

SpeakCup: Simplicity, *BABL*, and Shape Change

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ABSTRACT

In this paper we present SpeakCup, a simple tangible interface that uses shape change to convey meaning in its interaction design. SpeakCup is a voice recorder in the form of a soft silicone disk with embedded sensors and actuators. Advances in sensor technology and material science have provided new ways for users to interact with computational devices. Rather than issuing commands to a system via abstract and multi-purpose buttons the door is open for more nuanced and application-specific approaches. Here we explore the coupling of shape and action in an interface designed for simplicity while discussing some questions that we have encountered along the way.

Author Keywords

Tangible interaction, shape change, simplicity, calm computing

ACM Classification Keywords

H.5.2 User Interfaces: Interaction Styles;

INTRODUCTION

As an experiment in simplicity we created SpeakCup [figure 1], a digital voice recorder in the form of a soft silicone disk that relies on shape change as input. The design arose from our earlier investigations in reducing interface *BABL* (buttons and blinking lights) [2]. To record sound with SpeakCup the user deforms the disk into a cup, so that it can *hold* the sound. Pressing the cup inside out will then *release* the captured sound [figure 2]. Our contribution is a demonstration of using shape change as an interface strategy. We are interested in shape change as a way to privilege simplicity in interaction design and also as a means to incorporate physical metaphor or analogy into new devices.

Using shape change as an input to computational systems is nothing new, the mouse changes shape when you click it

and so do keyboards. Shape change is the dominant form of human-machine interaction but in most cases the change in form and the action incurring the change are only loosely connected to the desired response. Hutchins, Hollan, and Norman described this as *the gulf of execution* [3], in other words it's the gap between a user's goals for action and the means to execute those goals. Interfaces (by definition and observation) get in between users and their goals. Weiser's vision of *calm computing* [6] has been a serious challenge—it is not easy to make functional interfaces disappear!

One way to create invisible interfaces is to design devices that function like the real, un-digital world [5]. But in some cases the un-digital world is not as versatile as the digital world, so how do we go about providing valuable expressive power and reducing the gulf of execution at the same time? There are some answers for this question in Ishii and Ullmer's *tangible bits* [4] as well as in [5]. In this paper we describe a small exploration in the use of shape and metaphor to address these questions.



Figure 1. SpeakCup

SPEAKCUP

We first imagined SpeakCup during a design exercise in which we challenged ourselves to create interfaces with minimal feature sets without relying on abstract buttons or blinking lights [2].

Implementation

SpeakCup's body is made from a six-inch disk of platinum cure silicone rubber. A ring of aluminum is embedded

inside the outer rim of the disk so that it stays round when deformed. A combination microphone/speaker is embedded in the center of the disk. Red and green LEDs are wired around the perimeter of the microphone/speaker. Two flex sensors that change resistance when bent span the diameter of the disk embedded in the silicone and facing in opposite directions to sense deformations on either side. SpeakCup is wired to a protoboard where the electronics and batteries that power it are located. We used a cheap RadioShack voice recorder module with 20 seconds of memory to store and playback sound. We rewired this module's buttons, running them through analog electronics to connect the flex sensors and drive the LEDs.

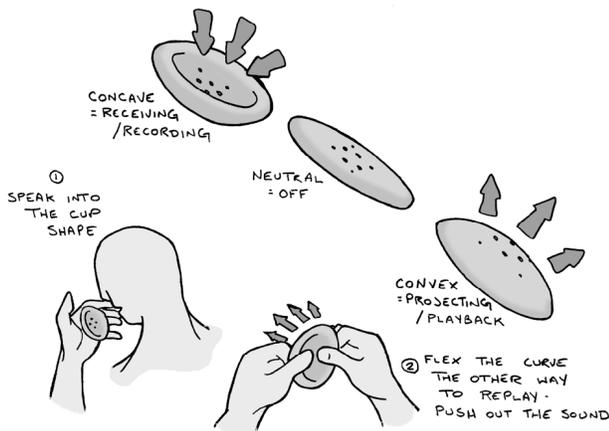


Figure 2. SpeakCup interaction design

Interaction Design

We rely on metaphor to inform the use of SpeakCup. Sound is imagined to be a physical substance that can be *contained* and *absorbed* into the medium of a malleable disk. The disk has seven holes on one side, deforming SpeakCup so that these holes become the bottom of a cup triggers the sound recording. Once in cup form, red LEDs pulse within SpeakCup's body¹. The LEDs get brighter as the user's voice gets louder, mirroring the amplitude of recorded sound.

When the user removes pressure from SpeakCup's center it springs back to disk form. To playback the recorded sound the user then presses in the opposite direction, pushing the holes out to release the stored sound. During playback the brightness of the green LEDs portray the amplitude of the sound.

¹ Although during the design exercise we initially conceived of SpeakCup without LED feedback we added this feature during implementation because it provided clear feedback for the user.

DISCUSSION

Although our goal for this work was simplicity of function and form we experimented with adding more expressive power. We added a tri-axis accelerometer and dual-axis gyro board and built gesture recognition software so that users could store multiple voice files by linking them to parts of their body similarly to [1]. This method was interesting but it added an extra level of complexity that we were unable to integrate into the existing metaphor so we did not develop it enough for testing.

The simple version of SpeakCup turned out to be best. Although limited in functionality, we have found some promising uses for it, for example as a toy for social interaction in public spaces—users drawn to SpeakCup's novel form could record messages and stick them to a wall for someone else to experience.

CONCLUSION

After reflecting on SpeakCup and trying it out with colleagues and friends we are optimistic about using soft forms and shape changes in interaction design. From our informal testing we found that users enjoyed SpeakCup. This type of testing is very subjective, but we are encouraged by the simple pleasure that this novel form is able to elicit in users. At the same time we are skeptical about using these techniques for feature rich applications. One way or another we will have to abandon the abstract buttons and blinking lights used in today's interfaces if we hope realize the vision of calm computing. Many great strides have been made towards this goal; in this paper we have presented a small exploration into this space.

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