CREATING MOBILE COMPUTER MUSIC FOR PERCUSSIONISTS: *SNOW MUSIC*

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ABSTRACT

This paper traces the development of an *Apple iPad* and *iPhone* based musical instrument, *Snow Music,* and its use in performances by *Ensemble Evolution*, a percussion group formed by the author and two other percussionists.

This artistic research is motivated by a desire to use computer based instruments along with percussion in a group with non-programmer performers. The aims were to develop an elegant, portable, and flexible computer instrument that is accessible to the group and to find out what opportunities it enables in performance practice.

A project was undertaken to develop *Snow Music*, using *Pure Data* and *libpd*, and to collaboratively compose a musical work. The process was documented with video recordings and analysed using ethnographic methods.

The resulting setup was extremely portable and convenient for rehearsal and performance. A design that emphasised "percussive" interaction with the instrument and an improvised performance practice contributed to a collaborative development cycle. Analysis of performances gave insight into the limitations and affordances of mobile computer music devices.

1. INTRODUCTION

Starting in 2010, I co-founded a percussion group, *Ensemble Evolution*[1] in Piteå, Sweden with Jacob Remington and Maria Finkelmeier. The goal of the group was to explore projects in composition and improvisation. As a percussionist and computer musician, one of my goals was to integrate computer based instruments into this group. As the other members of the group had no experience with computer music it became clear to me that I needed new computer music tools to complement percussion instruments in my work as a music creator, collaborator and performer.

Inspired by recent developments in computer music on mobile devices, I decided to use *Apple*'s *iPad* and *iPhone*, as platforms for computer music in *Ensemble Evolution*. I thought that these devices could work better in this situation that the laptop based computer systems I had used previously.

There are several previous works that inspired this research. Schiemer and Havryliv's work, *Pocket Gamelan* [6], exploits the portability of mobile devices by having non-expert performers swing the devices on a cord in performance. Tanaka's four-hand *iPhone* performances demonstrate the affordances of sensors built into mobile devices through a collaborative improvised performance practice [7].

For *Ensemble Evolution*, it was important that the mobile devices were portable enough to easily fit into our percussion setups and to take on tour. The interesting new interfaces for musical interaction, such as touch screens, could be useful for engaging non-programmer percussionists in performance.

The research project presented in this paper was designed to study the process of producing a new *iOS*[2] based instrument to be used alongside percussion instruments. The project also studied the performance practice that emerged from collaboratively creating a musical work using this instrument. Over the course of the project, both the musical work and the *iOS* app were called *Snow Music*.

This project is part of a larger study that is the topic of my master's thesis *Mobile Computer Music for Percussionists,* completed in June 2012 at Luleå University of Technology [3]. In addition to the project described in this paper, the thesis includes a study of a mobile computer music system for vibraphone and an examination of the current state of research into mobile computer music.

2. RESEARCH QUESTIONS

The goal of the project was to address four research questions about mobile computer music:

1. *Heaviness*. Can computer music setups be made more simple, elegant and convenient using mobile devices?
2. *Shareability*. How can mobile computer music instruments be made accessible to a non-programmer percussion ensemble, and what creative processes can be used to explore them?

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[1] Performance and other information about *Ensemble Evolution* can be found at http://www.ensemble-evolution.com

[2] *iOS* is the operating system that runs on *Apple*'s *iPhone, iPad* and *iPod Touch*. It is possible to produce "universal" *iOS* apps that can run on all of these devices.

3. *Playability*. How can the affordances of mobile music devices be used to create playable instruments for percussionists?

4. *Performance practice*. What new performance practices are enabled or demanded when complementing acoustic percussion instruments with mobile music devices?

3. RESEARCH METHOD

The research questions of this project were addressed qualitatively through ethnographic[3] analysis of the process of developing, rehearsing and performing the collaborative work with *Ensemble Evolution*. These processes were documented through written notes and video recordings. Analysis of the video documentation was made through a process of coding, following techniques described in Krüger's *Ethnography in the Performing Arts* [2]. In this process, key-concepts are chosen and assigned to events occurring in the video. Events can then be grouped by key-concept to make connections between the various rehearsals and performances. The process for coding verbal information is well understood, conversations can be transcribed and then coded easily in this form. Performances were coded following Östersjö's method of working directly from the video [4], using time codes to identify events.

The artistic investigation was pursued experimentally with the choice of hardware and software elements informed by current trends in computer music research.

3.1. *libpd: Pure Data* in *iOS*

The *iOS*-based instrument for this project was developed as a native *iOS* app, using *libpd [1],* a general project to port *Pure Data* [5] to a number of computing platforms. *libpd* is an effort to separate the audio synthesis parts of *Pure Data* from its graphical programming interface. *Pure Data* can then be used as a synthesis library for other applications.

In this project, *libpd* allowed the musical elements of the app to be composed in the familiar environment of *Pure Data* while the user interface was created in *objective-C* using *XCode*.

