creative process (2013). While there is a significant body of work that explores the impact of new technologies, there is little work on the impact of music production apps. As such, this paper fills a gap and explores one area of the contemporary digital landscape that is significantly changing the creative practice of music producers around the world. Drawing on notions of mobility and performativity, I consider how contemporary technologies have generated renewed approaches to electronic music production and performance. I do not intend to present a comprehensive overview of all available workflows and key apps, but rather, a point of view based on my own experience of producing music with iPads with a reference to discussions within the above-mentioned community of iOS musicians. The key affordances of mobile music production tools that I would like to highlight, concern the following five areas:

- iOS-specific *workflow*, which allows *accessibility* and *flexibility* but also introduces certain *constraints*

- *Performance*, which enhances *playability* and *improvisation*
- *Acquisition of knowledge*
- *Sequencing*
- *Mobility*

The relationship of affordances listed in Figure 1 is demonstrated in their position in the graph and will be further explained in the remaining sections of the paper.

*Figure 1: The key affordances of iOS mobile music production tools. (Image credit: Martin K. Koszolkó)*

Incorporation of iOS devices in one's music production practice requires challenging certain assertions which deny that such devices can be serious contenders to laptop/desktop computers (Sinofsky 2016). On the one hand, the popular press provides reports such as the one on how the song 'PRIDE.' from Kendrick Lamar's album 'DAMN.' (2017) was produced by Steve Lacy with the use of just an iPhone 6 and an iRig interface used to connect guitars directly into the iPhone (Hein 2017). On the other hand, reports such as the one by Dobrev (2017) show that certain challenges of the platform can be difficult to overcome for some users. Interestingly, the comments section underneath Dobrev's article presents an opposite point of view expressed by music producers, who praise the positives of the iOS-based workflow.

## *Theoretical background*

The theory of affordances stems from Gibson's assertion that "[t]he possibilities of the environment and the way of life of the animal go together inseparably" (1986, 143). Building on Gibson's ecological psychology approach, Norman proposed that in the realm of information technologies and product design, the use of affordances relates to cultural, physical, logical and cultural constraints and conventions (1999). "Affordances per se are independent of perception" (Gaver: 1991), however, as noted by Gibson, "affordances are properties taken with reference to the observer" (Gibson: 1986, 143). Other scholars have also highlighted the subjective properties of affordances, which relate to our experiences and perceptions (Capulet and Zagorski-Thomas: 2017). Volkoff and Strong stated that affordances "represent the potential for action rather than action itself" (2013) and that there are different ways in which an affordance can be actualised. Following on this assertion, my discussion concentrates on affordances that can be empirically observed. Moreover, my analysis of affordances of the iOS apps confirms Volkoff and Strong's statement that "multiple affordances exist and may interact with each other" (2013).

The theoretical background for my brief discussion on creativity is drawn from a selection of scholarly texts on this topic (Csikszentmihalyi 2014, Kaufman and Sternberg 2010, Russ 2013, Sawyer 2003) as well as texts analysing the creative process of music producers (Bennett 2011, Hugill 2012, McIntyre 2008). I use the term 'creativity' to refer to outputs and ideas that are novel as well as acknowledged by experts in the field as possessing value. As asserted by McIntyre (2008) similar definitions are found in a broad range of texts on the subject. Authors, such as Blanning (2016), Mumaw (2013) and Stokes (2006), point out that creativity needs restrictions to thrive. As Stokes (2006) demonstrated in her research, constraints lead problem solvers to more variable and more creative outcomes. My statements on creativity are also linked to the notion of constraints in the workflow of producers using iOS apps.

## *Workflow*

The workflow of a producer using portable, touchscreen devices with iOS apps is often noticeably different from the modes of work afforded by desktop DAWs, where the majority of music production still takes place nowadays. To characterise the workflow involving iOS apps, I will discuss its three facets: accessibility, flexibility and constraints. These facets are intertwined with other affordances that overlap with 'workflow' in Figure 1.

