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Beyond web content accessibility guidelines: Design of enhanced text user interfaces for blind internet users

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Abstract

Websites do not become usable just because their content is accessible. For people who are blind, the application of the W3C's Web Content Accessibility Guidelines (WCAG) often might not even make a significant difference in terms of efficiency, errors or satisfaction in website usage. This paper documents the development of nine guidelines to construct an enhanced text user interface (ETI) as an alternative to the graphical user interface (GUI). An experimental design with 39 blind participants executing a search and a navigation task on a website showed that with the ETI, blind users executed the search task significantly faster, committing fewer mistakes, rating it significantly better on subjective scales as well as when compared to the GUIs from other websites they had visited. However, performance did not improve with the ETI on the navigation task, the main reason presumed to be labeling problems. We conclude that the ETI is an improvement over the GUI, but that it cannot help in overcoming one major weakness of most websites: If users do not understand navigation labels, even the best user interface cannot help them navigate.

Keywords: Accessibility; Blind users; Graphical user interface; Interface for the blind; Screenreader; Text interface; Usability for the blind; User interface; WAI; WCAG

1. Introduction

The graphical user interface (GUI) is the most widespread user frontend for applications today and the dominant user interface for websites on the internet. But graphical elements like windows and buttons are designed for sighted users; blind people can neither perceive nor use them (Kieninger, 1996). To compensate for this disadvantage, several countries have passed laws to enforce accessibility of websites for handicapped users. In the United States, these laws are being published as Section 508 of the Rehabilitation Act (Section 508, 1998), which prohibits discrimination against people with disabilities in all aspects of daily life, including education, work and access to public buildings. Since 2004, a Swiss act has required the government to provide access to all internet services for people with disabilities. Namely, communication and transaction services are to be made accessible for visually impaired people. In this context, websites compliant to a certain standard of accessibility are referred to as barrier-free-websites (BehiG, 2002; BehiV, 2003).

To bolster laws like Section 508, the World Wide Web Consortium's Web Accessibility Initiative (WAI) developed guidelines known as the Web Content Accessibility Guidelines (WCAG, 1999). Application of these guidelines ensures that HTML code is readable by screenreader software like JAWS, supporting handicapped users to access the website. Nowadays, the WCAG are the de-facto standard when it comes to accessibility of websites. The above-mentioned Swiss act explicitly refers to them.

Currently, the WCAG are mainly a result of ideas and discussions in the WAI working group, since by nature, working toward standards is different from empirical research. An overview of guidelines, standards and style guides for human–computer interaction (HCI) is provided by Stewart and Travis (2003). No empirical studies are referenced on the WAI website that would support the

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WCAG's normative character, demonstrating positive impact on user behavior. Whereas HCI research has yielded many sets of user interface design guidelines (Nielsen, 1994; Shneiderman and Plaisant, 2004), to date, it has solely focused on accessibility and technological aids for perceptually impaired people (cf. Section 2.1).

The vast majority of the WCAG contain checkpoints and core techniques to improve the *programming* of websites to render them accessible for all users and all devices, and only the three guidelines stated in Table 1 contain advice for user interface design in the sense of *conceptual* design, comparable to Shneiderman's and Nielsen's work cited above. This illustrates that, regarding websites, the situation for blind and visually impaired users resembles the situation for sighted users in the mid-1990s: Content on websites is often accessible, but not consequently usable.

According to Nielsen (1993), a website is usable if it satisfies the five criteria shown in Table 2. This definition is context-independent. It needs to be conceptualized into concrete, applicable guidelines on the user interface level to be of practical value in real design contexts. This has been demonstrated for sighted users by Agarwal and Venkatesh (2002) or Venkatesh and Agarwal (2006), as they were able to determine the success of e-commerce websites from their empirically researched set of the Microsoft Usability Guidelines (Keeker, 1997).

This research sheds light on what influences usability from a blind person's point of view. It also shows how a new set of guidelines leads to a new kind of user interface, that will be called enhanced text user interface (ETI), because it relies only on text and not on graphical representations of content and navigation items. ETI can be regarded as an extension of the WCAG insofar as the guidelines can be associated to the last 3 of the 14 WCAG, explicating them for blind internet users. Thus, it could be a first step toward an exhaustive set of empirically researched guidelines that may be used to ensure usability, and not only accessibility, of user interfaces for blind users.

Table 1
The three non-technical WCAG

No.	Guideline
12	Provide context and orientation information
13	Provide clear navigation mechanisms
14	Ensure that documents are clear and simple

Numbering corresponds to numbering of WCAG (WCAG, 1999).

Table 2
Nielsen's five usability criteria

Factor	Explanation
Efficiency	Users accomplish their tasks quickly and without much cognitive effort
Errors	Users commit only few errors and are able to recover quickly
Satisfaction	Users are satisfied with how the website works
Memorability	Returning users do not have to relearn the use of navigation items and functionalities
Learnability	Novice users of a website get productive quickly, finding information and using the website's functionality

2. Theoretical background

This section starts with a brief overview of relevant research in HCI regarding accessibility and the conception of guidelines for user interface design. It then summarizes current research which shows that, as of today, the WCAG are rarely used, and if they are used, their impact is not as originally intended. The end of the section contains a short overview of approaches that go beyond the WCAG to support blind or visually impaired people.

2.1. Relevant HCI research regarding accessibility and guidelines for user interface design

Both Jacko's and Brewster's summary of recent HCI research make it clear that most researchers dealing with perceptually impaired people have devoted their time to investigate the *accessibility* of information and/or functionality via computers in order to enable or enhance usage for diverse user groups (Brewster, 2003; Jacko et al., 2003). However, they have not focused on usability or user interface guidelines, leaving a theoretical gap to address. Edwards' exemplary work on the Soundtrack user interface illustrates this point: The aim of the research was to adapt a mouse-based interface into an auditory form, i.e. make it accessible for blind users, and not to conceive user interface guidelines for the blind (Edwards, 1989).

Many researchers have contributed to the development of user interface guidelines for sighted users (see e.g. Nielsen, 1994; Shneiderman and Plaisant, 2004), and the International Standards Organization (ISO) has published a vast body of work on them as well (as described in Stewart and Travis, 2003).

2.2. WCAG are rarely used

The WCAG certainly do lead in the right direction. However, Sullivan and Matson (2000) found that if content accessibility is defined in a continuous, rather than dichotomous manner, 29 of 50 of the Web's most popular sites can still be classified as inaccessible. Klein et al. (2003) examined 157 websites of public high schools in Iowa with different methods, including Bobby, an automated engine for checking WCAG compliance. They found that 94.3% of these pages did not pass the Bobby priority 1 check (e.g. provide alternative text for all images) and 98.1% did not pass priority 2 check (e.g. do not use fixed font size). These