Understanding
the HCI of Digital Musical Instruments

We at Yu Centrik see contribution to academia as necessary fuel for the long-term development of our field. In 2009, we made just such an effort toward McGill University researchers' study of digital drum interfaces. The original experiment focused mainly on physical and objective metrics with a light focus on user perception; we sent our researchers to expand the study's focus to include user expectations, reactions, perceptions and preferences. Analysis showed a useful and pertinent array of conclusions toward the nature of musicians' interaction with digital musical instruments. This inter-disciplinary experiment also gave us insight toward new applications of our expertise.

CONTEXT

Mandates : We applied our usability expertise to the study of 8 percussionists interacting with four drum interfaces, a selection designed to represent different levels of abstraction from a real percussion instrument. The work represented our voluntary partnership with a scientific laboratory directed by Marcelo Wanderley: the Input Devices and Music Interaction Laboratory (IDMIL) at McGill University.

Solution : The final report presented trends and patterns between participants' explicit preferences, self-ranking of ability (to be compared with physical data), and live interaction data obtained through protocol analysis (the talk-aloud procedure).

Instrument Selection

Aligning with the title of Dr. Wanderley's first paper on this subject, his team selected four percussive musical instruments chosen to reflect a specific axis: "From Real to Virtual". What follows are short descriptions of the four selected percussive interfaces, presented in order from "real" to "virtual".

- Standard Tom Drum: used as a control for the experiment. Although physical and objective measures were taken, subjective analysis was not conducted. As our participants were all trained percussionists, this drum represented something they were all quite accustomed to.

- Roland V-Drum: a digital drum controller which has become an industry standard in terms of digital drum kits. The interface looks like a digitized version of a standard drum and is used in much the same way.

- Radio Baton: developed by Max Matthews around 20 years ago, this instrument is reminiscent of a giant table. The musician uses two wired batons to control sound. Although the instrument is traditionally able to sense height and position, we had it configured to only detect contact in an attempt to parallel the other drums.

- Buchla Lightning II: A virtual midi controller involving two infrared-emitting wands used in free space (not unlike Nintendo's Wii). The instrument's photo-sensing unit detects the controllers' location, acceleration, velocity and direction. Again, the instrument was configured to produce contact sound through standard drum motions for experimental consistency.

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Digital Drum Interfaces: Understanding the HCI of Digital Musical Instruments

1. EXPERIMENTAL PROCEDURE

Our interface analysis sessions were interspersed between the IDMIL team's measurement of participants playing standard percussion patterns. Participants were interviewed while engaging with each percussion interface during a 10 minute warm-up session. At the end of the test, an in-depth final interview gathered more summative, comparative feedback.

Questions were asked targeting general feelings, consistency, dynamics control, practical uses, and the holistic experience of engaging with each interface. Much of the procedure involved open discussion which was recorded and later subjected to a detailed protocol analysis.

2. GENERAL FINDINGS

DEFINING AN 'INSTRUMENT'

While the appearance and sound of a drum are certainly critical, the action, feedback and procedure seem to also be a vital constituent of that which is considered a percussion instrument. Comments about the physical feeling of contact were extremely precise and abundant throughout the study. Interestingly, the appearance of a virtual instrument also generates clear expectations, and violating these expectations leads to a negative reaction. For example, people expected deeper and louder sounds from the big interface and mallets of the radio baton; they were disappointed with the simple tom sounds they heard. The lightning's lack of appearance created no such expectations, a fact which likely contributed to a more positive reaction from participants.

APPROPRIATION AND EXPRESSION

According to our participants, drums become a venue for expression as we adapt and use them in ways which were never intended in the initial design. Musicians tend to explore and find new ways to use them, taking advantage of their physical properties. Protocol analysis revealed that our participants found the true subtlety and potential for innovation of an acoustic drum missing from the virtual instruments studied here. Angle changes, positioning changes, and muting/bending the virtual drum's skin have no effect on the sound.

PHYSICALITY OF PERCUSSION

Participants had many comments about the resistance and rebound of the drums, suggesting that the analysis of percussive interaction might also benefit from comparing motion capture data of percussionists playing on real and virtual instruments. Some participants felt themselves using muscles they weren't used to, or tiring easily with the drums, due to slight differences in the interface control. Similar to the study of athletes, analyzing how a percussionist's actions differ between a virtual drum and a real drum could help understand the sources of these differences and correct the interface's physical properties, optimizing the percussionist's interaction with the instrument.

PERCUSSIONIST PROFILES

Based on participants' comments and their ratings of the most expressive, the most awkward and the instrument they'd want to take home, two distinct user profiles seemed to emerge. Three participants seemed to be adamant on comparing each virtual drum to a real acoustic drum, as if searching for a real drum's substitute in the interfaces. The other five participants were more interested in exploring the novelty and possibilities of the virtual instruments.

The V-Drum and Lightning II seemed to pique the interest of the simulation-seeking drummers and the exploratory drummers respectively. Interestingly, poor subjective judgments of the radio baton align with this idea as well, as it lies somewhere between emulating a real drum and innovating a new interaction mode. Although we had a small sample, and it consisted only of trained percussionists*, these trends represent that distinct user profiles may exist for virtual musical instruments. In this case, one profile saw virtual percussion instruments as an attempt to emulate/improve standard percussion, and another profile saw them as a novel way to explore and expand percussive interaction in new directions.

*** ISSUES WITH USING ONLY TRAINED ACADEMIC PERCUSSIONISTS :** All participants were trained academic percussionists. Results would likely be very different with self-educated rock and pop drummers, especially for the V-Drum (which even our academic participants claimed they would use mostly for Rock and Pop) and the Lightning II (which many claimed would be most useful for live performance). Applying this methodology to less formal drummers might also lead to less structured and more emotional/experiential qualitative data.

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