Working with iOS devices is characterised by the speed of access of desired tools, since tablets and phones are typically always on. Musical ideas

can be captured quickly with minimal setup time, particularly when using the gear standalone without the need to interface it with other equipment. The setup can be as quick as waking the device up and launching a chosen app. Because of that, touchscreen devices are very helpful in quickly capturing and sketching ideas. I tend to use these devices as portable recording machines to capture location sounds for further productions as well as for improvised live performances as KOshowKO or Iubar Project, where I record my audiences and then manipulate the recordings live while creating improvised compositions. For the latter, I tend to use two apps ‘iDensity’ by apeSoft and ‘Yellofier’ by Boris Blank. The first allows me to apply granular synthesis to sampled material and the second allows for quick live sequencing of samples recorded during my live shows.

The small size of touchscreen devices increases the accessibility factor. This is further intensified by a possible lack of reliance on additional gear, such as studio monitors, MIDI controllers and associated cables. As I will discuss further, additional equipment is often used in conjunction with mobile devices, although users have the choice of using their devices standalone. Limiting oneself to just the touchscreen control means that music producers interact with music apps with tactility that is aligned with specific features of the chosen apps.

The workflow associated with touchscreen tools imposes certain constraints, for example a limited file system within iOS or, on occasions, limited inter-app connectivity. Furthermore, it is common that producers using iOS work with just one device. In my experience, the restrictions imposed on the amount of equipment and options available to a music producer and performer can help to streamline the creative process via increased accessibility. A limited setup allows for faster music creation and with a lesser scope for technical problems to interrupt the creative process. A practical example taken from my work is that I tend to restrict the number of apps that I use on a single device. I prefer to run apps in a standalone mode outputting their signal directly to a venue’s mixing desk (when playing live) or my DAW (when working in a studio). With this setup, I manage to remove the reliance on mixer apps such as ‘Audiobus’ by Audiobus Pty Ltd and ‘AUM’ by Kymatica, and therefore, can concentrate on the creative work first and foremost, without having to do MIDI mapping for additional hardware or setting up processing chains within mixer apps.

There are also some external constraints that touch screen devices allow to overcome. For example, constraints of desktop computer systems which enforce the reliance on using a computer mouse—a device that has not been designed with music creation in mind and can be detrimental to a creative workflow. To quote Alexander Randon, who builds music apps as Alexandernaut:

I'm convinced that using a touchscreen — as opposed to using a mouse — has a HUGE impact on workflow. After my experience with iPads over the past few years, I now notice how constrained I feel when using a mouse. So much so, that it often breaks my musical flow. (Cited in Wilson: 2016)

An additional aspect of iOS music production workflow is the use of touchscreen devices in studio or live settings alongside other gear, such as hardware MIDI controllers and hardware synths or desktop DAWs. While iOS based 'in the box' music production is often pursued and can be particularly successful in relation to experimental styles of music, there are technologies, such as 'musicIO: Audio and MIDI over USB' by Power Trio that allow music apps to become a part of a larger ecosystem of instruments that are being controlled via a desktop DAW. Examining how additional hardware equipment is used alongside iOS devices illustrates the flexibility of available setups. Figure 2 provides an example of a setup used in a live performance context by one of iPad Musician group members—Mathias Hellquist.

