Reach
Designing keyboard instruments with pianists in mind

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Abstract

This poster focuses on the comparative user testing conducted to evaluate Reach, a gesture recognition system for live piano sound modulation. The user testing compares the Reach system with two existing keyboard-based systems for keyboard live sound modulation: ROLI Seaboard (Lamb and Robertson, 2011) and TouchKeys (McPherson, 2012). The study analyses ease of use, learnability and creative freedom, based on two jazz improvisations each on all three systems by the participants. This is presented along with user experience questionnaire (UEQ) data. The poster illustrates results from the test, focusing on the relationship between the learning curve and creative barrier in digital instruments and showing promising results for touch-free digital musical instruments (DMIs) like Reach.

The comparative user testing taken into analysis is part of a larger research project that seeks to investigate how a low degree of invasiveness in digital systems for live sound modulation can reduce the learning curve and eventually make electronic music more accessible.

Motivation for Study

Pianists spend years crafting and refining their instrumental technique, usually to find themselves in front of DMIs that require them to adapt or relearn the gestural technique required in order to operate them. For pianists, as discussed by Nicolls (2010), this turns out to be the most disruptive element of DMIs: learning a new gestural language while retaining pianistic control or freedom. This research has the aim of investigating how DMIs like Reach, with a low degree of invasiveness and based on pre-existing technique, can foster creativity and help classically trained pianists approach DMIs with a less steep learning curve.

Research Background

Reach is a system that uses the Leap Motion data, gathered from the VR oriented Orion SDK (Leap Motion, 2018), and uses it to map the hand gestures to sound modulation in a Pure Data effects system, enabling live sound modulation.

In recent years, the ROLI Seaboard (Lamb and Robertson, 2011) and TouchKeys (McPherson, 2012) present two innovative keyboard interface developments. Both require users to alter or adapt their technique to accommodate a new gestural vocabulary built to work with their systems. At the same time, they are the two most prominent keyboard interfaces for live sound modulation. For this reason, they have been chosen as optimal candidates for a comparative test for real time piano sound modulation.

User Testing

The test was designed to compare two existing keyboard interfaces that enable piano sound modulation with the Reach System V1.0. The testing method combined guided and free improvisation/exploration. Both TouchKeys and Seaboard were set to play high quality grand piano samples from the Equator (ROLI, 2018) sound library. Quantitative data was gathered using the UEQ after every individual session on one of the three systems, with a single semi-structured interview at the end of the test.

Six jazz pianists took part in the test. A brief introductory interview took place at the beginning of the test to frame the musical background, knowledge of the pieces proposed and comfort in playing electronic instruments.

The study investigates several factors: importance of low degree of invasiveness of a DMI, importance of the ability to retain pianistic technique when playing a keyboard based DMI and importance of other surrounding affordances such as learnability, ease of use, price and portability.

For each system, users had 5 minutes to explore the individual system and ask questions, 5 minutes to improvise on a jazz standard (Goodbye Pork Pie Hat, Charles Mingus) and 5 minutes to more freely improvise on a modal melody (Musica Ricercata N.07, György Ligeti). After having completed the tasks on a system, they were asked to complete the UEQ for that system alone, and then move on to the next system. The order of the keyboards was different for every participant to minimise the influence of the order on the test results.

