Chapter 1.10
Blind User Interfacing:
Requirements, Models and a Framework

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ABSTRACT

There are specific usability requirements for developing dual interfaces, that is, graphical user interfaces that are also adapted for blind users. These include task adequacy, dimensional trade-off, behavior equivalence, semantic loss avoidance and device-independence. Consequently, the development of human-computer interfaces based on task, domain, dialog, presentation, platform and user models has to be modified to take into account these requirements. This paper presents the requirements for blind user interfacing, the changes to be made to the human-computer interface models and a framework that improves the development of dual user interfaces. The framework includes a set of guidelines for interface design, a toolkit for the low effort implementation of dual user interfaces, and a programming library for the inclusion of speech and Braille in applications. A case study of the development of one such dual interface application is also presented.

INTRODUCTION

Graphical user interfaces were designed to increase the usability and improve the functionality of applications (Cox and Walker, 1993). These interfaces are generally user friendly and easy to use. However, blind and visually-impaired people may find them hard to manage. Not only does this group of people find the items on screen difficult to access, but also many items whose meaning is important for users to be able to understand the application are represented as images only and are,

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therefore, not directly accessible for blind users. On top of this, this group of users cannot operate a mouse. A graphical interface is, therefore, obviously a barrier for blind people, although screen readers solve many of the problems they come up against. Making an application accessible for blind users involves, firstly, putting each item into a proper text-based format and, secondly and more importantly, reproducing the visual interface in a structure that can be understood by users.

To do this, designers must be familiar with the needs and capabilities of blind users and with the assistive technologies they use. Synthesized speech, Braille displays, Braille and QWERTY keyboards and speech recognition are the major, albeit not the only, assistive technologies used by blind people. One feature that all these elements have in common is linearity (these devices can only interchange information sequentially). Nevertheless, they all have their own peculiarities and behaviors (think about the volatility of the information that the user receives through speech messages as opposed to the persistence of Braille displays). Therefore, these behaviors need to be analyzed when trying to develop effective interfaces.

Hence an adequate graphical user interface for blind people sets some specific usability requirements for these users. This means that the designer has to present the interface information in an appropriate structure that blind users can understand, none of the meaning of the interface content should be lost during the adaptation and the information supplied should be adapted for the assistive technologies used by blind people. These requirements have an impact on HCI modeling, involving the creation of the task, domain, dialog, presentation, platform and user interface models (Szekely et al., 1993). Model design is therefore affected by this adaptation.

Based on the above, this chapter describes some usability requirements for blind users and sets out what actions have to be taken in each of the above-mentioned HCI models to incorporate these requirements to develop applications with a graphical interface that is also adapted for blind people. The paper also describes a framework for developing graphical user interfaces for blind people based on the actions described for each of the HCI models. The experience in developing this kind of applications (Alonso et al., 1997a; Alonso et al., 1997b; Alonso et al., 1998) gathered over the years has served as input for defining this framework.

The chapter is organized as follows. Section 2 shows the background about applications for blind people. Section 3 describes the requirements, models and framework for blind user interfacing. Section 4 describes the future trends. The chapter ends with some general conclusions.

BACKGROUND

The development of user interfaces for blind people has taken two complementary research and development paths: (1) adapting existing visual interfaces for blind users and (2) building dual interfaces or interfaces especially adapted for blind or visually impaired users.

The adaptation of visual interfaces for blind people emerged in response to the need to adapt the directly manipulated graphical environments that were proliferating to enable people with impaired vision to use common development software. The pioneering projects on this subject include OutSpoken (Edwards, 1991) and Mercator (Mynatt and Edwards, 1992a), which aimed to adapt MacOS and X-Windows, the most commonly used graphical environments in the early 90s. These projects encouraged the development of the Off Screen Model (Mynatt and Edwards, 1992b), the adaptation model on which most of the tools available for adapting interfaces for blind users are based. Tools like Orca help provide access to applications and toolkits that support the AT-SPI (e.g., the GNOME desktop) (GNOME, 2009), VoiceOver gives blind people access to