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Redesigning a CD Player for Intuitive Rich Interaction

Bram Hendriks and Jun Hu

Eindhoven University of Technology
Department of Industrial Design
Eindhoven, The Netherlands

Abstract. This paper presents a redesign of a CD player, a combination of creative and analytical processes. After an analysis with users of the product and its functionalities, the interaction relabelling technique was used to explore richness of actions, while the Frogger framework was used to design for intuitiveness. The resulting ideas were translated into interactive prototypes, involving functional hard- and software. Evaluated with users during a usability test and integrated into a singular design.

Keywords: rich interaction, intuitiveness, design process.

1 Introduction

Many products do not communicate, or only to a limited extent, what they should be used for and how they should be used. Nor do these products express the state in which they are. "Even the smartest among us can feel inept as we fail to figure out which light switch or oven burner to turn on, or whether to push, pull or slide a door." [1]. Often symbols and icons are used, or simply text, to make differentiation between indistinguishable buttons, and so offering feedforward and feedback on how to use a product. Leaving out these signs irrevocably results in confusion.

This paper presents a redesign of a compact disc player, without using any of these signs. Instead the redesign tries to couple the user's actions and the CD player's functions to improve the intuitiveness and richness in interaction, following the Frogger framework by Wensveen et al [2].

The redesign is aimed at a non-portable CD player for use within a home environment. Though CD players are getting outdated today, many people think there's still a quality in such a music device because of the physicality of the medium. Playing music from a physical medium could be looked upon as a performance, like making music using an instrument. More and more of this performance is lost; the interactions involved tend to become increasingly sober. The redesign tries to make playing CDs a performance again, intuitive and rich of nature.

2 Design Process

The redesign is built around a combination of creative and analytical processes. Creative activities are for example interaction relabelling [3] and concept elicitation

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through prototyping. On the other hand there are a user study using questionnaires and a usability test for selecting the elements from the concepts. The combined process completed with an engineering approach to integrate the selected elements into a single design with functional hard- and software.

2.1 Determining Functionalities

Research was conducted to identify how frequently CD player functions are used. Pauws found that most users never, seldom or only sometimes use advanced features like program and random (or shuffle) [4]. A user study using questionnaires was set up to verify these findings from the literature. The findings were confirmed by the study. In addition, the frequency of use of the repeat function was not convincing either. These functions were therefore left out in the redesign.

2.2 Designing Interactions

Interaction relabelling was applied as a technique for generating rich forms of interaction with electronic products. In this method, interaction possibilities of existing products are projected onto the product to be designed. By forcing a mapping between things with quite different functionalities, the focus shifts from the functionality to the actual interaction possibilities [3]. Various products were collected and considered for interaction relabelling (from cocktail shaker to gear shift for example) and the CD player's functionalities were merged with the interaction possibilities of these products. In this process the CD player functionalities were categorized, resulting in four distinctive interaction areas: inserting CDs, selecting a CD, setting the volume and most importantly from a user perspective, selecting the music.

2.3 Low- and High-Fidelity Prototyping

For every interaction area series of low-fidelity paper-prototypes were created, following an iterative, design-by-doing approach. These prototypes, mainly from cardboard, were tested with users "quick and dirty". This was done within a short time span, with the emphasis on fast input rather than carefully documented findings. Later in the design, in order to test and compare the generated ideas, high-fidelity prototypes were made for the music selection category. These prototypes consist of functional hardware and software using a PIC microcontroller in combination with sensors, connected to an external media player software program. This approach moves beyond paper-prototypes and "wizard of oz" simulations [5], see figure 1.

2.4 Usability Testing

A usability test was set up to evaluate the various prototypes. On the one hand, the interaction between users and interactive prototypes for the music selection category were observed. Also the amount of satisfaction arising from the interaction itself was determined for every prototype in this category. This led to a collection of data used to make a selection between the concepts, on the basis of inferential statistics. On the other hand, observations of users interacting with the low-fidelity prototypes from the

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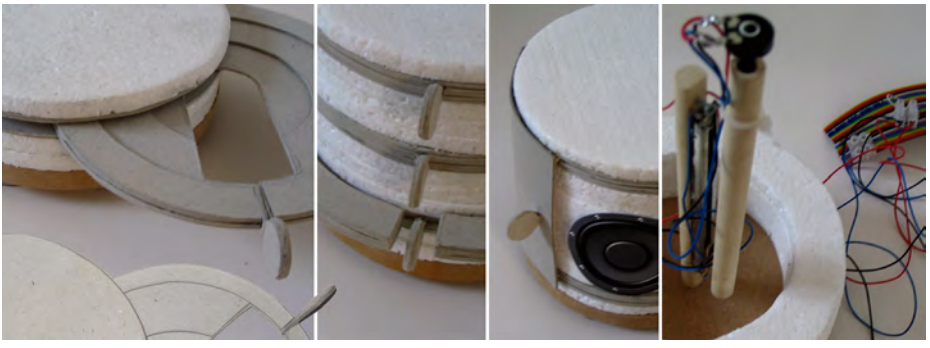

Fig. 1. Selection of low and high-fidelity prototypes

other categories were done, to see if reality is in line with the ideas developed using the Frogger framework [2], see figure 2.

