

AUSTRALIA NATIONAL UNIVERSITY

# An evaluation of touch-based music sequencer apps on iPad

by

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A thesis submitted in partial fulfillment for the  
degree of Bachelor of Advanced Computing(Honours)  
in the  
[Research School of Computer Science](#)

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**Dr. Benjamin Swift**

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# Declaration of Authorship

I, Ke Ding, declare that this thesis titled, ‘An evaluation of touch-based music sequencer apps on iPad’ and the work presented in it are my own. I confirm that:

- This work was done wholly or mainly while in candidature for a research degree at this University.
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- Where I have consulted the published work of others, this is always clearly attributed.
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- I have acknowledged all main sources of help.
- Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself.

Signed:

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Date:

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*“We tend to overestimate the effect of a technology in the short run and underestimate the effect in the long run.”*

Roy Amara, leader at the Institute for the Future

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## *Abstract*

ANU College of Engineering and Computer Science

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With the rapid development of technology, mobile devices have become the new ground for musicians to express themselves. With a variety of sensors, as well as the exponential growth in the processing power, iPad offer an attractive platform for music performing. Thousands of music applications have been developed for the iPad. Music sequencer applications, as one of the major category of music making applications, have seen a lot of derivation and innovation

# *Acknowledgements*

The acknowledgements and the people to thank go here, don't forget to include your project advisor...

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# Abbreviations

**NIME**    New Musical Instrument Expression

**MPX-Q**   Musicians's Perception of the Experiential Quality

# Physical Constants

$$\text{Speed of Light } c = 2.997\,924\,58 \times 10^8 \text{ ms}^{-\text{s}} \text{ (exact)}$$

# Symbols

|          |                   |                        |
|----------|-------------------|------------------------|
| $a$      | distance          | m                      |
| $P$      | power             | W ( $\text{Js}^{-1}$ ) |
| $\omega$ | angular frequency | $\text{rads}^{-1}$     |

*For/Dedicated to/To my...*

# Chapter 1

## Introduction

As shown in [Müller et al., 2012].

### 1.1 Background

#### 1.1.1 The development of NIME

#### 1.1.2 iPad: a new playground for musicians

The iPad, a tablet computer with touchscreen display, has quickly occupied the market all around world since it's first release in 2010[Nguyen et al., 2015]. The emergence of iPad have provided a new platform for users to explore digital world [Müller et al., 2012]. After 7 generations, the usage of iPad has shifted from the extension of iPhone to a powerful prductivity tool. In this shift, thousands of applications which was designed to utilise the larger touch screen has emerged. According to Daniel, there are over 1.5 million apps are currently hosted in the App Store and more than half of those apps are specifically designed for iPad[Nations, 2017].

### 1.2 Related Work

### 1.3 Research goals and motivation

### 1.4 Structure

The research project was divided into two consecutive studies()

## Chapter 2

# Literature review

### 2.1 Mobile Music

With the increasing popularity of mobile device such as smart phone and tablet, a new research field called Mobile Music emerged [Flores et al., 2010]. According to the definition by Gaye et al., *Mobile Music* with employing portable technology does not only include the scope of playing music, but also involve music composing, synthesizing and sharing[Gaye et al., 2006].

In the last 15 years, there is a growing number of researchers start concerning the development of applications in mobile devices. This new trend was first highlighted by John after analysing 98 NIME proceeding papers related to mobile music during the period from 2002 to 2012[John, 2013].

The expanding capabilities of mobile devices inspired researchers to exploit the new features. The wireless network ability of mobile device is the first area attract researchers' attention. TunA is the first practice of building connection among PDA users through wireless network[Bassoli et al.]. By accessing the playlists of nearby users, TunA help users in same network to exchange their music. Tanaka extended Bassoli et al.'s work from music sharing towards collaborative musical creation [Tanaka, 2004]. Tanaka proposed a system which exploits ad-hoc wireless networks to allow a community of people using their PDA to work on the same piece of music [Tanaka, 2004]. Some research started from a different approach by investigating the possibility of utilizing the touch screen on the mobile devices. Geiger designed a paradigm for using touch screen on mobile device like iPaq [Geiger, 2003, 2006]. MoGMI, which stand for Mobile Gesture Music Instrument, is a research project focused on using the accelerometer inside the mobile phone to perform music. Through examining three different axis mapping models, Dekel and Dekel

explored how to turn mobile phone into a standard instrument. Smule Ocarina is the most successful mobile musical artifact, which take advantages of the global popularity of iPhone [Wang, 2014]. It leveraged the microphone to take input from breath, and combined with command from the multitouch screen to mimic the physical interaction of ocarina. Besides, Smule Ocarina also utilizing the GPS module to connect users all around the world and create a new social experience [Wang, 2009].

