

Simplicity in Interaction Design

Angela Chang, James Gouldstone, Jamie Zigelbaum, Hiroshi Ishii

MIT Media Lab

20 Ames St. Cambridge, MA 02142

{anjchang,jimbones,zig,ishii}@media.mit.edu

ABSTRACT

Attaining simplicity is a key challenge in interaction design. Our approach relies on a minimalist design exercise to explore the communication capacity for interaction components. This approach results in expressive design solutions, useful perspectives of interaction design and new interaction techniques.

Author Keywords

Interface design, expressiveness, simplicity, usability

ACM Classification Keywords

H5.2. Information interfaces and presentation D.2.2. Design Tools and Techniques, User Interfaces

INTRODUCTION

We are awash in a monotonous sea of buttons and blinking lights. Many modern interfaces fail by incorporating more choices and more feedback than an average user can easily understand. We seek to diminish interface *B.A.B.L.* (the mesmerizing arrays of *buttons and blinking lights*).

Our approach is to focus on simplicity and expressiveness in interface design. We introduce a simplicity design exercise for creating embedded interfaces. This technique aims to get the designer thinking about reducing complexity and enhancing the information potential of a small set of interface components.

We present a suggested design exercise, some sample design solutions, and distill some insights on encouraging simplicity in design.

BACKGROUND

One key problem in interface design is choosing an adequate physical form for representing digital information. The semiotics of physical objects plays a large role in the affordances and metaphors available to the user, explored

by Ullmer in [9]. Many institutions have focused on industrial design to explore the representation of information in different forms [2], resulting in an expansive array of aesthetic artifacts such as musicBottles [4]. We were particularly inspired by Durrell Bishop's marble answering machine, a solution that did not require any buttons or light emitting diodes (LEDs). Maeda's recent treatise on simplicity[6] argues for deeper thinking of our interfaces. We wondered how to encourage student designers to represent information simply and creatively.

SIMPLICITY DESIGN EXERCISE

Three tangible interface researchers in a university research group decided to try and understand the communication potential of a minimal set of interaction possibilities. Two of us have corporate backgrounds, with mechanical engineering training. The third has a background in human-computer interaction. All three of us have experience teaching classes in tangible user interface design at different institutions.

We noted that the problems students had included *featuritis*, defined as the tendency for designers to emphasize the number or novelty of features over core usability. Instead of simple single-function devices (e.g. the old-fashioned telephone), students tended to design multi-function devices (fax-copier-phones), using buttons and LEDs as a crutch.

As we look at devices around us, we realize that this problem is not just limited to student designs. As device functionality increases, so does complexity in the user interface, in terms of mental and physical clutter [8]. The user has to remember more control sequences (e.g. features accessed through certain menus or key combinations), and there is often a confusion of buttons from which to choose (as in a "universal remote control" [5, p.27]).

Conversely, the increasing need for feedback (due to increased complexity) is met with blinking lights, attracting attention without context. We often asked "what does the blinking light mean?" and found that designers add LEDs to provide users with a range of status and alert information. We wondered whether these designers really intended for users to infer meaning and assign importance to each LED. We designed the following exercise to explore the potential expressiveness of components, while enforcing simplicity of expression through minimalism.

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, to republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.

TEI'07, February 15-17, 2007, Baton Rouge, Louisiana, USA.

Copyright 2007 ACM ISBN 978-1-59593-619-6/07/02...\$5.00.

Simplicity design exercise

Sketch your redesign of an existing device (e.g. an answering machine, a camera, a voice recorder, an MP3 player, a telephone) with two constraints:

1. Choose a minimal number of input and output mechanisms; at most you can have one of each type of mechanism. For example, do not allow yourself more than one button and one LED.
2. Explore the expressiveness available to this minimized set of mechanisms as it relates to your device.

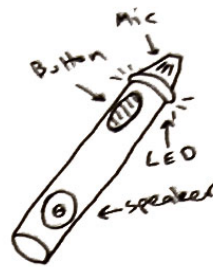
The design exercise aims to nurture the imagination and to reduce the functional complexity that can arise — employing the *Keep It Simple, Stupid* (KISS) principle. By constraining devices to only a few input and output mechanisms, we necessitate that the designer choose and prioritize the features they will include. Secondly, the charge to focus on expressiveness guides the designer to think about the relationship between interaction and creative ways to represent information. This can give rise to inventive solutions that result in new interactions. For example, if a designer was given the task of creating a digitally augmented listening device, one approach is to think about interactions with objects where one listens, while another approach might be to think about representing the status of the audio. The solution in one case (see Figure 2b) resulted in metaphors about filling a volume while in another case resulted in blinking the LED to show recording status (Figure 2a).