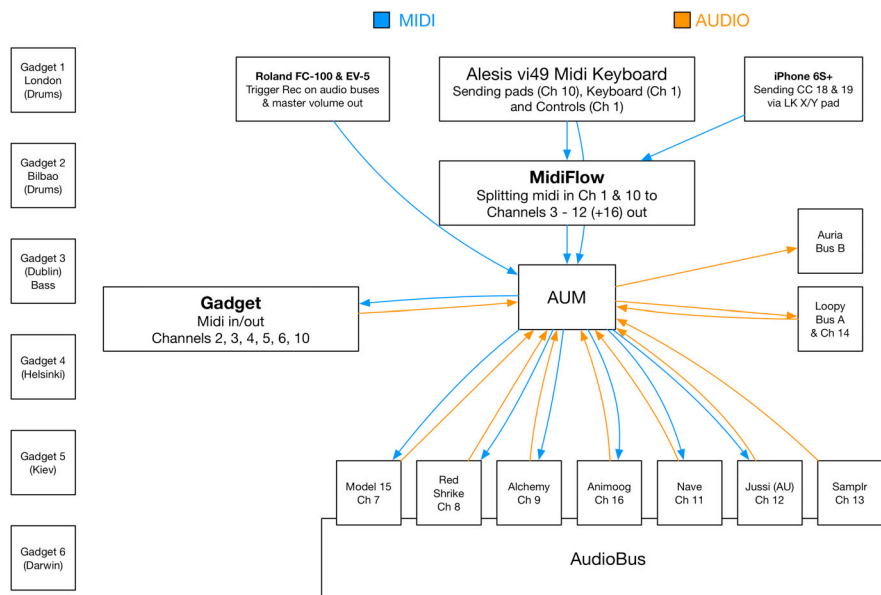


Figure 2: Live performance setup of Mathias Hellquist from Enköping, Sweden. (Image credit: Mathias Hellquist)

The workflow of iOS musicians frequently involves studio or stage performance and for that reason, these areas overlap in Figure 1. Hellquist uses an iPad and iPhone in conjunction with Alesis MIDI keyboard, Roland's FC-100 footswitch pedal and EV-5 Expression Pedal. All other names listed in

Figure 2 refer to iOS apps. Hellquist describes the construction of his setup as follows:

I was trying to find the best setup where I could play live in a preconfigured environment, and still be able to cover almost any need. Another aspect was that I wanted it to be controllable from my MIDI keyboard (Alesis vi49 + footpedals), with only minor screen interaction. Thirdly, I wanted to ‘stress test’ my iPad Pro (12.9”, 1st generation) to see if it could handle it all. For me it was also important to be able to record both MIDI and audio, but I was trying to avoid using a regular iOS DAW (such as Auria, Cubasis etc). These tests were also carried out before apps like LayR, BeatMaker 3 and Xequence had been released. (Email interview: January 15 2018)

Over the last five years, despite the occasionally problematic cycle of annual updates of the iOS, several technologies have emerged that simplify the process of playing multiple apps synchronously. Of these technologies, the most notable examples include apps such as ‘Audiobus’ and ‘AUM’. However, a pivotal change arrived with the introduction of a protocol established by Ableton and called ‘Link’, which enables electronic instruments to be synchronised over a wireless network and is being implemented in a growing number of apps.

My own workflow tends to bypass iOS DAWs and focus on playing individual synthesizer apps in a live performance context or recording into Ableton Live installed on my home studio computer. An example of the latter is audible in ‘Untold’ by Iubar Project vs Modus Op (2017). I have, however, produced some songs entirely on the iPad and sometimes even with the use of a single app as it was the case with ‘Now



Figure 3: Bedroom studio of Rohan Gover from Brisbane, Australia, featuring iPad Air 2 showing ‘Model 15’ app by Moog Music Inc. as an AU plug-in in the ‘AUM’ app and iPad 2017 showing Bit Shape’s ‘TC-11’ app. (Photo credit: Rohan Gover)

You’re Talking Baby’ for KOShowKO (2015), which was created with the ‘Yellofier’ app. Many iOS musicians aim for iPad-only based workflows centred on either a standalone DAW such as ‘KORG Gadget’ by KORG INC. or commonly, a mixer app such as ‘Audiobus’ and/or ‘AUM’ (see Figure 2). The mixer app scenario incorporates several other apps being con-

nected to the mixer which can distribute the signal to other destinations such as iOS DAWs or standalone recording apps such as ‘AudioShare’ by Kymatica. This type of workflow often incorporates live sequencing which I will discuss in a further section of this paper. Figures 2 and 3 illustrate that dependence on desktop DAWs is not mandatory and iOS producers increasingly treat their iOS devices, particularly iPads, as the central recording and sequencing element of a studio, replacing desktop computers altogether.

