Bubbaboard and Mommaspeaker: Creating Digital Tonal Sounds from an Acoustic Percussive Instrument

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ABSTRACT
This paper describes the transformation of an everyday object into a digital musical instrument. By tracking hand movements and tilt on one of two axes, the Bubbaboard, a transformed handheld washboard, allows a user to play scales at different octaves while simultaneously offering the ability to use its inherent acoustic percussive qualities. Processed sound is fed to the Mommaspeaker, which creates physically generated vibrato at a speed determined by tilting the Bubbaboard on its second axis.

Keywords
Gesture based controllers, Musical Performance, MIDI, Accelerometer, Microcontroller, Contact Microphone

1. INTRODUCTION
The Bubbaboard was created as a means to combine natural acoustic percussion with digitally created tones. The Bubbaboard was intended to allow the player to perform tonal solos on a handheld washboard as well as accompaniment in its traditional manner as it is often used in Zydeco and other Cajun influenced music. The hardware consisted of a washboard bought in a local hardware store modified with an array of sensors connected to an onboard microprocessor. Data is fed to MAX/MSP for digital sound processing and then output to the Mommaspeaker. The Mommaspeaker was constructed of wood, DC motor and mount, and speaker parts.

2. BACKGROUND
This instrument was created specifically for use in live performance. The Bubbaboard and Mommaspeaker were designed as gesture based instruments with the intention of allowing both user and viewers to gain a clear idea of feedback from engaging with the instrument. Bubbaboard also offers a unique bridge between performing percussion and tones on the same instrument.

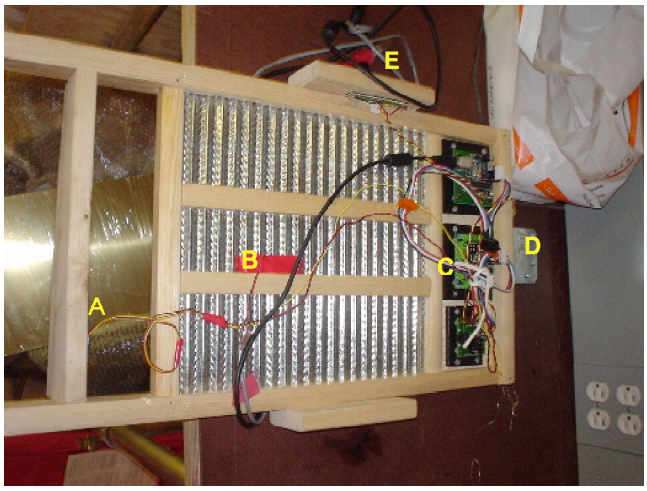
The ribbed metal of a handheld washboard has unique percussive qualities that led to its popularity in Zydeco and Dixieland music [1]. Over time, the design evolved to allow players to physically wear the washboard essentially like a body armor suit [2].

The Bubbaboard leverages the traditional feel of the original handheld washboard while allowing an entirely new manner of gesture based performing.

3. DESIGN
Both Bubbaboard and Mommaspeaker were designed and developed at the NIME workshop taught by Gideon D'Arcangelo at NYU's Interactive Telecommunication Program [3]. Early challenges that had to be overcome dealt primarily with balancing the inherent loud percussive qualities of the washboard with the creation of tones that would not be lost in cacophony. The design also focused on allowing the user to either play tones and percussion at the same time or separately.

3.1 HARDWARE
The washboard, purchased from a local hardware store, was outfitted with an IR ranging sensor (A) mounted to the bottom of the instrument. This sensor tracks the position of the left hand of the player.

A contact microphone (B) was mounted on the underside of the washboard to sense when the washboard was being hit.

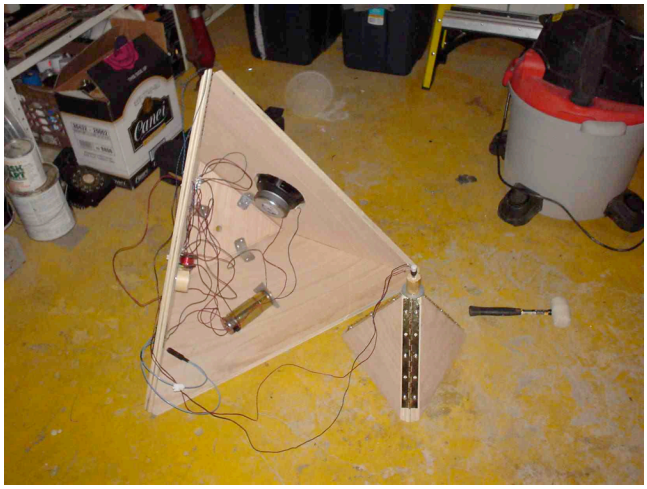


All the sensors were wired to a PIC based Teleo system (C) mounted to the top of the washboard [4].

A two-axis accelerometer (D) was mounted on top of the washboard. One axis is used to control octaves when playing tones, while the other axis is used to trigger the speaker spin speed of the Mommaspeaker.

Volume level of the Bubbaboard was controlled by a mixer fader switch (E) mounted on the right side of the washboard.

The Mommaspeaker motor was controlled directly from the microprocessor mounted on the washboard. The base of the Mommaspeaker housed the woofer, crossover, and the DC motor. The DC motor armature was mounted directly to a wood enclosure housing the tweeter. Wiring from the tweeter was connected to the crossover in the base via a Mercotac rotating electrical connector [5].



3.2 SOFTWARE

Software was designed entirely within MAX/MSP for digital sound processing. Miller Puckette's Bonk object [6] was used to detect percussive attack from the washboard and other sensor data was processed to generate tone and volume based on Dan Trueman's and R. Luke DuBois' PerCColate objects [7]. Motor speed of the Mommaspeaker was also controlled within MAX/MSP using pulse code modulation.

4. PERFORMANCE

Bubbaboard and Mommaspeaker debuted at the NIME performance at Tonic in New York on May 6, 2004. Both the instrument and speaker were accompanied by an acoustic banjo and was well received by the audience.

5. ONGOING DEVELOPMENT

Designs are currently focused on allowing dynamic pitch shift with controls mounted directly on the Bubbaboard. The motor mount design on the Mommaspeaker is currently being revised to improve stability and improve motor speed.

6. ACKNOWLEDGMENTS

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7. REFERENCES

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[4] Making Things Teleo System
http://makingthings.com/products/products.htm

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[7] Dan Trueman's and R. Luke Dubois' PerCColate objects
http://www.music.columbia.edu/PeRColate/