TOUCHSCREEN TOGGLE DESIGN

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INTRODUCTION

This video describes and compares six different touchscreen based toggle switches to be used by novice or occasional users to control two state (on/off) devices in a touchscreen environment.

Computer based toggle switches can be very confusing. The most common problem encountered is the confusion between state indication and possible action label; does the label ON indicates the state of the device or does it indicate the resulting state when the toggle is activated? Another common problem comes from the difficulty of deciding what to do to change the state of the device. The design needs to signal to the user the appropriate activity necessary to perform the desired action. For example, Valk showed that users were confused by a design which showed a slider switch where only touches on the end of the slider were permitted, but "sliding" was not possible [5].

Computers allow designers to design many new types of "soft" toggle switches by providing an easy way to create and modify the appearance and behavior (or look and feel) of the controls. It is no longer necessary to select a control from a catalog, but unfortunately the lessons from traditional control design [1,2] are often ignored. This additional freedom brought a new wave of inadequate toggle designs (Figure 1).

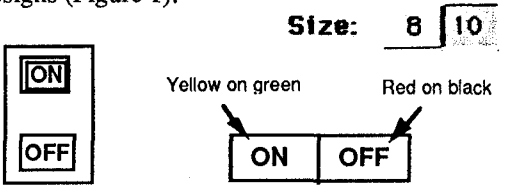

Figure 1 - Examples of ambiguous toggles we found in existing systems.

* This work was done while Daniel Wallace was a graduate student in the Psychology Dept. of the Univ. of Maryland.

The project had a practical orientation since this work was conducted in collaboration with Custom Command Systems Inc. which specializes in the development and marketing of integrated entertainment, security, and climate control systems for homes and offices. Their focus is on providing state-of-the-art systems that are easy for the home owner to use. The control of these systems is afforded through a touchscreen interface. Users see the screen flushmounted into the wall or the cabinetry. Our goal was to select a usability-tested/error-free toggle and to better understand some of the problems and issues involved in the design of controls for a touchscreen environment.

The color, graphical screen displays are implemented under MS-DOS in VGA mode. The touchscreen used returns a continuous flow of coordinates allowing the dragging of objects, the identification of sliding motion and the use of a lift-off strategy for selection [4].

DESCRIPTION OF THE TOGGLES

A requirement imposed by our particular application was to design toggles allowing lists of devices or options to be presented on the screen. This limited us to horizontal toggles (Figure 2) to increase the number of possible toggles and labels per page.

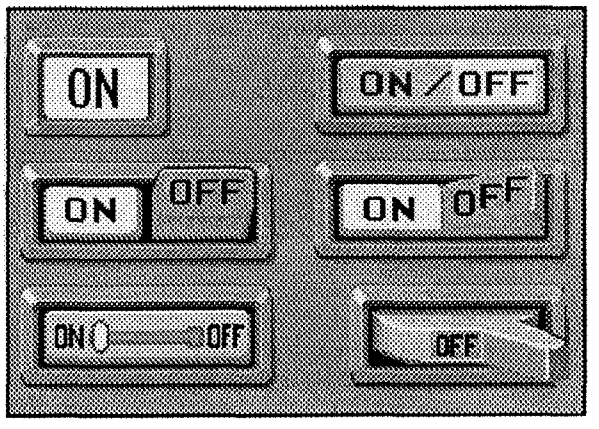

Figure 2: The six toggles: one-button, "words", two-button, rocker, slider and lever. In the tested application users did see several lines of devices names with the corresponding toggles on the side (only one type of toggle is used at a time).

• *One-button toggle* (Pushbutton): The main problem with pushbuttons is that their identification as a toggle (and not a simple indicator) might not be obvious; users may not realize that they can change the state by touching it. Once recognized as a toggle the pushbutton has the advantage of being graphically simple and uncluttered and its size can be reduced if necessary [4].
• *"Words" toggle:* When the device is ON the ON-label is on a bright green background, when OFF the OFF-label is on a bright green background (this design simulated the existing implementation in Custom Command's system).
• *Two-button toggle:* When the device is ON the ON side is depressed and the ON-label is on a buttercup yellow background while the OFF-label is gray like the button itself. The advantage of this toggle is that it allows the design of very similar controls having 3 or more states.
• *Rocker toggle:* This toggle only differs from the two-button by its graphical appearance which is less "busy" than the two-button toggle.
• *Slider toggle:* In this toggle a sliding/dragging movement is required to change the position of the yellow pointer from one side of the toggle to the other. A simple three step animation shows the movement of the pointer along the slide. If the device is ON the pointer is on the ON side. Users can then grab the pointer and slide it to the other side. If the finger is released before reaching the other side the pointer springs back to its previous position.
• *Lever toggle:* Same "behavior" as the slider. Only the graphical appearance is different.

The video shows other aspects of the prototypes (such as highlighting, animation, sound effects, etc.) which are very important but described with difficulties in such an abstract as this.

USABILITY TESTING

Fifteen undergraduate students used every toggles without instruction or demonstration [3]. No errors were made when subjects were asked to determine the current state of the toggles. A fairly consistent rank ordering of preference between the toggles was found (from one-button to rocker, two-button, "words", slider and lever). Although few statistical differences were found at the a priori level of 0.05 the mean differences were sizable. Large individual differences contributed to the lack of statistical difference between toggles.

Our interpretation was that the one-button design is appreciated for its simplicity (but of course users know that they were dealing with toggles and the pushbuttons were not confused with labels). The rocker was appreciated probably because the required movement on the screen matched the action on a real rocker. Its graphic is also simpler and more appealing than the two-button and word toggles.

The toggles that are pushed seemed to be preferred over the toggles that slide. A possible explanation is that sliding is a more complex task than simply touching, but we also noticed that sliders are more difficult to implement than buttons! The usability test brought to light many imperfections in our two sliding toggles (e.g.: because of its strong perspective the lever toggle was often touched too low - this bias has to be corrected; the slider pointer should be larger, and the lever or pointer should highlight when touched to signify that the user now has control over it). Even if several subjects first attempted to touch the extremities of the toggle before trying to slide the lever or pointer we observed that all subjects (spontaneously or after one trial) used sliding motions successfully to manipulate the sliding toggles. Even if sliders were not preferred, the fact that users used them correctly is encouraging since many other controls can be designed using sliding motions. Another advantage of the sliding movement is that it is less likely to be done inadvertently therefore making the toggle very secure (the finger has to land on and lift off the right locations). This advantage can be pushed further and controls can be designed to be very secure by requiring more complex gestures (e.g. a U or W shape slider can be used for a 2 or 3 setting control respectively).

The evaluation of the toggles showed some important differences in personal preferences. Every toggle had at least one unconditional fan. Only the one-button and rocker received all positive or neutral comments. Therefore toggles are good candidates for user customization. If one toggle had to be recommended as a potential "always acceptable toggle" (the vanilla ice-cream of toggles), the rocker implementation is probably the best bet.

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