Exploring Percussive Gesture on iPads with Ensemble Metatone

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ABSTRACT

Percussionists are unique among western classical instrumentalists in that their artistic practice is defined by an approach to interaction rather than their instruments. While percussionists are accustomed to exploring non-traditional objects to create music, these objects have yet to encompass touch-screen computing devices to any great extent. The proliferation and popularity of these devices now presents an opportunity to explore their use in combining computer-generated sound together with percussive interaction in a musical ensemble.

This paper examines Ensemble Metatone, a group formed to explore the "infiltration" of iPad-based musical instruments into a free-improvisation percussion ensemble. We discuss the design approach for two different iPad percussion instruments and the methodology for exploring them with the group over a series of rehearsals and performances. Qualitative analysis of discussions throughout this process shows that the musicians developed a vocabulary of gestures and musical interactions to make musical sense of these new instruments.

Author Keywords

music; expression; multitouch; gesture; percussion; user experience

ACM Classification Keywords

H.5.2. Information Interfaces and Presentation (e.g. HCI): Evaluation/methodology

INTRODUCTION

Percussion is a musical practice more defined by the methods of interacting with instruments rather than the instruments themselves. Percussionists perform by "striking, scraping, brushing, rubbing, whacking, or crashing any... available object" [11]. These percussive gestures are used to coax wide varieties of timbres and musical gestures from simple instruments. For percussionists, free improvisation is often a process of gestural exploration, discovering new sounds

Figure 1. Ensemble Metatone performing with iPads and percussion instruments.

from traditional and non-traditional instruments and responding to other sounds in an ensemble. Like some percussion instruments, touch-screen computing devices can be rubbed, scraped, and struck with fingers and hands. While it is well established that popular touch-screen devices can be used to make music, mainstream creative frameworks for their use (tapping virtual piano keys, for instance) are limited. The percussive affordances of these devices motivates an exploration of their use in a modern percussion ensemble to establish more varied modes of interaction that could be used in app-design, for musical composition, and other applications.

HCI studies of gestures on touch screens have been conducted for tasks such as activating a shortcut in a smartphone [10, 1], manipulating virtual objects on a table-based interface [7] and controlling a video performance [9]. Many of these studies have characterised gestures that emerged as part of users' interactions with a touch interface. In a similar way, the work described in this paper examines touch-screen gestures that emerge when iPads are introduced into a modern, free-improvisation percussion ensemble. Qualitative analysis of a series of the group's rehearsals and discussions reveals a vocabulary of new gestures invented by the musicians. These gestures were used by the musicians to creatively interact-with, and expand the power of, two specially-designed iPad percussion apps. Unlike other studies such as Wobbrock et al [12], the gestures we observed are generally two-handed and combine many touches over a number of seconds to express sustained musical ideas. Our study also yields a refined concept of how iPad based instruments fit into a percussive

artistic practice and how these instruments can contribute to the musical structure of a free-improvisation.

Ensemble Metatone

Ensemble Metatone was brought together to explore the "infiltration" of iPad-based musical instruments into a percussion ensemble through free-improvisation. The members of the group, Charles Martin (CM - one of the authors of this paper), Christina Hopgood (CH), Jonathan Griffiths (JG), and Yvonne Lam (YL), had previously studied and worked together as professional musicians. CM was the designer of the iPad instruments and facilitator of the group's rehearsals and performances. Over four studio sessions and two live concerts, two different performance paradigms were explored: in the first paradigm, only iPads were used; in the second, the performers each played a setup which included a number of percussion instruments of their own choosing as well as an iPad.

DESIGNING TABLET INSTRUMENTS

While the field of computer music abounds with creative examples of touch-sensor-based instruments, the goals of this project placed constraints on what could practically be used within the percussion group: the touch-screen devices needed to be self-contained, durable, and easy to provision with software updates. Many tablet computing devices meet these requirements, but Apple iPads were chosen as the computer instrument in the ensemble because of their widespread adoption and established development frameworks for musical applications. Even though iPad touch screens have drawbacks such as a lack of pressure sensitivity or physical feedback, their physical dimensions mimic that of some simple percussion instruments such as the woodblock or tambourine. Despite their limitations, the study described below shows that they can be played musically and expressively, particularly in setups of multiple percussion instruments.

Two apps were produced for the group: MetaTravels and MetaLonsdale (shown in Figure 2). Both apps used the same interaction scheme and both allowed access to pitched percussive sounds and field recordings. In both apps, the majority of the iPad screen was a performance surface and there were few graphical UI elements. Tapping the screen produced short sounds at a pitch determined by the location of the tap. Swiping triggered continuous field recordings with the velocity of the swipe directly mapped to the volume of the field recording. Both apps featured simple delay functions, that repeated tapped notes, and switchable auto-play features, that algorithmically produced background sounds. These features were activated by switches in the user interface. A button on both apps allowed the performer to shuffle the available sounds.