## **2.2 Musical Interaction Patterns**

## **2.3 Evaluation of musical instruments**

### **2.3.1 From performer's pespective**

### **2.3.2 From audience's pespective**



## Chapter 3

# Study 1: Classification of music sequencer

A quantitative study was conducted to create an interface taxonomy of current music sequencer apps on the iOS App Store. In total, 55 music sequencer applications on App Store have been examined (see Appendix [A](#)). Several search criteria are implemented to locate music sequencer on the App Store (see Section [3.1.1](#)). After analysing those music sequencer apps, we proposed classification criteria based on the design of the user interface (see Section [3.2](#)). The 55 music sequencer applications were classify into 3 major groups according to the classification criteria (see Section [3.3](#)).

### 3.1 Method

#### 3.1.1 Search Criteria

### 3.2 Classification criteria

### 3.3 Results

## Chapter 4

# Study 2: User Study

Following the first study (See Chapter 3), A laboratory study was conducted to evaluate user experience on different design patterns of music sequencers. Base on the previous work of evaluating music instruments, a questionnaire was designed to measure muscians experience (See Section 4.1.1).

### 4.1 Method

#### 4.1.1 Questionnaire

Base on Schmid’s work, which developed a 80-item pool ordered by descending mean importance for questionnaire, 10 questions that scored the highest mark from 9 different categories were used in the user study (see Appendix A).

Schmid indicated the following three criteria for musicians to perceive musical instruments:

**Experienced freedom and possibilities (EFP)**

**Perceived control and comfort (PCC)**

**Perceived stability, sound quality and aesthetics (PSSQA)**

*EFP* as the predominant facet, mainly targets at evaluating the musicianship and expressivity of music instruments. For example, questions like “*The instrument allows me to express myself.*” are used to decide whether the instruments can let muscians to express themselves; *PCC* is used to assess the controbility of the music instruments. Questions such as “*I can control the sound appropriately.*” are setted to identify how well the musicians believed they can control the instruments; *PSSQA* is the most unique facet which

TABLE 4.1: Items in the questionnaire with thier factor and category(ordered by descending mean importance)

| Factor | Category       | Item  | $\mu$ |
|--------|----------------|---|-------|
| EFP    | Creativity     | The instrument allows me to be creative                         | 6.25  |
|        | Enjoyment      | I have fun playing the instrument                               | 6.08  |
|        | Expressiveness | The instrument allows me to express myself                      | 6.06  |
| PCC    | Conformance    | The instrument responds well to my actions                      | 6.23  |
|        | Control        | I can control the sound appropriately                           | 6.04  |
|        | Engagement     | The instrument allows me to be engaged when I'm playing it      | 5.98  |
|        | Engagement     | I feel the urge to play the instrument again                    | 5.79  |
|        | Play Comfort   | I can recognize that the instrument responds well to my playing | 5.85  |
| PSSQA  | Stability      | I can rely on the instrument when playing it                    | 6.21  |
|        | Sound Quality  | The instrument pleases me sound-wise                            | 6.02  |

should be a caption

analyses the quality of the instruments from the material, the sound and the apperience perspectives. For instance, questions like “*The instrument pleases me sound-wise*” test the sound quality of the instrument. The above three interrelated facets construct the framework of MPX-Q questionnaire.