Retaining the touch-device centred approach while limiting additional gear has the added benefit of overcoming the constraint of a static studio space. This notion has been in the past analysed by Theberge (2004) in relation to the concept of remote, networked studio and in my own research on remote music collaboration software (Koszolko 2015, Koszolko and Montano 2016). A portable setup, with an iPad replacing the need for a desktop DAW can be also seen in Figure 4 and its benefits will be further discussed in the section on Mobility.

The above summary of workflows possible with the use of iOS-based devices paints a picture of a flexible environment where a traditional studio



*Figure 4: Mobile setup of Savino Mazzuocco from Toronto, Canada. iPad Air 2 running the ‘AUM’ app as a mixer in conjunction with selected apps and hardware sound modules. (Photo credit: Savino Mazzuocco)*

approach is possible but not necessary. Similarly, in the context of live performance, users can choose between standalone, iOS-only gear or incorporate additional equipment. My experience as a live performer indicates that standalone operation intensifies the exploration of new ways of interaction with musical instruments in the form of iOS apps.

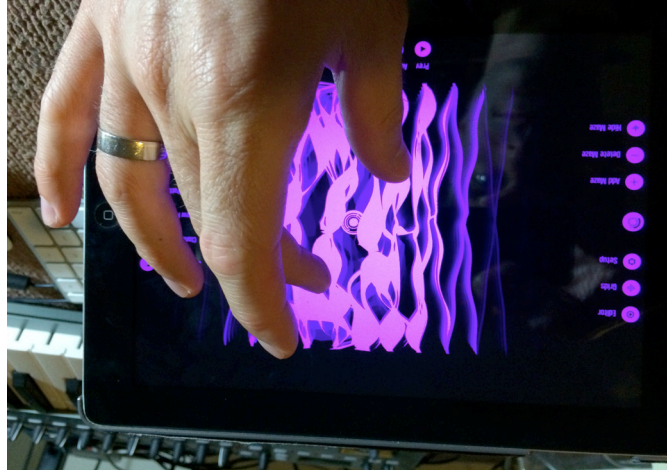
## *Performance*

The affordance of performance is implied primarily as playability, which can be incorporated in a studio setting or on stage. When using iOS apps, the key enhancer is, naturally, a touchscreen interface and also features such as the gyroscope and accelerometer that allow for more fluid and new playing styles in comparison to what can be accomplished on traditional hardware. This is characterised by the graphical user interface (GUI) that allows for touching, sliding on and wiggling the virtual keys or buttons in order to modulate the sound with parameters such as note on and off, vibrato, pitch bend and velocity. The ability to perform these actions is of course depend-



ent on a specific instrument design. Examples of synthesisers allowing for powerful gestural modulation include ‘TC-11’ by Bit Shape and ‘Mazetools Soniface’ by Ectoplastic UG (Figure 5). The former is a modular synthesiser and the latter is described by the manufacturer as a visual synthesiser.

Several apps allow manipulation of multiple sonic parameters with various finger gestures. For example, in ‘Mazetools Soniface’, enlarging the distance on the screen between two fingertips defines the radius in which notes are played. Doing the same with three fingers controls the level of distortion, while turning three fingers clockwise adds the vibrato effect. As stated by Haq in one of his video guides (2015), learning how to program sophisticated apps such as ‘TC-11’ can be daunting and requires that users invest time into learning how to harness the power of the app. This example illustrates that app designers can utilise possibilities of touch-screen devices and create complex instruments that demand users’ attention and



*Figure 5: Martin K. Koszolko gestural performance on iPad 3 with the use of ‘Mazetools Soniface’ app by Ectoplastic UG: 2017. (Photo credit: Martin K. Koszolko)*

devotion of time in order to master the operation and customisation options. Similar to what is expected from a musician learning to play an acoustic instrument.