While the functionality of the two apps was similar, the sound palette was different. MetaTravels used field recordings from around the world, with chromatically-tuned pitches, while MetaLonsdale featured field recordings from a particular location (a coffee shop and gallery in Canberra, Australia) and diatonically-tuned pitches selected from three different
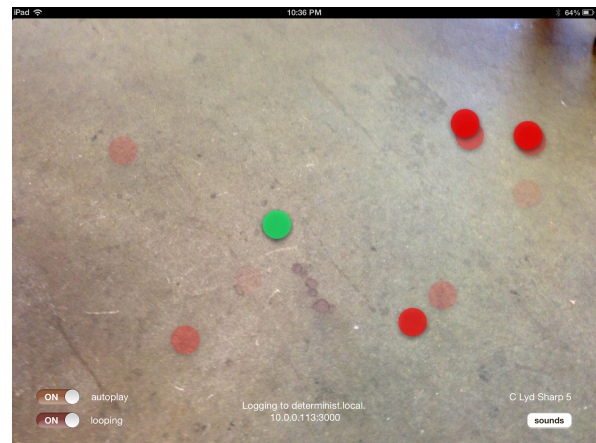
Figure 2. Screenshot of the MetaLonsdale app. The green circle denotes the user's touch point while red circles show delayed notes. The delay and auto play functions are controlled by switches on the lower left and the button on the lower right changes the sounds that can be played.

scales. An additional network feature in MetaLonsdale ensured that all iPads in the ensemble had the same scale. Finally, both apps allowed logs of performances to be captured by sending OSC messages of each touch event to a server.

DEVELOPING AN ENSEMBLE "VOICE"

Our approach for studying the emergence of "expressive interaction" [8] of the performers with the iPad instruments followed common methods for collaboratively developing a musical performance. The process for creating the performance was collaborative amongst all four musicians with free-improvisation leading to collective decisions about stucturing the work both in rehearsal and in performance [6]. The rehearsal process followed Cahn's concept of "Creative Music Making" [3] with a series of freely-improvised performances that were recorded, played back and discussed. These rehearsals were facilitated by CM who, as noted above, was the app developer and one of the authors of this paper. Similar to video-cued recall [5], the listening stage of this process allowed the performers to articulate their musical intentions and discuss the structure of the pieces in context.

Following a public concert, the three other musicians participated in an open-ended interview with CM concerning the techniques they had developed for performing with the iPads and how they had used them to shape the performances over the whole process. Video and multi-channel audio recordings were made of all the rehearsals and the final performance. The performers' touch interactions with the iPads were logged and visualised into recreations of the performances that were incorporated into the video record.

The rehearsal discussions and interview, a corpus of over six hours of video (see Table 1), were transcribed and coded using Thematic Analysis [2]. The coding focussed on the the performers' articulations of gestures they used on the iPads, their understanding of the iPads in relation to percussion instruments and how the iPad instruments influenced the structure of the improvisation. The codes followed the gestures

available in the app: taps, swipes and combinations of the two.

Date	Type	Duration	id
13-04-20	iPads only	1H16M	
13-04-20	iPads only	40M	ifgC_KnauOs
13-04-21	iPads only	46M	5OmUnKYcaL4
13-04-27	iPads only	1H	x1SwCVfqLQU
13-05-04	iPads & percussion	54M	
13-05-04	iPads & percussion	1H8M	RqLfsBCE3mM
13-08-04	interview	29M	

Table 1. The corpus of rehearsal and interview recordings used in this study. Selected performances are available online at `http://youtu.be/id`

RESULTS

The qualitative analysis of interview and recording transcripts revealed a vocabulary of gestures developed by the group to express musical ideas in the rehearsals and performances. The gestures embrace the affordances of the iPad instrument but also reflect the group's training and experience with percussion. The study produced a refined concept of the relationship between the iPads and percussion and how the performers used these instruments to structure improvisation.

Taps

By their own admission, the pitched percussion sounds that could be created with taps on the iPad were well understood by the performers. As described below, over the rehearsals they used the iPads to create unique interpretations of these sounds.

Fast Taps

The performers used fast tapping and the delay function to create a continuous, pitched sound. Fast Taps were generally not used in precise rhythms but in a single stroke roll where continuous fast attacks created the illusion of a continuous sound [4]. When this was performed with low pitches, the attacks blended together and created an "organ" or "bass" sound which was used as a "pedal point", or continuous low-pitched drone. High-pitched Fast Taps were a very distinctive sound that encouraged imitation among the group while Fast Taps used on field recordings created soft underlying textures. The performers commented on the experience of filling up the delay function's buffer with fast taps: "setting it going and just watching it for a while" (JG).

Slow Taps

Very slow taps were associated with low-pitched sounds from the performers and were used with and without the delay function to create a slow, but measured, rhythm.

Random Phrases

YL demonstrated a "capricious" sound using multiple fingers in quick succession to tap all over the iPad screen. Unlike the fast and slow tap, these random phrases grouped a small number of taps into a short gesture.

Swipes

Swiping, moving a finger across the iPad screen, produced continuous field recording sounds with volume directly controlled by the velocity of the movement. The performers used this control of volume (or "dynamics" in musical terminology) to express rhythm and to accompany performers using other gestures.