Follow the framework of MPQ-Q questionnaire, 10 questions from 3 factors were implemented in our questionnaire(see Table 4.1). For each factor, only the items score the highest mean importance value in the certain category were picked. Under the EFP factor, we focused at the creativity, enjoyment and expressiveness of the music sequencer. The reason for this, it's because we want to figure out whether the design of the interface is encouraging musicians to explore new possibilities and inspiring musicians' creativity. As for the PCC, items associate with conformance, control and engagement are chose. The reason behind this is when musicians performing on instruments there are a lot of physical interaction between musicians and instruments, whether the musiciain feel conformance and engagement have impact on their overall satisfaction. For items under PSSQA, we only look at the stability and sound quality. Because the more stable of the music sequencer the more confident musicians can rely on it. Same with the sound quality, only the instrument that can satisfy the muscian is able to please the audience.

#### 4.1.2 Participants

In total, twenty participants with different music background were invited and took part in the user study. Fifteen of them are male and five are female. All the participants have at least one year training on music and master at least one instrument. Two participants

are semi-professional musicians who have spend more than 10 years on performing and music making. One are currently teaching music in the middle school. The remaining musicians play musical instruments mainly because their parents forced them to do when they were children, however, they were all grateful that they have learned music and still practise the instrument in their spare time.



FIGURE 4.1: Participants test on the music sequencer on iPad

Four of them have learned more than one instrument. One have learned more than five different instruments. The popular pick of instruments are piano and guitar. Ten participants have learned to play piano and three of them have over five years experience. Seven participants have learned guitar and still play guitar occasionally. Other instruments are drums, violin and flute. Three participants have experience playing drums. Two have learned to play violin. Two have learned some flute many years ago. But only 15% had experience on electronic music before and had played on music sequencer on the laptop.

#### 4.1.3 Interview

Participants were interviewed at the end of the user study. The main purpose of the interview is to find out the reason behind their decision on the questionnaire. Besides, the background of participants such as "*how many years of music training*"

In order to acquire the deeper reason, all the interview followed the same procedure: 1) Since the majority of the participants did not know music sequencer before, they were

asked to describe the similarities among the three different music sequencer applications, and then defined what is music sequencer. which was designed to help them to form a general idea of music sequencer. 2) After that, interviewees were asked to choose their favourite application based on different scenario. Also, the interviewee needed to give reasons why certain music sequencer application was better than another. 3) In the final step, all the questions shifted to an abstract level, where they were asked whether music sequencer application on iPad were an instrument ,and what features that made them thought it is or it is not an instrument.

The interviews were recorded on video and audio based on the participants agreement. The recording lasted between 10 to 20 minutes.

## **4.2 Results**

## **4.3 Discussion**

## **4.4 Summary**

## Appendix A

# App Store Music Sequencer Applications

| App Store Music Sequencer Applications |                                       |                 |   |
|--|---------------------------------------|-----------------|---|
| Application Name                       | Description                           | Seller          | Link  |
| Music Pad                              | dj player remix electronic music beat | Xinggui Zhang   | <a href="https://appstore/au/_Dkmeb.i">https://appstore/au/_Dkmeb.i</a> |
| Volotic                                | N/A                                   | Scott Garner    | <a href="https://appstore/au/-WW64.i">https://appstore/au/-WW64.i</a>   |
| Beatwave                               | N/A                                   | collect3        | <a href="https://appstore/au/UzERv.i">https://appstore/au/UzERv.i</a>   |
| EGDR808                                | Drum Machine free                     | Elliott Garage  | <a href="https://appstore/au/rPfX0.i">https://appstore/au/rPfX0.i</a>   |
| LoopStation                            | N/A                                   | Rene Zuidhof    | <a href="https://appstore/au/UzMw7.i">https://appstore/au/UzMw7.i</a>   |
| Noise                                  | N/A                                   | ROLI Ltd        | <a href="https://appstore/au/Zzkr8.i">https://appstore/au/Zzkr8.i</a>   |
| Music Strobe Starter                   | N/A                                   | Arun Bab        | <a href="https://appstore/au/y4NFQ.i">https://appstore/au/y4NFQ.i</a>   |
| Beatbox Looper                         | N/A                                   | Pierre Guilluy  | <a href="https://appstore/au/Sfk6R.i">https://appstore/au/Sfk6R.i</a>   |
| Dubstep Invasion                       | Music And Song Hit Maker              | Jochen Heizmann | <a href="https://appstore/au/0ane3.i">https://appstore/au/0ane3.i</a>   |