Discussion

At the end of the interview, the users were asked to rank the three systems according to general interest in the system, freedom of playing and learning curve. Overall, the Reach system was at the top in every ranking (table 1-3). In one case, a user considered it tied with TouchKeys both regarding the interest factor and the ease of learning. Another user found Seaboard and Reach equally interesting, while they considered TouchKeys the easiest interface to learn and approach. This reflected the results of the UEQ data the highest marks in all six aspects analysed (fig. 1).
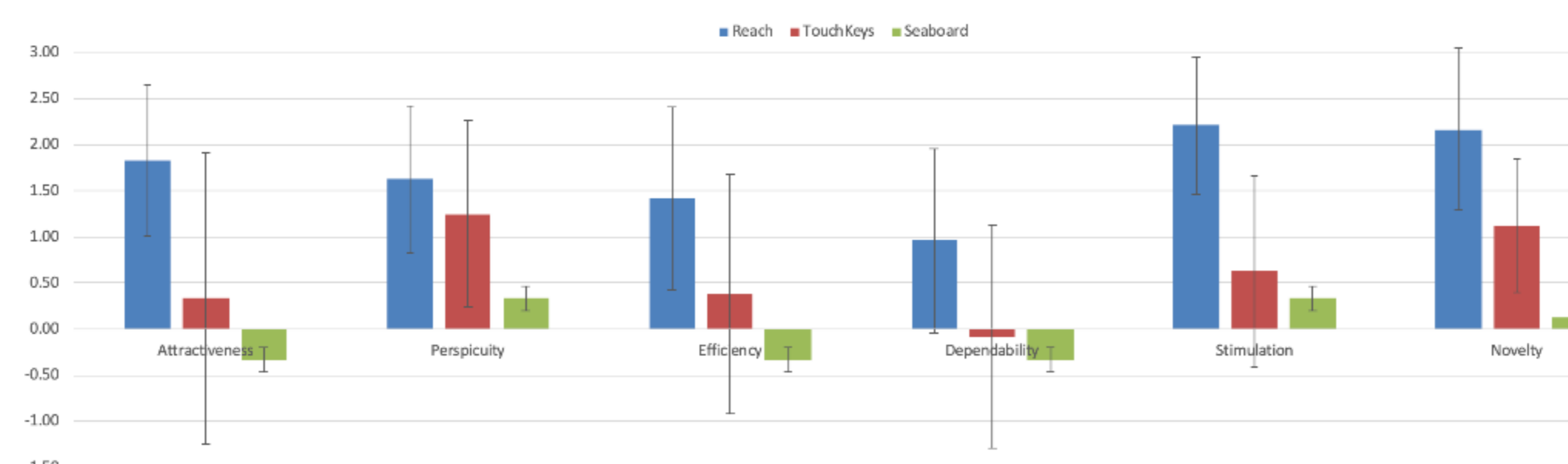

Figure 1: UEQ results regarding the attractiveness, perspicuity, efficiency, dependability, stimulation and novelty for all three systems.

While being almost tied with TouchKeys, Seaboard was never even considered close to either. There are two main factors that seem to cause these results. The first and most important factor is that Reach is mounted on an acoustic grand piano, which provided all the comfort cues that the pianists missed in the other two interfaces. Moreover, the loud acoustic sound was always prominent, and made the sound modulation from the speakers less invasive than on the other two systems, which were directly modulating the piano samples they were reproducing. This and the touch-free / non-invasive nature of the system were said to provide the most comfortable and interesting experience. While Reach and TouchKeys were evaluated similarly by two users, Seaboard was never seen as a valid competitor. This most probably because, as noted by Dahlstedt (2017): "its wedge-shaped key design prevents any advanced keyboard technique to be used and seems to be mainly aimed towards non-keyboard players".

Interest				Freedom of Playing			
Ranking	Reach	TouchKeys	Seaboard	Ranking	Reach	TouchKeys	Seaboard
First	5	1	2	First	6	0	0
Second	1	2	1	Second	0	5	1
Third	0	3	3	Third	0	1	5

Learning Curve			
Ranking	Reach	TouchKeys	Seaboard
First	1	3	0
Second	2	2	1
Third	1	1	5

Tables 1, 2, 3: Ranking of the three systems according to Interest, Freedom of Playing and Learning Curve.

Conclusion

The results from the comparative testing show that there is a clear connection between invasiveness of the digital system, comfortableness of the instrumentalist to approach the instrument and ability to freely improvise and transfer previously learned skills and technique. Out of the investigated topics, the most surprising results were gathered when the users were asked about the trade-off between precision of modulation in relation to the invasiveness of the system. All of the jazz players that took part in the test seemed to prefer a less precise mean of modulation in favour of a less invasive interface. This was for two main reasons: an overly precise mapping of the fingers resulted in disrupting the flow of the improvisation and, not being able to precisely predict the outcome of the modulation, the pianists treated the system almost like another musician with which they could interact.

References

Dahlstedt, P. (2017) Physical Interactions with Digital Strings - A hybrid approach to a digital keyboard instrument. In Proceedings of the International Conference on New Interfaces for Musical Expression (NIME), 115-120.

Lamb, R. and Robertson, A.N. (2011) Seaboard: a new piano keyboard-related interface combining discrete and continuous control. In Proceedings of the International Conference on New Interfaces for Musical Expression (NIME), 503–506.

Leap Motion, Inc. (2018) Leap Motion [online] Available from https://developer.leapmotion.com/orion/ [Accessed September 2018]

McPherson, A. (2012) TouchKeys: Capacitive Multi-Touch Sensing on a Physical Keyboard. In Proceedings of the International Conference on New Interfaces for Musical Expression (NIME), 1–4.

Nicolls, S.L. (2011) Interacting with the Piano. PhD Thesis, Brunel University.

ROLI, Ltd. (2018) Equator, Bend your sonic universe [online] Available at https://roli.com/products/software/equator-synth [Accessed September 2018]