Short Swipes

Short swipes had a distinct beginning and end and were usually performed in a straight line across the iPad screens. The end of short swipes was often more striking than the beginning due to the sudden stop in sound when the performer lifted their finger from the screen. Performers emphasised this contrast by accelerating their movement at the end of the gesture producing a loud sound and then silence. This gesture was rhythmically clear, CH remarked that it was: "more defined, I can make rhythms that way".

Swirls

A continuous swiping sound could be achieved by moving continually back and forth across the iPad screen. While large circular motions could be made slowly or quickly to form soft or loud dynamics, the performers often used small swirls for softer sounds and larger swirls for accents and loud continuous sounds. This gesture mimics snare-drum brush-technique where wire brushes are swept across a rough drumskin in patterns of large and small swirls to create rhythms [4]. A very slow movement across the iPad screen was used to produce a very quiet but continuous sound in a long, focussed gesture.

Combinations

Two gestures were discussed that used combinations of taps and swirls. In the first, a small swirl in one hand was used as an underlying sound for phrases of taps in the other. The second combination-gesture used taps with a distinctive pitched sound followed by a short swipe.

Volume control

The iPads' volume control was used performatively throughout the improvisations. While the performers would use the hardware volume control to balance their sound with the rest of the group, they also used it to fade continuous sound in and out, especially those created with the delay function. CH used quick changes to the "mute" volume setting to produce a sense of space and rhythm in her phrases.

Relationship between iPads and percussion

Performers commented that the iPad instruments afforded less control over sound than percussion instruments and, in response, they developed gestures that emphasised rhythmic playing and dynamics. The performers did, however, acknowledge features of the iPad instruments that were not available in percussion instruments. The field recordings were "something we can't replicate" (JG) and the network feature that matched the scale of pitched notes across the ensemble "made everyone sound more cohesive" (CH). When matched with percussion instruments, the iPad became "just another instrument" (CH) in multi-instrument setups. In this situation, CH commented that she "really wanted to play

the iPad with sticks", but also acknowledged that she would sometimes play her regular percussion instruments with her fingers. In this way, the gestural vocabulary of iPad performance had influenced her approach to the percussion setup.

Structuring an Improvisation
Rather than using the app to create melodies and rhythmic accompaniments, the performers acknowledged that they were instead creating "textures" (YL, JG) or layerings of timbrally diverse sounds. While performers frequently imitated each other, responding with similar gestures, they also developed a sense of their own style over the rehearsals, for example, YL used "the ideas I was doing yesterday". They also had moments of introversion, "I wasn't listening to anybody, just having fun" (JG).

The performers were conscious of creating an aesthetically pleasing structure in their performances and were more successful after a number of improvisation sessions together. At the end of the series of rehearsals, YL commented that "we're really developing a sense of... motion. There's definitely parts of it where... we're definitely now in a new section". Given the ease of creating continuous sounds with the iPads, the performers appreciated moments of silence or "space" (YL) in between musical ideas. When discussing the goal of playing longer performances, the performers noted they would need to continue developing confidence pursuing particular musical ideas. YL commented "we'd have to be comfortable sitting on one idea for longer" and JG suggested "getting used to... the really gradual shift" of musical ideas.

CONCLUSIONS
We have described the findings of a qualitative study of gestures used by a group of percussionists on new iPad instruments. The main contribution of this research is a vocabulary of expressive gestures that emerged from the group to communicate musical ideas and to overcome some of the perceived limitations of the apps. The performers borrowed from their percussion backgrounds to create distinctive gestures using one or both hands: fast, slow and random phrases of taps; short swipes; fast and slow swirls; combinations of swirls and taps; single handed extension of taps with a swipe; and combinations of these gestures with the iPad's volume control.

The performers used these gestures to express rhythm and dynamics and to explore timbres from outside the design-intentions of the apps. While the "organ" sound of continually delayed fast taps was not foreseen in the design of the app, this became a key motif in performances. Our vocabulary of touch gestures can be used for composition or music-education with the apps, as a design framework for expanding the expressive possibilities of future touch-screen based instruments, or even other non-musical touch-screen applications.

We have also discussed the group's understanding of how the iPads fitted into their existing percussive artistic practice and how they used the iPads to give structure to an improvisation. While the performers felt the touch-screen provided less control than percussion instruments, they used the non-percussive sounds from the apps to augment the traditional

percussion in their setups. Even though they were equipped with identical iPad instruments, the performers developed their own styles over the rehearsals. In each improvisation they were conscious of carefully pacing their performance and using space between phrases and ideas. The group used ensemble interactions such as imitation as well as introverted explorations of particular gestures.

This work demonstrates that expressive gestures can be used to expand the power of musical touch-screen apps and create compelling performances. In future work, our results could be used to iterate the design of iPad percussion instruments so that they fit more easily within percussion setups. Our findings could also be useful for training other musicians or students in the use of iPad percussion instruments.

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