| App Store Music Sequencer Applications(Continued) |                                      |                  |   |
|---|--------------------------------------|------------------|---|
| Application Name                                  | Description                          | Seller           | Link  |
| Remix Pads  | make groove beats record music app   | Alexey Natarov   | <a href="https://appstore/au/R7_pdb.i">https://appstore/au/R7_pdb.i</a> |
| Music Touch                                       | Make Mix Music DJ Beats              | Qiao He          | <a href="https://appstore/au/D_ZTdb.i">https://appstore/au/D_ZTdb.i</a> |
| Loop maker  | Amazing music maker                  | Miguel Saldana   | <a href="https://appstore/au/MpDthb.i">https://appstore/au/MpDthb.i</a> |
| Drum Pads Machine                                 | Beat maker dj music studio           | Alexey           | <a href="https://appstore/au/JZ9adb.i">https://appstore/au/JZ9adb.i</a> |
| Drum Pads Machine 2                               | Beat maker dj music app              | Alexey Natarov   | <a href="https://appstore/au/c5DZdb.i">https://appstore/au/c5DZdb.i</a> |
| MIxpads   | Virtual dj pads sampler free app     | Alexey Natarov   | <a href="https://appstore/au/CPj1eb.i">https://appstore/au/CPj1eb.i</a> |
| Loopacks  | Music Maker Loop Machine DJ Beats    | Hernan Arber     | <a href="https://appstore/au/oXKt1.i">https://appstore/au/oXKt1.i</a>   |
| Dubstep Dubpad 2                                  | Electronic Music Sampler             | FAD Games LLC    | <a href="https://appstore/au/mCRXO.i">https://appstore/au/mCRXO.i</a>   |
| NOIZ  | Make Epic Music                      | Studio Amplify   | <a href="https://appstore/au/KK9Uab.i">https://appstore/au/KK9Uab.i</a> |
| Blocs Wave  | Make Record Music                    | Novation         | <a href="https://appstore/au/LOMTab.i">https://appstore/au/LOMTab.i</a> |
| MIxpads 2   | Dubstep Trap drum pad sampler for DJ | Alexey Natarov   | <a href="https://appstore/au/oH_ffb.i">https://appstore/au/oH_ffb.i</a> |
| Polyphonic!                                       | NA                                   | Flip Studios LLC | <a href="https://appstore/au/u_PhS.i">https://appstore/au/u_PhS.i</a>   |
| Steve Reich's Clapping Music                      | Improve Your Rhythm                  | Amphio Limited   | <a href="https://appstore/au/R-JA4.i">https://appstore/au/R-JA4.i</a>   |
| Music Pad   | remix electronic music beat          | Xinggui Zhang    | <a href="https://appstore/au/_Dkmeb.i">https://appstore/au/_Dkmeb.i</a> |
| Loop Community                                    | NA                                   | Loop Community   | <a href="https://appstore/au/VyLNN.i">https://appstore/au/VyLNN.i</a>   |
| LP-5  | Loop-based Music Sequencer           | Markus Waldboth  | <a href="https://appstore/au/Z6EDN.i">https://appstore/au/Z6EDN.i</a>   |