4. RESULTS

In order to capture the creative process in developing *Snow Music*, every rehearsal, and a series of initial public performances was video recorded. The rehearsals took place in February 2012 in Piteå, Sweden, while performances occurred in March 2012 in Australia.

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[3] Ethnography is a qualitative research method for studying cultural phenomena. The researcher conducts fieldwork to collect notes, audio and video recordings, and images relating to the phenomena, an active and subjective method. "The open-ended nature of the ethnographic approach is particularly suitable for active discovery and exploration" (Krüger [2]). Analysis of the data can be an iterative process with multiple phases of field work and analysis to refine the research question. Conclusions are drawn inductively from the data gathered.

Over the first three rehearsals, I introduced the *Snow Music* app to the other performers. The app was designed to give the performers "percussive" control of field recordings from the harsh winter in Piteå. The early rehearsals were marked by changing ideas about the musical content of the work and discovery of how to play the *iOS* devices.

In the fourth rehearsal, it was agreed that the performance would be a free improvisation, *Snow Music*, motivated by the computer sounds. Each player would use an *iOS* device and a keyboard percussion instrument. The *iOS* devices were each connected directly to a powered loudspeaker.

There were three public performances of the work in Australia, all including collaborations with performers outside of *Ensemble Evolution.* The first was at Melbourne Conservatory and included Nat Grant, a percussionist and computer musician. The second, in *Serial Space,* Sydney, took the form of a group improvisation with members of *Nomad Percussion.* The final performance was part of an *iPad* music workshop for high school students at Canberra Grammar School.

4.1. The *Snow Music* app

The final *iOS* app for *Snow Music* has two main functions. The first is a touch interface that creates snow sounds when the screen is tapped or swiped with a finger. The dynamic of tapped sounds can be controlled by the distance of a tap from the centre of the screen. The dynamics of swiped sounds corresponds to the speed of the swipe. The second function was a set of three background soundscapes, algorithmic processes that produce phrases of notes in free rhythm. The three soundscapes are of bells, cymbals, and a swooshing, wind-like, snow sound. The bells were set to use notes only from the C aeolian scale while the cymbals and snow sounds were of indeterminate but changing pitch. The overall dynamic of the sounds could be controlled using the *iOS* devices' hardware volume controls. In the first rehearsal, only a prototype of the snow sounds was available. All sounds had been developed by the fourth rehearsal.

4.2. Rehearsing and Developing *Snow Music*

4.2.1. Problems

A number of problems came up repeatedly over the rehearsal process. Most of the technical problems related to situations where an interaction with the app did not align with the player's expectation. In the first rehearsal, Maria remarked that "the interaction was throwing me off a bit". Managing the expected volume of the *iOS* devices through the loudspeakers was also a problem.

The musical problems were related to the clarity of expression that was possible with the app. Initially, it was difficult to express clear rhythms with the *iOS* devices and our early attempts to play precise, repetitive rhythms with the snow sounds were not very successful. Also, the sounds initially produced by the *iOS* devices

had a lack of timbral clarity. Jacob commented that the app felt "limited" and its available sounds just "sounded too similar" in rehearsal two.

4.2.2. Solutions

Fortunately, these problems could be addressed. In some cases, all that was needed was some more explanation from me, as my ideas about programming the interaction between the performers' gestures on the touch screen and the sound output were rapidly evolving.

The interactive concept came down to using "percussion-y technique". Common techniques for using hands to play percussion instruments – taps, finger rolls, scraping and rubbing – also work on the *iOS* devices' touch screens. Another simple explanation was to use the hardware volume control on the devices to adjust for unexpected volume levels. Finding these techniques was an important part of developing a performance practice with the *iOS* devices.

The musical problems were also addressed through updates to the app made in between rehearsals in response to suggestions and inspiration from the group. For example, the group suggested using more mimetic sounds from Piteå. In response, I added the sound of footsteps in snow and the wind that blows around the student housing.

4.3. Performing *Snow Music*

To understand the performance practice that we developed for *Snow Music,* three representative performances from different stages of the project were chosen and coded. These were: Our first[4] attempt at using the *iOS* app with three keyboard percussion instruments; a free improvisation[5] in the fourth rehearsal with a guest, Matteo Spano, playing guitar (see Figure 1); and lastly, a public concert[6] in Melbourne with a guest artist, Nat Grant, performing on laptop. The results can be categorized as concerning techniques for playing the *iOS* devices, musical affordances and musical applications of the devices in performance.
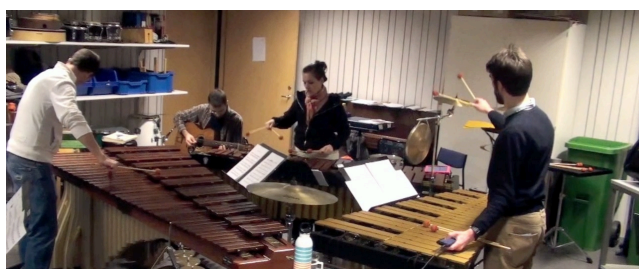

Figure 1. *Ensemble Evolution* and Matteo Spano rehearsing *Snow Music*.

