Prototyping Hybrid Musical Interactions on Tablet Devices

Henri Palleis
Ludwig-Maximilians-Universität
Amalienstraße 17 80333 Munich
henri.palleis@ifi.lmu.de

ABSTRACT
This paper will explore hybrid musical interactions on tablet devices that combine tangible, touch and gestural input. Existing low-fidelity prototyping tools are a promising platform for these investigations. An overview of intended research projects is given.

Author Keywords
Hybrid interaction, tangible interaction, musical instruments, mobile music computing.

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
There is a great variety of applications targeting the creation of music on mobile computing platforms. These applications range from emulated instruments to complex multi-track recording and editing systems. However, the interaction is usually restricted to simple touch input. The lack of haptic feedback and the absence of pressure sensing create an "input bottleneck", an unbalance between powerful sound processing and poor handling that goes along with a high visual workload. While there have been various approaches to extend the input capabilities by exploiting the sensors embedded in modern mobile devices [1], little work has been done to investigate the use of tangibles in combination with mobile devices in order to create new possibilities for expressive interaction within music creation contexts.

On a larger scale, there have been several research projects, which have demonstrated the potential of tangibles on interactive tabletop displays to create new and rich musical interaction styles [2]. In the context of these research projects, several tools and frameworks have been developed in order to facilitate the prototyping process of similar applications (e.g. [3]). However, these tools are not applicable on capacitive touchscreens of mobile devices. In a recent publication, Wiethoff et al. propose a lightweight low-fidelity prototyping method which allows developers of mobile applications to construct versatile tangibles made of paper and lines of conductive ink which bridge the gap between the screen and the human skin (see figure 1) [4]. Utilizing this prototyping method opens up a design space that allows the rapid exploration of hybrid musical interaction concepts on tablet devices with capacitive touchscreens.

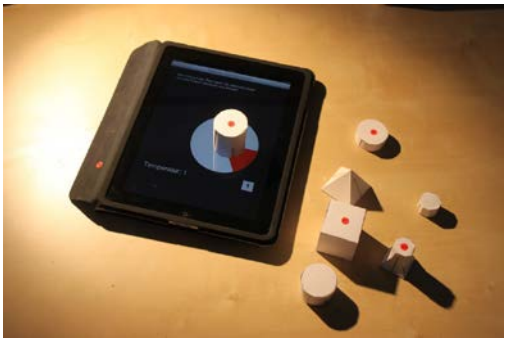

Figure 1 Sketch-a-TUI allows quick exploration of versatile tangibles by drawing lines of conductive ink on paper objects [4].

INTENDED RESEARCH
In particular, the intended research addresses the following topics:

- Multisided tangible objects on capacitive touchscreens
- The combination of tangible, touch-based and gestural interaction
- The Integration of sensors and actuators into the tangible objects

For example, an object as seen in figure 2 could be used to control multiple parameters by mapping both different sides of the tangible and it's on-screen position to different musical parameters such as volume, pitch or effect parameters. Depending on where the user grasps the object, rotating it will have a different effect. Technically, this can be achieved by drawing lines of conductive ink starting from the sides and branching out to a varying number of endpoints on the bottom side, where they can be tracked as touch events by the software running on the mobile device.

Furthermore, a gestural dimension might be added to the interaction by using data from the sensors of the tablet to control either additional musical parameters or application-specific functions such as mode switches or sound selection. For example, data from the acceleration

sensor might be used to enable the user to switch between playback and record modes without interrupting his performance.

The integration of sensors and actuators into the tangible objects provides further room for the exploration of expressive musical interactions on tablet devices. The availability of electronics prototyping platforms like Arduino [5] and the flexibility of the prototyping method mentioned above facilitate the creation of tangible objects capable of sensing applied pressure and providing tactile feedback.

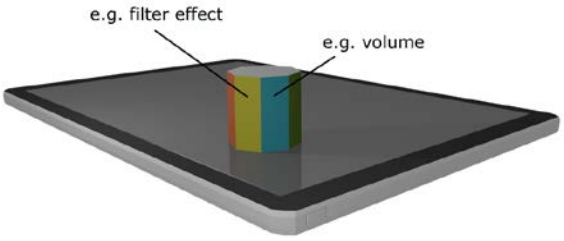

Figure 2 A multisided low-fidelity object that can be used on capacitive touchscreens

EXAMPLE APPLICATIONS

A possible use case to explore tangibles with distinguishable sides is a DJing application. Typical interactions of a DJ include crossfading between two audio channels and applying sound effects to the audio playback. In traditional DJ setups this is achieved by controlling physical sliders and knobs. Utilizing multisided tangible objects on touch-sensitive screens might enable DJs to execute both tasks by rotating and moving a single physical object and thus increase the bandwidth of his musical interactions. For example, rotating and moving a single tangible could achieve simultaneous crossfading and applying of effects, which is usually a bimanual task.

Another possible use case is a new musical controller, allowing users to generate sounds by touching and moving tangible objects on the screen of a tablet device. The volume and duration of the generated sounds depend on the applied pressure and length of the touch. In addition, the sound can be modulated (e.g. with a tremolo effect) by tilting the tablet. Tactile feedback might be provided through an actuator inside the tangible object vibrating with a frequency that corresponds to the pitch of the sound. Increasing the input and output capabilities by assigning additional functionality to the tangibles allows for the exploration of versatile, precise and complex musical interactions on tablet devices.

CONCLUSION

Utilizing existing low-fidelity prototyping tools enables the quick implementation of new hybrid musical interactions on tablet devices. In particular, this allows the exploration and evaluation of interactions that combine tangible, touch and gestural input.

Furthermore, by implementing and testing such hybrid musical interactions on tablet devices, we want to contribute to the mobile music community by extending existing prototyping tools in order to facilitate the development of applications which utilize tangible objects with the goal to enable expressive and rich musical interactions on mobile devices.

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