
Physical Interaction with Audio

Florian Heller
RWTH Aachen University
52056 Aachen, Germany
flo@cs.rwth-aachen.de

Jan Borchers
RWTH Aachen University
52056 Aachen, Germany
borchers@cs.rwth-aachen.de

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the owner/author(s). Copyright is held by the author/owner(s).
CHI'15 Workshop 05 "Collaborating with Intelligent Machines: Interfaces for Creative Sound", April 18, 2015, Seoul, Republic of Korea.

Abstract

Sound and its creation are an inherently physical process, yet in the age of digital audio the physical part disappeared. Instead of working with the medium itself as, e.g., with vinyl records, the media player introduced a new level of abstraction. This new abstraction layer, however, rarely made use of our manual skills and instead forced us to work with simple binary buttons. The NIME community has created various interfaces that allow to use our manual skill to a higher extent, but only few of these developments made it to a broad market. With the separation of media player and controller, the DJ world has seen a slow transition from the traditional interfaces, mostly inspired by DJ CD players, towards hardware that supports a more creative approach and integrates features known from electronic music performance interfaces. The possible extensions on the software side are numerous, but they only work if complemented by an adapted physical interface. We present a design space to classify the existing approaches in physical interaction with audio and to discover potential opportunities for extensions.

Author Keywords

Guides, instructions, author's kit, conference publications



Figure 1: DiskPlay visualizes additional information directly on the timecode record of a digital vinyl system, integrating visual output and tangible controller in on device.

Let's get physical

In contrast to a guitarist's performance which highly depends on her manual skill, an electronic musician or a DJ has to work mostly with buttons and knobs. While this does not need to affect expressivity, our hands provide more capabilities, much of which remain unused. The rise of powerful laptop computers as general purpose media players and replacement for an entire rack of synthesizers also means that the hardware interface is reduced to mouse and keyboard at first. While the NIME community has presented numerous creative hardware interfaces that leverage the physical interaction to a new level, ranging from interaction with tangibles using the *reactTable* [6] to Imogen Heap's interactive gloves [7]. Tim Exile's *FlowMachine* shows that physical controls are key to a powerful software. The DJ community however, is extremely conservative regarding new hardware, which is partly due to the fact that nightclubs mostly provide the same equipment for overall consistency. However, phenomena like the so called *Serato Face* [1] show that there is potential for improvement in the user interface. In digital vinyl systems (DVS), the separation of visualization and control results in a constant switch of interaction focus.

With *DiskPlay* [2, 3], we visualized information like track start and end, cue points, and waveform directly on the timecode record, creating a fully integrated interface that allows the DJ to build on her manual skill. With the integration of larger screens, the DJ controller becomes a highly adapted hardware interface for a powerful software and the laptop can slowly fade into the background.

However, manual skill is not the only way of physical interaction with audio. Our second example is *Corona*, a Mobile Audio Augmented Reality System (MAARS) [4, 5],

where physical displacement and change in orientation is used as input for the digital audio processing. While the intended use case is not primarily musical, the interaction can be used for a spatial audio performance, e.g., playing samples at specific locations in space and thereby overcoming the predominant stereo recording.

Design space

We propose a design space for the physical interaction with digital audio building on the following three modalities: visual, auditory, and haptics/embodiment. We do not use the word tangible here, as physical interaction should also integrate body posture or movement. The goal is to broaden the focus from instruments towards interaction with audio and to support a structured exploration of the space of physical interaction with it.

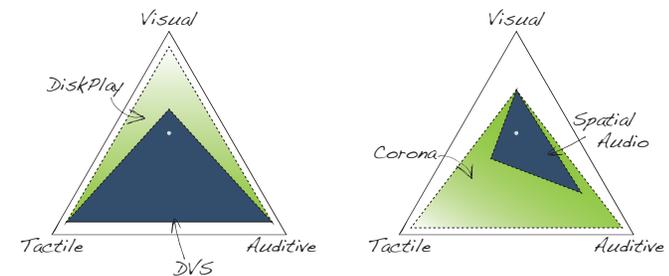


Figure 2: The design space helps discover a potential augmentation of an existing system. The blue triangle is the original system, the green one is the augmented version.

The details of this design space are omitted due to space restrictions, but the general idea is that a system is classified along all three axes, and thus covers a certain area in the design space. A larger coverage does not mean 'good' or 'bad', it just shows a potential extension of a certain system.

Expecting to see a number of interesting physical interfaces at the workshop, we would like to use the opportunity of the venue to see whether and if so, where the design space needs refinement. The goal is to provide a theoretical framework for the systematic exploration of the space of physical interfaces.

References

- [1] The Serato Face. <http://seratoface.tumblr.com/>.
- [2] Heller, F., and Borchers, J. DiskPlay: In-track Navigation on Turntables. In *CHI '12*, ACM Request Permissions (New York, NY, USA, May 2012), 1829–1832.
- [3] Heller, F., and Borchers, J. Visualizing Song Structure on Timecode Vinyls. In *NIME '14*, B. Caramiaux, K. Tahiroglu, R. Fiebrink, and A. Tanaka, Eds., Goldsmiths, University of London (London, UK, June 2014), 66–69.
- [4] Heller, F., Knott, T., Weiss, M., and Borchers, J. Multi-user interaction in virtual audio spaces. In *CHI EA '09*, ACM (Apr. 2009).
- [5] Heller, F., Krämer, A., and Borchers, J. Simplifying Orientation Measurement for Mobile Audio Augmented Reality Applications. In *CHI '14* (Apr. 2014).
- [6] Jorda, S., Geiger, G. u. n., Alonso, M., and Kaltenbrunner, M. The reacTable: Exploring the Synergy Between Live Music Performance and Tabletop Tangible Interfaces. In *TEI '07*, ACM (New York, NY, USA, 2007), 139–146.
- [7] Mitchell, T., and Heap, I. SoundGrasp: A Gestural Interface for the Performance of Live Music. In *NIME '11*, A. R. Jensenius, A. Tveit, R. I. Godøy, and D. Overholt, Eds. (Oslo, Norway, 2011), 465–468.