| App Store Music Sequencer Applications(Continued) |                                      |                           |   |  |
|---|--------------------------------------|---------------------------|---|--|
| Application Name                                  | Description                          | Seller                    | Link  |  |
| Dubstep Song Construction Kit                     | NA                                   | Jochen Heizmann           | <a href="https://appstore/au/KndOI.i">https://appstore/au/KndOI.i</a>   |  |
| Dubstep Filth Factory                             | Sampler and Loop Machine             | Ben Frost                 | <a href="https://appstore/au/iHnUX.i">https://appstore/au/iHnUX.i</a>   |  |
| Monolith Loop                                     | Relax Meditate Sleep Zen             | Monolith Interactive Inc. | <a href="https://appstore/au/vfGDy.i">https://appstore/au/vfGDy.i</a>   |  |
| Theremin Synth                                    | Loop Record Download                 | Luke Phillips             | <a href="https://appstore/au/gJI2bb.i">https://appstore/au/gJI2bb.i</a> |  |
| Music Makr JAM                                    | Create remix share your music!       | JAM just add music GmbH   | <a href="https://appstore/au/EXEG0.i">https://appstore/au/EXEG0.i</a>   |  |
| Novation Launchpad                                | Make Remix Music                     | Novation                  | <a href="https://appstore/au/QNk1I.i">https://appstore/au/QNk1I.i</a>   |  |
| Multi Track Song Recorder                         | NA                                   | Derrick Walker            | <a href="https://appstore/au/Ygbsx.i">https://appstore/au/Ygbsx.i</a>   |  |
| Triqtraq  | Jam Sequencer music making on the go | Zaplin Music              | <a href="https://appstore/au/G8XhD.i">https://appstore/au/G8XhD.i</a>   |  |
| Trigger Box                                       | NA                                   | Justus Kandzi             | <a href="https://appstore/au/j4Hn1.i">https://appstore/au/j4Hn1.i</a>   |  |
| Composer's Sketchpad Lite                         | NA                                   | Alexei Baboulevitch       | <a href="https://appstore/au/nWJO_.i">https://appstore/au/nWJO_.i</a>   |  |
| Orbita for iOS                                    | NA                                   | Keijiro Takahashi         | <a href="https://appstore/au/kBIaN.i">https://appstore/au/kBIaN.i</a>   |  |
| S.A.M.M.I.  | NA                                   | Christopher Ayles         | <a href="https://appstore/au/YDMeY.i">https://appstore/au/YDMeY.i</a>   |  |
| ScratchVOX  | NA                                   | ScratchVOX                | <a href="https://appstore/au/e4aX0.i">https://appstore/au/e4aX0.i</a>   |  |
| Oro   | Visual Music                         | Light the Music LLC       | <a href="https://appstore/au/d6px5.i">https://appstore/au/d6px5.i</a>   |  |
| Poly  | NA                                   | James Milton              | <a href="https://appstore/au/LFspN.i">https://appstore/au/LFspN.i</a>   |  |
| Mutone  | NA                                   | william LIND-MEIER        | <a href="https://appstore/au/IkoJM.i">https://appstore/au/IkoJM.i</a>   |  |



| App Store Music Sequencer Applications(Continued) |   |                    |   |
|---|---|--------------------|---|
| Application Name                                  | Description   | Seller             | Link  |
| WR6000  | NA  | WEJAAM             | <a href="https://appsto.re/au/pM3E3.i">https://appsto.re/au/pM3E3.i</a>   |
| SoundZen HD                                       | NA  | Tapbox LTD         | <a href="https://appsto.re/au/dHrZB.i">https://appsto.re/au/dHrZB.i</a>   |
| SoundGrid   | NA  | Vitaly Pronkin     | <a href="https://appsto.re/au/fSB3s.i">https://appsto.re/au/fSB3s.i</a>   |
| Visual Beat                                       | Interactive Music Video                             | Max Moertl         | <a href="https://appsto.re/au/B-8l6.i">https://appsto.re/au/B-8l6.i</a>   |
| MINI-COMPOSER                                     | NA  | Masayuki Akamatsu  | <a href="https://appsto.re/au/Ar8Ez.i">https://appsto.re/au/Ar8Ez.i</a>   |
| Loopseque Lite                                    | NA  | Casual Underground | <a href="https://appsto.re/au/BTm8x.i">https://appsto.re/au/BTm8x.i</a>   |
| Bass Drop   | Deep House Electronic music sampler and synthesizer | Ben Frost          | <a href="https://appsto.re/au/k3rp0.i">https://appsto.re/au/k3rp0.i</a>   |
| Beat Boss   | Electronic Dance Music Sampler                      | Ben Frost          | <a href="https://appsto.re/au/DWLyU.i">https://appsto.re/au/DWLyU.i</a>   |
| TonePad   | NA  | LoftLab            | <a href="https://appsto.re/au/n0x1s.i">https://appsto.re/au/n0x1s.i</a>   |
| Navichord Lite                                    | intuitive chord sequencer                           | Denis Kutuzov      | <a href="https://appsto.re/au/kTci2.i">https://appsto.re/au/kTci2.i</a>   |
| EasyBeats Drum Machine Free MPC                   | Hopefully Useful Software                           | Christian Inkster  | <a href="https://appsto.re/au/gJ10t.i">https://appsto.re/au/gJ10t.i</a>   |
| Fifth Degree                                      | MIDI Sequencer                                      | Bernie Maier       | <a href="https://appsto.re/au/qFZM1.i">https://appsto.re/au/qFZM1.i</a>   |
| Light Medley                                      | NA  | Tek Min Ewe        | <a href="https://appsto.re/au/FU06hb.i">https://appsto.re/au/FU06hb.i</a> |
| Medly   | Music Maker   | Medly Labs Inc     | <a href="https://appsto.re/au/CP1c4.i">https://appsto.re/au/CP1c4.i</a>   |