RESULTS

Initially we carried out this exercise ourselves and then later guided a class of 25 students through the same exercise. An analysis of the student’s work is forthcoming. We found that the simplicity design exercise resulted in a wide variety of solutions that related to *usage metaphors*. Through storytelling and flow diagrams, the designs highlighted new perspectives on the relationship between data and representation. Here we present some of our own sketches, four redesign solutions that highlight a range of interactions devised for a minimal set of components.

Voice Recorder

Two designs for a voice recorder explored mapping functional status to physical appearance, shown in Figure 1. One design featured a stick with a button and LED to control toggling between recording and playback. Figure 1a shows the flow diagram, and a snippet of the explanation of use. An alternative design indicates mode through form, shown in Figure 1b. The proposed design uses a flexible bowl shape that can be flattened as well as bowed in either direction. On one face is a pattern of holes, suggesting audio input or output. When flat, the device is off. When the user wishes to record, he flexes the form such that the holes sit at the bottom of a dish. This cup-shaped form



“When the user holds down the button, the LED will cycle between red and green slowly. Releasing the button while it is red, engages the recording mode, shown by a solid red light. To record a new piece of audio, the user presses and holds the button and the LED displays the voice amplitude to the brightness. Audio recording stops when the button is released. To save the audio, the user can tap the button again and the LED displays solid red to show that the audio has been saved...”

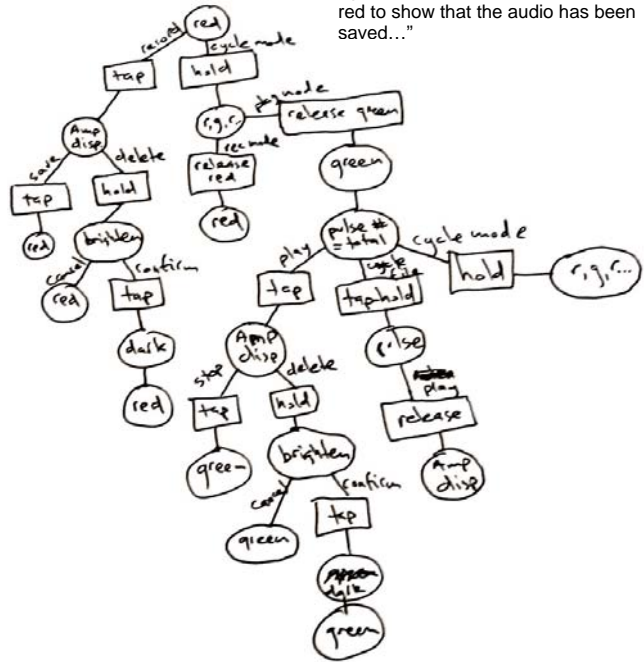


Figure 1a. A voice recorder design using one LED and one button. Sketch, state diagram, and description included.

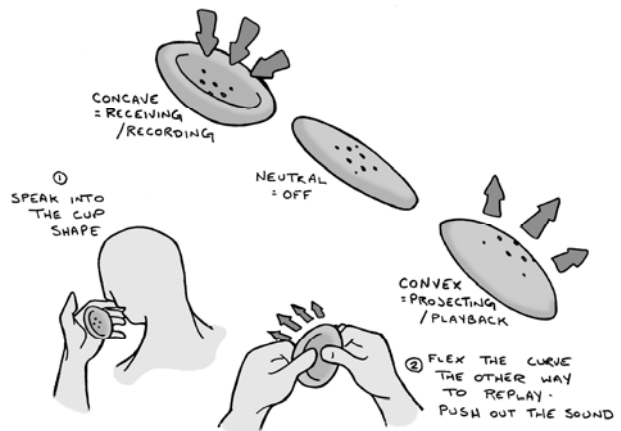


Figure 1b. A voice recorder design that leverages an ear and speaker metaphor to create a simpler interaction design.

suggests collection, or capture from an external source. To play back, the user flexes the form in the other direction. The holes are now atop a dome shape, suggesting projection

or broadcast. The device becomes a point source. Note that when flexing the device, the motion of the thumbs with respect to the audio holes indicates the user's desire. Pushing against the holes (as if forcing something into them) creates the record mode form. Pushing them from behind (as if forcing something out) creates the playback shape.