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[4] First *Snow Music* performance with mallet percussion instruments: http://youtu.be/W091aaKSIU4

[5] *Snow Music* performance along with Matteo Spano: http://youtu.be/MWicLWySxdI

[6] *Snow Music* performance at Melbourne Conservatory along with Nat Grant: http://youtu.be/Vz5aQxc_jlE

4.3.1. Techniques

Since all of the interactions for the *Snow Music* app occurred through the touch screen we needed to use skin contact to activate it. Although it is possible to hold mallets in our hands touch the devices with the heel of our hands, or the little finger, we generally played the *iOS* devices without simultaneously trying to hold mallets. This encouraged us to also play the keyboard percussion instruments with our fingers, an intimate, but striking sound. It also turned out to be possible to hold mallets in one hand and play the *iOS* device with the other.

One of the limitations of the *iOS* app was in expressing clear rhythm. The performers adopted several techniques to address this issue. One strategy was using "finger rolls" to express continuous rather than singular sounds. Other experiments included exaggerated swipes across the whole *iPad* screen.

4.3.2. Musical affordances

The three background sound generators (bells, cymbals and "snow-wind") were added to the app in response to the discussions in rehearsals. It is clear from the performance videos that the musical affordances of these sounds inspired their use during our improvisation. The bell sound was by far the most used. The clear tonal centre and texture cut through other sounds in our improvisation. The group responded to these affordances by using the sound to trigger sections of tonal improvisation in free rhythm.

The other background sounds, cymbals and snow wind, were not used as frequently. Where they did appear, their musical function was to create a dense texture that would support various styles of improvisation. The Melbourne performance had a much denser texture due to the fourth player on laptop and as a result, these sounds were not activated as frequently.

4.3.3. Musical application

Over the rehearsal process, the sounds we could create in the *Snow Music* app came to define the improvised piece we were developing. Even in the earliest performances, we started the piece with a "snow collage" by tapping the screens. In the later performances, this element became better defined. The sounds of footsteps in snow were strongly mimetic and gave a distinctive theme to the piece.

It is interesting to see how the *Snow Music* app was used to change the intensity of the improvisation. While the opening "snow collage" built intensity, the app was mostly used to decrease intensity. My use of the app at the end of the Melbourne performance triggered a closing "snow collage".

The ability to present a "new idea" to the ensemble is critical in free improvisation. Significantly, the "bells"

background sound was useful for driving the improvisation into a particular direction.

5. CONCLUSIONS

Overall, the *Snow Music* project was successful in introducing computer instruments to *Ensemble Evolution* and resulted in extremely satisfying performance results. The investigation uncovered conclusions to address all four research questions, which are briefly summarized here and discussed in more detail in my thesis [3].

5.1. Heaviness

The setup for *Snow Music* was extremely simple using only the three *iOS* devices and audio cables. In our rehearsal studio we used three powered speakers for performing while on tour we used a compact mixer to distribute the sound to two loudspeakers.

The light weight of the equipment and short set up time greatly contributed to the agility of our rehearsal process and performances on tour. The whole ensemble's computer music setup (not counting loudspeakers) could fit in one backpack.

5.2. Shareability

Snow Music was successful in putting computer based musical instruments in the hands of non-programmers. The performances demonstrate all the performers using the *iOS* devices confidently and musically. I received an unexpected level of input and engagement from Jacob and Maria during the rehearsals. Suggestions from the group directly connected to many of the technical and musical problems with the app. Importantly, the input from the group helped me to focus my programming in between rehearsals to address the most pressing musical issues.

5.3. Playability

The interactive focus in *Snow Music* was the touch screens of the *iOS* devices. The rehearsal process allowed us to uncover some of the problems encountered when playing these instruments. The most frustrating moments in the rehearsals were caused by a disconnect between gesture and result. These issues were able to be resolved through experience and fine tuning the app.

5.4. Performance Practice

The *Snow Music* project resulted in an investigation into free improvisation performance practice combining *iOS* devices and acoustic instruments. The group discovered that the field recording based sounds from the *Snow Music* app could define and motivate the piece and helped to give structure and meaning to our improvisation.

Analysis of the performances makes some of the constraints of the *Snow Music* app clear. Although many of the sounds are distinctive and allow a degree of precise playing, some were subtle and mainly textural.

There were limits to the extent that these sounds could be used in a precise rhythmic context. While this is probably not "bad", it is important to understand such limits and decide what impact they have on the compositional process.

6. FUTURE DIRECTIONS

The rapid, collaborative development process that was achieved for *Snow Music* can serve as a model for future projects. While musical interactions with the app had limitations, it may be that techniques can be found to address these. Future projects could also benefit from an investigation into how mobile music apps could be used to contribute "new ideas" in an improvised performance.

7. ACKNOWLEDGEMENTS

8. REFERENCES

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