The Sound of Touch

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1 Introduction

All people have experienced hearing sounds produced when they touch and manipulate different materials. We know what it will sound like to bang our fist against a wooden door, or to crumple a piece of newspaper. We can imagine what a coffee mug will sound like if it is dropped onto a concrete floor. But our wealth of experience handling physical materials does not typically produce much intuition for operating a new electronic instrument, given the inherently arbitrary mapping from gesture to sound.

2 Approach

The Sound of Touch is a new instrument for real-time capture and sensitive physical stimulation of sound samples using digital convolution. Our hand-held wand can be used to (1) record sound, then (2) playback the recording by brushing, scraping, striking or otherwise physically manipulating the wand against physical objects. During playback, the recorded sound is continuously filtered by the acoustic interaction of the wand and the material being touched. Our texture kit allows for convenient acoustic exploration of a range of materials.

The system enables a flexible capture and manipulation of audio that is characteristic of digital tools, but in a direct and physical manner that approaches the continuous experience of manipulating acoustic musical instruments and found objects. The Sound of Touch allows people to leverage their existing intuitions about how different objects will sound when these objects are touched, struck, or otherwise physically manipulated – a feature shared by acoustic instruments and objects from our everyday lives. It is thus a sonic exploration tool that borrows properties from both acoustic and electronic sound creation, bringing them together in a way that incorporates advantages of each.

3 Implementation and Use

We extend Aimi's methods [Aimi, 2006] for real-time percussion instruments, which allow a stored digital sound sample to be continuously stimulated by the signal from a piezoelectric sensor attached to a drum brush. The underlying mechanism of this stimulation is an always–running digital convolution [Oppenheim and Schafer, 1975] of the stored sound sample and the (digitized) incoming signal from the piezoelectric element.

The Wand

Collocated media capture and manipulation is intuitive for visual composition [Ryokai et al., 2005], and our experiments suggest that this interaction technique maps to the auditory domain. Our wand incorporates a microphone for recording samples and a piezoelectric sensor for stimulating playback of the newly–recorded sounds. To record, a user depresses the button on the wand. When the button is released, recording ends and vibrations to the piezoelectric element stimulate the recorded sample. When the wand is brushed, tapped, scratched, or interacts in other ways with physical objects, the stored sample is filtered by the wand's acoustic interactions. Samples sound as if they were recorded *through* the physical media. A user may also hold the wand against a found object, so that the object itself becomes the performative interface to the stored sound. The user can thus exploit the found object's physical shape or resonant characteristics during performance.

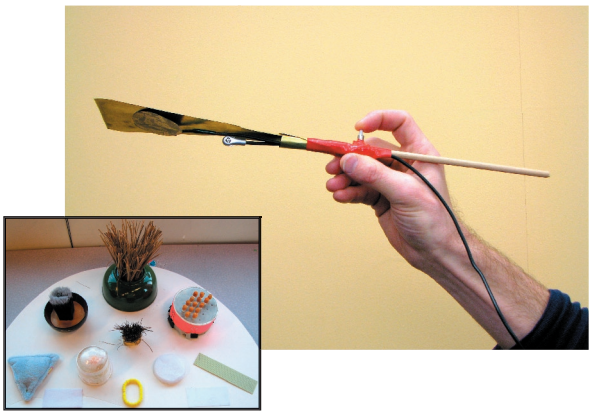

Figure 1. Recording a sample with the Wand. Texture kit (inset).

The Texture Kit

A texture kit enables convenient sonic experimentation with a wide range of physical materials. The kit includes a soft paintbrush, stiff wicker bristles, fabric, plastic, velcro, and a number of other unusual objects. In contrast to traditional electronic instruments, the Texture Kit introduces acoustic affordances to the system without requiring that they be integrated into the electronic instrument itself.

4 Implications

The decoupling of performer gesture and output sound is inherent in electronic instruments. Although revolutionary, it comes at a cost: most musical affordances must deliberately be created by the instrument designer. This stands in contrast to acoustic instruments, which feature many accidental or serendipitous affordances that need not have been foreseen by the instrument's designer. The Sound of Touch introduces a new class of "semi-acoustic" instruments that combines the flexibility of digital data manipulation with the acoustical affordances of physical media. Such hybrid digital/acoustic instruments can extend the breadth of sonic expression available to sound engineers, foley artists, musicians, and casual performers.

References

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