Music production tools that I have used facilitate experimentation. New ways of playing various iOS apps go beyond gestures described above and include direct interaction with audio content by “touching visual representations of the actual waveforms” (Johnston: 2015, 27) or exploring microtonal tunings, which is possible with selected apps (Burt 2016). Playable waveforms are available in apps such as ‘Samplr’ by Marcos Alonso and ‘iDensity’ while microtonal apps include ‘ThumbJam’ by Sonosaurus LLC and ‘Shoom’ by Yuri Turov. I use these apps frequently in my live performances (KOshowKO 2014) and, similar to Johnston (2015), I find their designs enhance the scope for improvisation. The way these apps afford improvisation, is linked to their GUI and aspects of playability as well as expressiveness. When I made a move from performing live with traditional digital technologies, such as Ableton Live and associated MIDI controllers to performing

with mobile devices, I felt liberated to start improvising a lot more. It has been intensified as I became drawn to the vast array of unusual GUIs and able to access multiple app interfaces relatively quickly within a performance of a single composition and on a single device. This, in turn, led me to becoming less bound to predefined song forms. As I will discuss further, improvisation is often incorporated in the context of live sequencing as well.

A touchpad, which Johnston refers to as a post-keyboard interface (2015), is another feature that is frequently integrated in music apps, and which enhances sound manipulation options available to a performer. The use of a touchpad for effects processing is part of the sound design and production process where live manipulation of effect parameters becomes a critical part of live performance. Touchpad enhanced music apps are performance tools that allow a tactile approach, which helps with streamlining of certain operations, such as manipulation of various parameters of an instrument in real time. A touchpad can be also used as a note triggering interface, an example of which is the ‘Shoom’ app, which is an expressive XY pad synthesizer, which includes three identical sound engines and is capable of playing any pitch in the audible range and does not limit a user to a particular scale.

In addition to innovative GUI designs, the iOS platform affords performing with software emulations of classic hardware synthesizers. This is an extension of the shift from hardware to software that we have seen in software plugins on desktop computers. Emulations of existing hardware often gain in expressiveness or new features after being ported to iOS. Examples include ‘iSEM Synthesizer’ by Arturia, a model of the 1974 Oberheim SEM synthesizer and ‘iVCS3’ by apeSoft, which is an emulator of EMS VCS3 synthesiser from 1969.

The novelty of performing with these apps is threefold. Firstly, tablets and phones offer access to instruments within a lighter, smaller and therefore more portable device than hardware synthesizers or desktop computers. Secondly, the user interaction is directly connected to instruments’ GUI through hand gestures rather than through additional devices such as MIDI controllers and computer mice. This interaction allows for a tactile approach, more akin to using the original hardware. Thirdly, emulations of older synthesizers often include features not available on the hardware. For example, ‘iVCS3’ has an added sampler allowing capturing of audio via a microphone or from other apps (Nagle: 2016).

### *Acquisition of knowledge*

The affordance of the acquisition of knowledge is related to four other affordances (see Figure 1) and can be manifested in several ways. Musical knowledge can be acquired through the use and examination of custom keyboard layouts, which is a feature of multiple iOS synthesizers, MIDI control-

lers and music composing tools. These apps enable musical performance within a predefined musical scale or mode and therefore can be used to improve one's understanding of various aspects of music theory, including intervals, scales and chord progressions. The use of such apps “makes improvisation easier due to the absence of unwanted notes” (Johnston: 2015, 24).

Limiting options can help less technically proficient musicians to progress but it can also benefit ones that are more experienced because, for example, limiting available notes to a predetermined scale can make them think differently about melodies (Claudio: 2017). The scale definition feature affects the production workflow as it simplifies

playability across multiple instruments within one composition. This in turn, allows the performer to focus on other nuances such as improvisation, articulation, melody building or live sequencing, since multiple iOS sequencers also include the ability to work within predefined musical scales. This ability means that acquiring the knowledge of music theory is equally possible on many sequencers as well as instruments.