Twenty participants were selected to perform specific tasks for every prototype, presented in random order. The participants were asked to think aloud, which means that a user is stimulated to verbalize his or her thoughts. It was decided to compare the music selection prototypes on the basis of satisfaction, which is one of the attributes of usability [6]. The amount of satisfaction that arose from the interactions was determined using System Usability Scale (SUS) [7]. This questionnaire was filled out by the participants directly after completing the tasks for every single prototype.

Fig. 2. Observing users interacting with the prototypes

Three music selection prototypes enabling for browsing a CD, within and between tracks, were tested. An analysis using a paired-samples t-test, in which the three prototypes were compared, revealed that one of the prototypes (prototype 1) yields significantly more satisfaction. See figure 3 for a graphical representation.

2.5 Integrating Ideas

After ideas for all interaction areas were selected, they were integrated into a single concept, the final design. To place this design within a certain context, collages were made to visualize possible environments in which the CD player could be placed.

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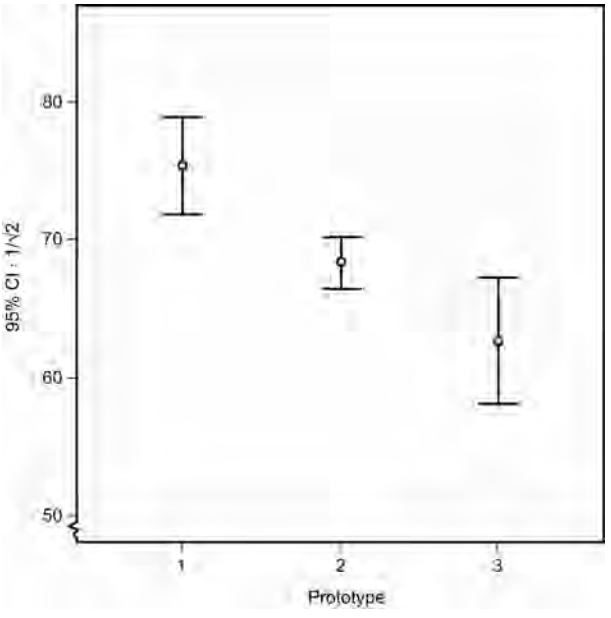

Fig. 3. Satisfaction that arose from interactions with three prototypes, quantified using System Usability Scale (SUS). Prototype 1 and 2 are based on a combination of slide and turn movements for browsing within and between tracks, but differ in software configuration. The third prototype makes use of a single jog-wheel for both functionalities.

Coupled to these collages scenarios were created, which helped to define the design with respect to the users and their social activities. One of these contextual environments was chosen to design for.

In short, the final design consists of rotating, circular CD trays, to be opened and closed manually. A constraining selector, around these trays is meant for CD selection. Once this selector is positioned around one specific tray, this tray can no longer be opened and thus selects the CD, if inserted. Volume is adjusted by manipulating a lid positioned around the speaker. CDs are browsed by sliding and rotating the tool on top. See figure 4 for an impression of the final design.

3 Conclusion

This paper not only presents an interesting design, but more importantly shows how creative idea and concept generation techniques can be combined with analytic research methods in a seamless integrated process. The design work and the social sciences based research, come together in the evaluation phase. Where there's a central role for interactive prototypes, requiring computer science as well as electrical engineering skills. Particularly the development of technological products not based on purely on-screen interactions, can benefit from a process using interactive and tangible prototypes as presented in this paper. It also helps to integrate the different fields of work, within the multidisciplinary process of product development.

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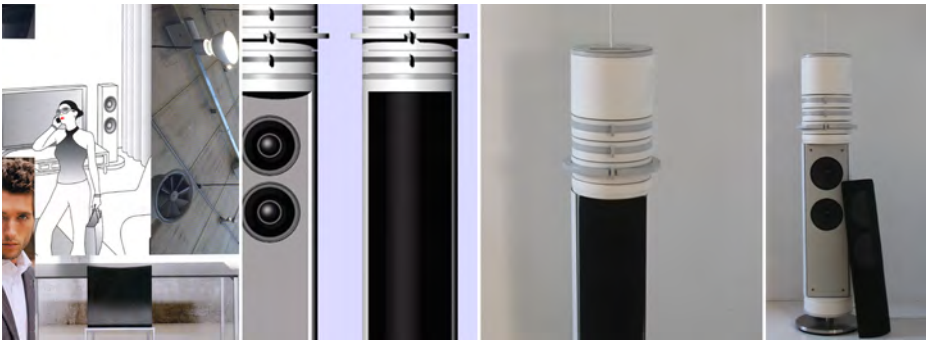

Fig. 4. The collage (*left*) and impressions of the final design

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