Loveform: the generative design of sculptural forms from spoken word

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ABSTRACT

ACM Classification Keywords
H.5.1. Information Interfaces and Presentation (e.g. HCI): Multimedia Information Systems; J.5 Arts and Humanities: Fine Arts

Author Keywords
Generative design, tangible interaction; digital fabrication.

INTRODUCTION
Loveform is a way to share personal messages in an abstract physical form with audio triggered on interaction. It is an interactive, 3D printed ceramic cup derived from the waveform of a spoken message that recites its recorded message when drunk from. Our first pair of cups each represent and recite the message 'I love you' (Figure 1). Loveform is about tangible interaction with abstract physical representations of audio. The cups and saucers function as a tangible interface for playing encoded messages. Precedents for the generative design include Nervous Systems' Coral Cup and Porifera jewelry collection [4, 3] and for the simple tangible interaction include Durrell Bishop's Marble Answering Machine [2] and Philip's Mindspheres [1]. Using our open source software, users can record their own messages and generate unique cups for 3D printing. Code for this project is available at https://github.com/baharmon/waveforms under the Creative Commons Attribution-ShareAlike 4.0 International (CC BY-SA 4.0) license.

GENERATIVE DESIGN AND FABRICATION
We each recorded our message – 'I love you' – and used Grasshopper, Rhinoceros 3D's visual programming language, to parametrically model the waveforms of each recording as sculptural forms. Our Grasshopper script draws the waveform of a recording as a curve, divides this curve into segments, translates and rotates these segments around a circle, sweeps the segments into a surface, and then extrudes the surface into a volume. Once we had generated the models, we 3D printed plaster negatives of the cups as formwork and then slip cast, bisque fired, glazed, and then fully fired the cups. We also experimented with 3D printing the cups with a ceramic resin.

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TANGIBLE INTERACTION
While each cup's sculptural form physically represents the unique waveform of the message it encodes, drinking from the cup plays back the encoded message as audio. Each cup rests on a saucer – an epoxy cast of a cupped hand embedded with a sensor, microcontroller, and speaker – that can playback the encoded message. When a cup is picked up to be drunk from, its saucer will play back the message that the cup represents. Picking up the cup releases pressure on a pressure sensor, triggering the recording to play. A tactile transducer generates the sound by vibrating the saucer. Users can record their our messages by whispering their own secrets into an epoxy cast of an ear embedded with a recording device. Each secret will be recorded, parametrically modeled as a sculptural vessel, and saved as a stereolithography file for 3D printing. Users can take their stereolithography files to a makerspace or use an online service like Shapeways for 3D printing.

CONCLUSION
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ACKNOWLEDGMENTS
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Figure 1. Loveform, 3D printed ceramic cups