Musical knowledge can be acquired in other ways than only scrutinising predefined scales and limiting notes available to the performer. Apps such as ‘Navichord • MIDI controller’ by Denis Kutuzov (Figure 6) demystify the relationships between notes of which chords are made and allow music producers to write and reorganise chord progressions. This is a dynamic process afforded by the touchscreen GUI where visible connections between notes change depending on the scale type and degree selection.

The relation of knowledge acquisition to mobility is primarily linked to the ability to facilitate learning in various, not necessarily musical environments. Learning can be conducted with the use of performance and composition enabling tools like ‘Navichord • MIDI controller’ but also with an array of interactive apps that teach music theory as well as a range of aural perception skills. Examples include ‘Music Theory and Practice by Musicopoulos’ and ‘Ear Training Course by Musicopoulos’. Both were created by SpartanApps and do not rely on Internet connectivity which further enhances mobility.

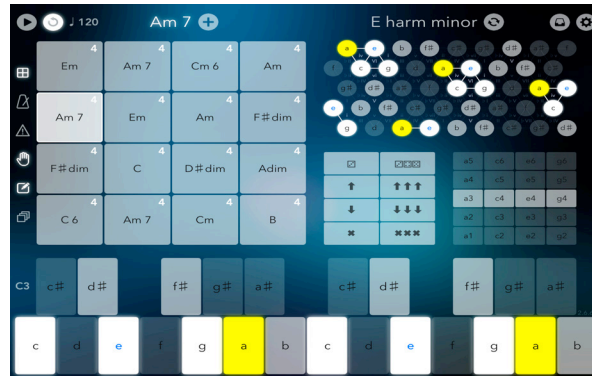


Figure 6: The ‘Navichord • MIDI controller’ app includes a selection of music composition tools and highlights the relationship between notes that make up different types of chords.

An additional element that facilitates learning of various facets of iOS music making are the globally dispersed communities of practice. The iPad Musician Facebook group as well as the Audiobus forum are two of the largest online communities of iOS music makers. Members discuss music production tools and obtain help from others, including the developers of various apps. There is a symbiotic relationship of app developers and their users visible in the above-mentioned communities. Since app developers frequently answer questions about their products and respond to requests for features from the users, the discussions can be seen as a form of market research as well as an opportunity to advertise new products or features.

Another area of my academic research is Remote Music Collaboration Software (RMCS) and iOS apps can also facilitate work in this sphere. Collaborative music production practice provides a fertile ground for knowledge acquisition and learning from people with different or more advanced skills than ours (Koszolko: 2015). There is a growing number of collaborative apps exploring different approaches to communal music making. Examples of self-contained collaborative apps taking form of relatively simple DAWs include ‘Songtree - Music Maker’ by Songtree S.r.l. as well as ‘Soundtrap’ by Soundtrap AB. Allihooop (closed down in 2019), was a networking platform for music makers that facilitated a different approach by allowing remote collaboration on music created with various third-party apps. Examples of apps that allowed to share audio to Allihooop include DAWs such as ‘KORG Gadget’ as well as instrument apps such as ‘Model 15’.

### *Sequencing*

iOS-based sequencing can be performative, meaning a real-time activity in the context of live performance. In addition, it can be also executed as a part of the song arranging process, which is more likely to happen in studio settings. There are iOS DAWs such as ‘Cubasis’ by Steinberg Media Technologies GmbH or ‘Auria Pro’ by WaveMachine Labs, Inc., which to a large degree behave like desktop DAW software. Sequencing with iOS DAWs is a process resembling work with desktop tools more than any other area of the iOS music production.

In addition, some apps feature built in sequencing, which reduces reliance on DAWs. These apps can be standalone sequencers relying on externally supplied MIDI inputs or self-contained music making environments capable of live sampling, signal processing and sequencing. The previously mentioned app ‘Yellofier’ serves as an example of an in-app sequencing that can function in the context of improvised live performance. The app has been co-designed by Boris Blank, a member of the electronic group Yello, whom use the app in their live shows (BR TV 2017).

