The use of a lo-fi 3D prototype: modeling touch-based interaction in co-design

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ABSTRACT
This paper describes the use of a lo-fi 3D prototype of a Near Field Communication (NFC) service in a co-design study. The purpose of this study was to involve users in the development of a mobile payment service based on NFC. To allow users to explore and experience the touch- and movement-based interaction with the service, a wooden prototype of a mobile handset and a cardboard prototype of a cash terminal were used. Findings concerning the use of such lo-fi prototypes in user-centered design of touch-based and haptic interactions are discussed.

Categories and Subject Descriptors
H5.2. User Interfaces – Input devices & strategies, Haptic I/O; D2.2 Design tools & techniques – User Interfaces

General Terms
Design, Human Factors

Keywords
NFC, Co-design, Prototyping, Interaction Modeling

1. INTRODUCTION
Near Field Communication (NFC) is a short-range, wireless connectivity technology that allows consumers to perform safe, contactless transactions, access digital content and connect electronic devices with the simplicity of a single touch. NFC-based devices are a special category of haptic interfaces. The touch-based interaction is not directly between the user and the device, instead the interaction is mediated by another, mobile device. While on the one hand touch-based interactions require very simple actions, on the other hand, such interfaces often are unfamiliar to users and therefore do not invite them to perform the correct actions. Findings of previous studies suggest that unfamiliarity with touch-related interfaces can indeed result in difficulties with regard to interaction [1, 2].

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The study described in this paper was carried out within the framework of a project in which an NFC-based mobile payment service is developed. This service runs on a mobile handset which connects to a cash terminal via NFC when the two devices touch. To make sure that the service meets both user needs and usability requirements, a user-centered design approach was adopted.

2. METHODS
Since it is generally quite difficult for people to express their feelings about unfamiliar products and situations, and to think about what it would be like to use a future product, generative tools were used to facilitate this discussion. When using generative techniques, people are stimulated to construct a view on the context by calling up their memories of the past and by eliciting their dreams of the future [3]. In this project, the technique of modeling is used to experience the interaction with the NFC service.

For this purpose, lo-fi 3D models of a mobile handset and a cash terminal were used (see Figure 2). The handset was made of wood (MDF) with hand drawn buttons, screens, screen elements etc. The cash terminal was made of a cardboard shoe box and only contained a screen. The “designs” of the handset and the cash terminal were kept as basic and sketchy as possible to make sure participants understood that they dealt with early stage prototypes and to decrease the risk of bias and distraction. A deliberate choice was made to use 3D prototypes in stead of paper prototypes. Because the touch-based interaction with the handset involves actions which are unusual to the users (e.g. bringing the handset to the cash terminal, positioning the handset, touching the cash terminal with the handset, holding the handset in a specific position for a while), hands-on experience was required to completely understand the use of the service.

The screens of both the mobile handset and of the cash terminal were of equal sizes as sticky notes, which were attached to the prototypes for each user action. Participants were asked for each use case of the service concept to demonstrate how they would act, which movements they would make with the mobile handset
and to design the interfaces and feedback that belong to their actions on the sticky notes.

3. FINDINGS

The use of the interaction modeling kit with the wooden and cardboard prototypes served two main purposes in the current study. First, the prototypes allowed users to experience the use of the new service concept in a more hands-on way than an explanation of the concept or paper prototypes would have. In this project, the technique of modeling was a successful approach to discuss the use of the NFC service into more detail and to explore the use of the service in a more generative way. As a result, users could imagine what it would be like to use the service, they were able to come up with advantages and disadvantages of the service, and they even invented new applications and uses of the service.

The second purpose of the modeling kit was to explore users’ expectations and mental models with respect to the interactions and interfaces. Because a physical, 3D prototype was used, users could demonstrate their expectations and needs related to the touch-based interactions (see Figure 2). The mobile handset prototype was based on a clamshell model intentionally. This was done to provide an implicit way (opening the handset) for the users to indicate that they expect an action from the user before a connection between the mobile device and the cash terminal could be made. Interestingly, almost all participants of the study opened the clamshell before bringing the handset to the cash terminal.

The interaction demonstrations clearly showed that users who are not yet familiar with NFC-based interactions are not at ease and hesitant in their actions. This reflects the need for clear communication about the correct use of the mobile device (e.g. orientation, distance, exact spot to touch).

In sum, the use of lo-fi wooden and cardboard prototypes facilitated the discussions with users about a new and unfamiliar service. Also, it allowed users to express their expectations about touch-based interactions as well as about the interfaces and feedback.

This study demonstrated that the use of a 3D prototype to model interactions based on touch, movement, etc., has some clear advantages compared to the use of paper prototypes. Most importantly, in the current study the 3D prototype allowed users to demonstrate their expectations of the interactions. They were able to explore the possibilities of an NFC-based interaction in a very early stage of the project. By combining the 3D prototype with sticky notes representing the screens, the advantages of paper prototyping (e.g. designing interfaces and feedback together with users) could be exploited at the same time.

4. RECOMMENDATIONS

Some of the observations during the current study led to recommendations for improving the method of lo-fi prototyping that was used:

- By providing visual information on a prototype only, users tend to restrict their thinking to visual interactions and feedback as well: stimulate participants in prototype studies to think in multimodal levels by providing predefined options users may choose from (e.g. specific sticky notes for visual, audio and haptic feedback)
- User might feel ill at ease the first few minutes they work with a lo-fi prototype, they might be hesitant to demonstrate the use of the model: allow ample time to play with the prototypes and make users feel at ease and taken seriously
- Take into account the fact that it is difficult for users to express expectations concerning their interaction with unfamiliar products, they might simply forget to mention specific expectations: provide implicit ways for users to indicate the actions they expect
- Using a prototype of a new and unfamiliar product can yield interesting information about the users’ mental models: stimulate users to think out loud and to explain their expectations and actions

5. REFERENCES