Answering machine

The first design identified an iconic shape for answering machines, a rounded sloping rectangle. This design was inspired by the designer's own answering machine. Figure 2a-right displays a drawing of the control flowchart, next to a rendering of the arrangement of led and button.

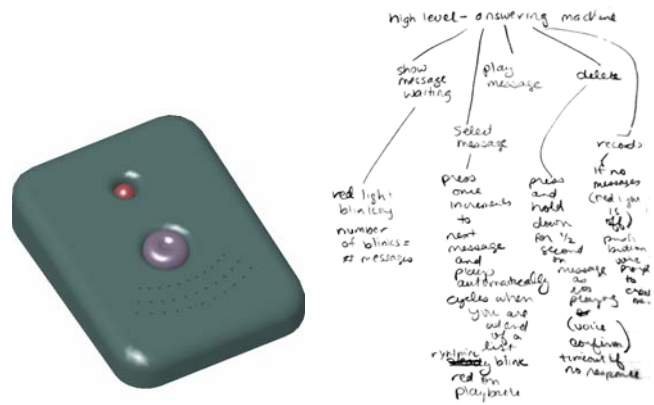


Figure 2a. One button, one LED answering machine with state diagram.

The second answering machine design associates messages with spatial volume. A bulbous shape sitting in a bucket "contains" messages. Initially, the machine is empty, and the surface within the bucket is flat. As messages are received, the surface swells into a bulb shape, serving as an obvious visual indicator. To replay the content, the user exerts a pressure on the bulb, effectively forcing the messages out and into audible form. Briefly relaxing the pressure rewinds the system by a few seconds, long enough to hear a phone number repeated. The spatial metaphor is preserved, as the natural local resilience of the bulb will cause it to re-expand slightly. Finally, the user can accelerate through the message stack by applying greater force.

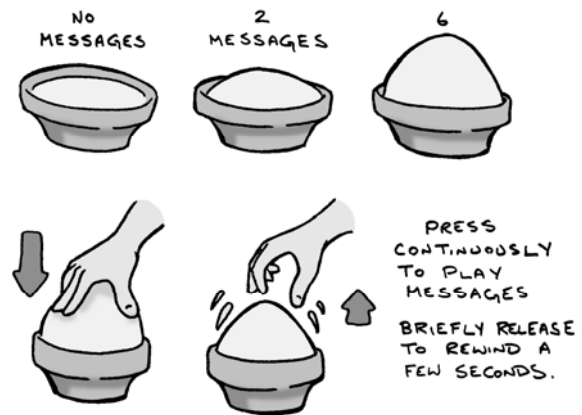


Figure 2b. Alternative design for an answering machine. Messages are mapped to a volume filling the machine.

DISCUSSION

Design review

The design exercise resulted in many creative discussions about the alternative representations of information. One clear observation was that design for simplicity does not result in boring design. Instead of BABL, we encountered discussions of particular shapes and the meanings they could convey (e.g. the second voice recorder employs concavity as a catching form and convexity as a spreading form). Other discussion included the mapping of motion to playback information, and identifying interaction metaphors.

There were clearly two approaches represented. The task-focused designs resulted in complexity by using combinations of button pressing behavior and light color. These designs required flow charts to describe the activity, and were quite hard to follow, because there were mode and functional changes associated with the control components. In comparison, solutions that used metaphor tended to be more easily understood. Perhaps, this is because metaphors help the user apply analogies of structure and organization

to the device, so the designer does not need to further specify the operation.

Lessons Learned

Individual LEDs and buttons are overloaded with multiple meanings. Table 1 shows the many different representations we noted just from our examples. Further exploration indicated that adding more buttons or lights would not have helped usability, nor reduced the size of the flow diagrams in these cases. Reviewing this daunting list also helped us to focus instead on mechanical change (e.g. sliding, bending, volume change, twisting) as a means to both control and represent device state. Additionally, we found that this focus on materials and the use of active touch to control kinesthetic movement could result in alternative expressions for this information.