Apart from a rather traditional, user-initiated step-sequencing, iOS apps allow for self-generation of MIDI sequences. The use of generative sequencing is a process where “a composition algorithm serves as a generative engine for music creation” (Roads: 2015, 339). Sequencing approaches involving randomisation and self-generations are equally useful in the studio and on stage. An app with particularly well developed generative sequencing is ‘Rozeta Sequencer Suite’ by Bram Bos.

The use of machine-determined compositional sequences can lead to questions about the virtuosity of the musician (Bowen: 2013) and since several iOS apps can facilitate randomisation and self-generation of patterns, the debates concerning virtuosity are relevant in the context of iOS apps and more broadly speaking, producing music with mobile technologies that afford such approaches. As observed by Hugill “machine musicianship grapples with essentially the same issues as human musicianship” and elements of human musicianship include “technical mastery, critical judgement, aural skills, musical literacy, ensemble abilities and creativity” (2012, 174). And while virtuosity can be questioned when musicians using generative sequencing systems apply little or no critical judgement or have limited musical literacy, it is also worth acknowledging that “generative strategies are conceptually attractive” (Roads: 2015, 339) and that their attraction lies in the fact “that they let composers control sonic processes on a level that would be impossible without algorithmic assistance” (2015, 341).

### *Mobility*

In her research on the mobile user experience, which preceded the launch of the Apple app store and availability of music apps, Ballard attempted to define parameters of mobile devices (2007). As she noted, this definition was not without its challenges as, for example, laptop computers can also be categorised as mobile. Defining the unique aspects of mobile electronic technologies, Ballard’s the ‘Carry Principle’ includes the following characteristics: wireless communication, multifunction device, battery powered, small, personal, and always on (2007, 231). This richness of characteristics, inclusive of multi-functionality, poses a challenge to end users since they need to redefine assumptions of what constitutes musical instruments as well as their perception of the music practice (Jones 2015).

Mobility, inherent to all iOS devices, affords music creation with apps in a variety of locations, and on the go, without the need for any additional hardware, with the possible exception of headphones. Jakob Haq is a mobile music producer from Stockholm who frequently reviews and experiments with various apps on his YouTube channel. As stated in the interview that I conducted with Haq in Stockholm, iOS apps allow him to make music during otherwise idle times, such as long commutes to work (Haq 2018). Fur-

thermore, Ben Kamen, who makes music apps under the name of Olympia Noise asserts:

I really like approaching the iPad as an instrument, and tend to use apps more that fit well into performance and live music making. It can also be a great, portable way to generate ideas away from all the cables and chaos of a studio. (Cited in Wilson 2016)

Members of the iPad Musician Facebook group frequently publish photos labelled ‘current studio view’ displaying a wide range of locations where they make music. Work in those locations typically relies on the battery power of touchscreen devices and is often carried outdoors. Showcased setups are frequently very simple, involving just one device with headphones, although occasionally, larger setups are also present (see Figures 4 and 7).

As visible in Figure 7, mobility is not only afforded because of the small size of individual iOS devices but by the fact that they are battery powered. Wireless communication is also an asset when it comes to technologies like Ableton Link, allowing for wireless synchronisation of apps on separate devices. Figure 7 showcases four iPads and two Samsung Galaxy tablets with additional hardware used in a remote location and utilizing battery power for all gear. This photo is also demonstrating how mobility is intertwined with the aspect of performing live with iOS devices.

A significant question in the context of mobile music production is how much can be achieved on iOS devices without the confines of the physical studio? The latter often incorporates monitors, microphones, instruments, interfaces, MIDI controllers and acoustically treated spaces, which all influence the final production in various ways. As I indicated earlier, I use a fully iOS-based mobile setup primarily in my live stage performances. Producing complete musical compositions with nothing else but an iPad is less likely for me in the studio, although I frequently use iOS apps as auxiliary sound sources captured and later edited with a desktop DAW. The reason for this approach is twofold. My desktop setup is a result of over 15 years of acquiring and learning about a large collection of software and associated workflows. This means that I have more options available to me during the music production process and that I can achieve desired outcomes faster while



Figure 7: Willard Van De Bogart performing in Clark Valley in the Anza Borrego Desert in Southern California: 2016. (Photo credit: Michael "Lemon" DeGeorge)

mixing and producing music with a desktop DAW. My ethnographic research confirms that iOS musicians are divided on the usefulness of ‘in the box’ music production on iOS and while some of them are adding additional hardware or use desktop DAWs, many others are content with nothing else but touchscreen devices.