## Appendix B

# Questionnaire

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### Questionnaire

App: \_\_\_\_\_

Type: \_\_\_\_\_

Date: \_\_\_\_\_

*\*Please indicate how strongly you agree or disagree with all the following statements which apply to you by selecting a number from 1 (strongly disagree) to 5 (strongly agree).*

Question #1: **The instrument allows me to be creative.**

|                      |          |         |       |                   |
|----------------------|----------|---------|-------|-------------------|
| 1                    | 2        | 3       | 4     | 5                 |
| Strongly<br>Disagree | Disagree | Neither | Agree | Strongly<br>Agree |

Question #2: **The instrument responds well to my actions.**

|                      |          |         |       |                   |
|----------------------|----------|---------|-------|-------------------|
| 1                    | 2        | 3       | 4     | 5                 |
| Strongly<br>Disagree | Disagree | Neither | Agree | Strongly<br>Agree |

Question #3: **I can rely on the instrument when playing it.**

|                      |          |         |       |                   |
|----------------------|----------|---------|-------|-------------------|
| 1                    | 2        | 3       | 4     | 5                 |
| Strongly<br>Disagree | Disagree | Neither | Agree | Strongly<br>Agree |

Question #4: **I have fun playing the instrument.**

|                      |          |         |       |                   |
|----------------------|----------|---------|-------|-------------------|
| 1                    | 2        | 3       | 4     | 5                 |
| Strongly<br>Disagree | Disagree | Neither | Agree | Strongly<br>Agree |

Question #5: **The instrument allows me to express myself.**

|                      |          |         |       |                   |
|----------------------|----------|---------|-------|-------------------|
| 1                    | 2        | 3       | 4     | 5                 |
| Strongly<br>Disagree | Disagree | Neither | Agree | Strongly<br>Agree |

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Question #6: **I can control the sound appropriately.**

|                      |          |         |       |                   |
|----------------------|----------|---------|-------|-------------------|
| 1                    | 2        | 3       | 4     | 5                 |
| Strongly<br>Disagree | Disagree | Neither | Agree | Strongly<br>Agree |

Question #7: **The instrument pleases me sound-wise.**

|                      |          |         |       |                   |
|----------------------|----------|---------|-------|-------------------|
| 1                    | 2        | 3       | 4     | 5                 |
| Strongly<br>Disagree | Disagree | Neither | Agree | Strongly<br>Agree |

Question #8: **I feel the urge to play the instrument again.**

|                      |          |         |       |                   |
|----------------------|----------|---------|-------|-------------------|
| 1                    | 2        | 3       | 4     | 5                 |
| Strongly<br>Disagree | Disagree | Neither | Agree | Strongly<br>Agree |

Question #9: **The instrument allows me to be engaged when I'm playing it.**

|                      |          |         |       |                   |
|----------------------|----------|---------|-------|-------------------|
| 1                    | 2        | 3       | 4     | 5                 |
| Strongly<br>Disagree | Disagree | Neither | Agree | Strongly<br>Agree |

Question #10: **I can recognize that the instrument responds well to my playing.**

|                      |          |         |       |                   |
|----------------------|----------|---------|-------|-------------------|
| 1                    | 2        | 3       | 4     | 5                 |
| Strongly<br>Disagree | Disagree | Neither | Agree | Strongly<br>Agree |

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