

User Requirements Analysis in the Context of Multimodal Applications for Blind Users

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Abstract

The Contribution identifies three main problems and challenges in developing multimodal applications for blind people. Since blind users are insufficiently involved and developers normally not blind, their mental models are different. In order to cope with these problems the authors present a phase model for blind user-centred design process. Correlating blind user-centred methods are proposed: User analysis through telephone interviews and the reconstruction mental models by methods like teaching back and thinking aloud (Sasse 1991).

1 Introduction

The known Human-centred design processes for interactive systems (ISO 9241-210 2010) and the Usability Engineering Lifecycle (Mayhew 1999) recommend to analyse the user requirements in the early stage of the development. However, in practice, the user requirements analysis has not been paid sufficient attention for different reasons. Problems arise increasingly while conducting user requirements analysis, especially when developing multimodal applications for blind people. The following main problems and challenges have been identified:

Blind users are insufficiently involved. The “technology-centric approach” still dominates the development of assistive technologies.

Developers are normally not blind. This leads to the following problems:

- Sighted developers and blind users have different mental models.
- Sighted developers normally do not have a realistic insight into the usage environment of blind users.
- Communication problems occur between developers and users with respect to terminology. For example, “tab” means a new window in Windows Internet Explorer 7. However, for blind users “tab” basically means the tab key on the keyboard.

- The subconscious requirements of blind users are much more difficult to discover as these are specific to blind users but not for the sighted.

The requirements analysis applies not only to aspect of usability, but also to accessibility.

2 Blind user-centred analysis approach

The above problems are insufficiently addressed in the existing approaches. Therefore it is necessary to develop a new approach to support the user requirements analysis for multi-modal applications for blind people. We present a new approach, which consists of 8 steps. These steps are built on one another.

2.1 Analysis of Users

Who are the target users and what characteristics do they have? In this step, we have to address these two questions. While answering these questions, all target users (primary, secondary, and tertiary users) should be considered. In addition to the common characteristics, ability of blind users to use screen reader and Braille display and the time of blindness (congenitally or adventitiously blind) are also important. On the basis of our experience, telephone interviews are the best way to determine characteristics of blind users. The result of this step is the user profile for each user group.

2.2.1 Analysis of usage environment

Information on the real usage environment provides the developers the possibility to understand the context of use better. The usage environment comprises the physical, technical and the social environments. Physical environment concerns the characteristics of workplace such as the temperature and noise. Technical environment refers to the hardware and software used for the application to be developed, particularly the characteristics of assistive technologies used for blind people such as the type and version of screen reader, the type of Braille display and devices for speech output. The social environment concerns about the cooperation and information exchange among blind users or between blind and sighted users.

2.3 Design principle analysis

The existing approaches recommend considering the requirements from available design principles. For developing multimodal applications, there are several relevant design principles such as the *7 dialogue principles* (ISO 9241-110 2006), the *Common Sense Suggestions for Developing Multimodal User Interfaces* (Larson 2006) and the *Multimodal interaction, communication and navigation guidelines* (ETSI 2003). There are also several design principles for developing applications for people with special needs.

2.4 Creation of mental models

Sighted and blind users have different experiences while using an application, because of the different input and output modalities. For the input, blind users do not use mouse, but only keyboard or speech or a combination of them. For the output, they do not need a display but a screen reader to read the content of the display. This leads to different approaches for interacting with an application. Blind and sighted users therefore build different mental models. Since mental models influence the effectiveness, efficiency and satisfaction of an application, it is important to analyse the mental models of blind users with respect to similar application and relevant matters. With the help of the mental models we can derive requirements, especially the subconscious requirements on the application.

In this step, we create mental models of blind people. There are several methods for doing this, such as interview, teaching back, and thinking aloud (Sasse 1991). If the application to be developed has some functions that an existing application has, we can analyse the behaviour of users to these functions with the help of task analysis.

2.5 Collection of conscious requirements

Generally we can subdivide the user requirements into conscious, subconscious and derived requirements. Conscious requirements are requirements, which users explicitly have on an application. In this step, we collect conscious requirements with methods like interview, focus group and questionnaire. Subconscious requirements are requirements, which users take for granted. Therefore, they normally do not mention these requirements openly. Derived requirements are not found out from users. We have to derive them based on the information we have.

2.6 Analysis of subconscious and derived requirements

After collecting the conscious requirements from users, subconscious and derived requirements should be analysed with the help of user profiles (step 1), descriptions about environment of use (step 2) and mental models (step 4).

2.7 Choice of modalities

The design of multimodal interaction is commonly divided into two aspects: design of input modality and design of output modality. For the choice of modality there are several design principles available. However, they are described in a very general manner. Moreover, most of them concentrate on the output modality. Hence, we conducted a study with blind users about the choice of input modalities on a multimodal navigation system. The results are not presented in this paper.

2.8 Validation of the requirements

In this step, all user requirements are validated by means of two aspects:

- Firstly, the developers verify the requirements with respect to technical realization.
- Subsequently, the users check the requirements with respect to the content through interview or questionnaire.

This approach takes the specific feature of blind users and multimodal application into account. In comparison with existing approaches, it stands out due to the following two characters: Firstly, mental models of blind people are analysed for understanding the user behaviour, analysing subconscious and derived requirements. Next, in order to minimize the cost of subsequent amendments, the choice of modality is considered in the stage of requirements analysis. If new user group is identified during the development, the process should be conducted once again.

References

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