## *Conclusions*

As I demonstrated, affordances of iOS apps are often intertwined and while I attempted to draw certain demarcation lines, the discussion on a specific affordance often transitions into another one. Creative immersion in the ecosystem of iOS apps opens up access to a multitude of workflows and new ways of interaction, playability and knowledge acquisition. Those innovations can empower producers to redefine their methods of music creation in the contemporary digital space and challenge their predefined notions of music production.

Music apps allow for the attractive combination between immediacy, control and unique sound design possibilities. They function in a relatively young and comparatively restrictive environment of the Apple iOS, which reduces certain options, for example, flexible connectivity and data exchanges with external hardware. Discussions among many producers within the iPad Musician group on Facebook indicate that while some users embrace an exclusively iOS-based music production, some others find available connectivity and setup options too limiting and as a result, use the iPad as a sketchpad for musical ideas, which are later developed with the help of desktop DAWs. Nevertheless, the iOS app store offers a very large array of apps featuring innovative designs that often challenge old paradigms of how music production tools are designed, how users can interact with the GUI and in what environmental settings music can be created.

Exploration of various workflows afforded by iOS apps demonstrates that in comparison to desktop music production methods centred on established DAWs, iOS tools stimulate flexible working methods where producers can explore new approaches to composition as well as multiple ways of interconnecting and manipulating the sound generating and sound processing apps. In this context, we witness, “the formation of intimate relationships between a musician and their tools” where “passive commodity consumption is resisted, and innovative/potentially lightweight workflows emerge” (Ferguson and Brown: 2016). Workflows inherent to the iOS environment allow for an all-in-one approach where recording via built in or external microphones, processing, post-production and live performance are possible with the use of dedicated apps. Moreover, these workflows allow enhancements of music production with video clips and artwork creation with the use of specialised apps.



Multiple apps available on iOS present innovative sound design approaches that open up uncharted sonic experiences for music producers, yet the connectivity between multiple apps requires the understanding that not all methodologies that are possible with desktop DAWs can be implemented on iOS. Currently there are several protocols facilitating connectivity—Ableton Link, Audiobus, Audio Units and Inter-App Audio—however, not all apps support the same protocols, which may increase the perception of reduced stability or reliability of the platform. Dobrev’s frustration with “the lack of a seamless, universal, and consistent standard for beaming audio, MIDI, and controller data between the iPad’s fantastic apps” (2017) can be seen as a craving for a stable production environment. Yet, as discussed by Lefford “[s]tability is problematic in domains like art and music production that value innovation” (2015). This represents a dilemma that producers utilising iOS tools often face: they are presented with a set of new approaches to creating and manipulating sound, but their utilisation often demands the abandonment of the ways of work known from desktop DAW environments. My own experience further confirms the dependency on desktop DAW workflows, however, only in the studio and not on stage. Differences between iOS and desktop methodologies highlight that the former are an expression of the exploration of uncharted territories of GUI and software design which allow producers to celebrate “uncertainty through improvisation and algorithmic processes” (Ferguson and Brown: 2016).

Various touchscreen music production tools that I incorporate in my creative practice and of which a few examples are featured in this paper, offer a distinctive qualitative character as well as new ways of playability and musical expression. Moreover, such technologies facilitate experimentation, acquisition of musical knowledge and enable tactile interaction. Despite its limitations, iOS music production apps offer significant advantages over various other existing technologies. These advantages include mobility, app affordability, new ways of designing the graphical user interface and an innovative approach to music production and performance.

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