Component function	Data mapping
LED blinking	Number of messages waiting, active playback status
LED static	Playback mode, record mode, messages waiting
LED color	Presence of messages, playback or recording mode
LED brightness	Query confirmation for deletion, volume of messages
Button tap	Interrupting a message, deleting a message, changing modes
Button press and hold	Changing modes, Recording a messages

Table 1. Variety mappings of component expressions to data observed. Note how the components have multiple, often overlapping functions.

Constraining the exercise to only one of each component type required that we *prioritize the information display*. In the quest for simplicity, the designer makes a conscious choice to reduce the feature set. This is not to be confused with sacrificing spatial complexity for temporal complexity (e.g. a group of LEDs reduced to a single LED which flashes a telling number of times). One suggestion was to omit the outgoing message recording mode in the Answering Machine exercises. That way, the user never has to worry about switching modes. The machine could have a default answering machine message that says “please leave a message”.

Although we have also used this design exercise in a class session, at this time, we only have qualitative results to report. As teaching assistants, we noted that there was a wide variety of creativity in the interfaces designed by the students, ranging from novel interactions (e.g. pulling and pushing strings to control weather parameters) to new metaphors (e.g. a spring can be a metaphor for resonance in selecting a radio station).

We feel that this new challenge was helpful as an exercise to encourage thinking about interface expressivity. By brainstorming alternative ways of engaging the user on a physical, physiological and mental level, this exercise guides the imagination beyond the constraints of function-driven design, and focus on the higher level interaction design purpose and metaphors. This design exercise adds a new angle to existing design methods and exercises [3], by concentrating more on expressivity and encouraging alternatives to the usual button-LED solution. We believe this method can be relevant to other design fields, particularly tangible interfaces and embodied interaction design.

One prominent area where we would like to see this line of thinking applied is consumer devices. The current paradigm of relying on standard navigation buttons often leaves the user confused and frustrated (it takes many clicks to go between all the different applications and modes available)[7]. However, adding more special-purpose

buttons creates physical clutter (the sides, bottom, top of most phones and mp3 players often result in accidental presses). Simplicity can help reduce the cost and features incorporated, while encouraging innovations in methods of accessing this information. One device that embodies simplicity, the iPod shuffle [1], seems to be a success.

CONCLUSION

Even though there are brilliantly designed interfaces, and at times, it may seem that the design space has been saturated, there are still many new ways to innovate interactions. This design exercise forces designers to imagine alternative ways to represent information. This approach is about how an arbitrary constraint (limiting the number of buttons and LEDs), can give new insight to design.

We have shown that simplicity does not necessarily limit the expressivity of interfaces. Instead, such thinking can engage discussion about better organization and aesthetics. Users are inundated with too much disparate information represented in similar fashion, so simplicity can foster novel interaction techniques. These practices have recently been proven to be very successful in the commercial marketplace.

ACKNOWLEDGMENTS

We thank the students of Fall 2006 Tangible Interfaces class and the Tufts HCI group, especially Mike Horn, Erin Treacy, Audrey Girouard, and Professor Rob Jacob.

REFERENCES

1. Apple iPod Shuffle <http://www.apple.com/ipodshuffle/>
2. Djajadiningrat, T., Wensveen, S., Frens, J. and Overbeeke, K. "Tangible products: Redressing the balance between appearance and action," *Personal and Ubiquitous Computing*, 8 (5). 2004, 294 - 309.
3. Harrison, S. and Back, M. (2005) “‘It’s Just a Method’: A Pedagogical Experiment In Interdisciplinary Design” *Proceedings of CHI 2005*, alt.chi, Portland, OR, ACM Press, April 2005.
4. Ishii, H. and Ullmer, B. *Tangible Bits: Toward Seamless Interfaces between People, Bits and Atoms*, Proc. of CHI 1997, ACM Press (1997), 234-241.
5. Kelley, T. et.al. *The Art of Innovation: Lessons in Creativity from IDEO, America’s Leading Design Firm*, New York, Doubleday, 2001.
6. Maeda, John. *The Laws of Simplicity*. MIT Press. Cambridge, MA, USA, 2006.
7. Mennecke, B. E., and StraderMather, T.J. *Mobile Commerce: Technology, Theory and Applications*, Idea Publishing, Hershey, PA, USA, 2003.
8. Norman, Donald A.: *The Design of Everyday Things*, New York, Doubleday, 1998, 174.
9. Ullmer, B. and Ishii, H. *IBM Systems Journal* 393, 3, 2000, 915-931.