Usability for the Elderly

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ABSTRACT

This paper discusses the findings of usability studies on the web usability for the elderly, and the research works to improve usability for the elderly. The older adults are a fast growing group of web users. They use the Internet to search for information such as health information and other products and services. They also use emails to communicate. As adults age, physical and mental abilities decrease. These factors pose difficulties for older adults to use the Internet to achieve their goals. This research investigates the usability issues encountered by the elderly people when they use the Internet to find information and use services, and surveys on various approaches to deal with them. Results showed that many health information web sites had usability issues such as small font size and high reading complexity. Older adults were found to be slower and less successful at completing tasks on the web sites than younger people. Basic search was found to be the fastest search strategy for older users. Research works aimed to improve usability for the elderly using different approaches. Some observed usability issues and adjusted the system and provided design guidelines to the web site designers. Other works constructed systems to mitigate usability issues related to difficulties with vision and cognition. It included formatting the web page, providing layered navigation framework, and providing speech output. Each method was successful to some extent to assist the target users.

INTRODUCTION

This paper discusses the findings of usability studies on the web usability for the elderly, and the research works to improve usability for the elderly. It starts with explaining the various issues associated with aging and how it affects them to use the Internet. It discusses the declining abilities and individual differences among the elderly people. The next section presents findings on usability for the elderly from the literature. It discusses the usability of health web sites for the elderly. It then discusses the findings of the efficiency of search strategies for the elderly, and findings on how the older adults interact differently from younger people when they browse the Internet for information. The next section discusses the approach of improving usability for the elderly by improving the design of web sites. The focus is on assisting the web site designers to cater for the needs of the elderly in their designs. The following section described a few research works on improving usability for the elderly using different approaches of presenting the web site contents. The approaches include transforming the web page to a customized format, providing a layered framework to let the older user familiarize with web navigation incrementally, and using a speech output browser with voice help. Lastly, it presents a summary and briefly discusses the possible future work on this topic.

AGING AND WEB USABILITY

As people age, their abilities decline and it becomes more difficult for them to use the Internet. Vision is reduced. The lens of eyes become less elastic and it is more difficult to focus on close objects (Becker, 2004). Acuity, contrast discrimination and colour perception are also reduced (Hanson, 2001). In addition, the eyes become less sensitive to light and they are difficult to adjust with changing light levels and more easily affected by glare (Becker, 2004). Therefore, older adults find it hard to read texts with small font sizes, and texts that are less legible due to the background colour or background image (Hanson, 2001).

Aging also decreases motor skills. Older adults find it more difficult to use mouse and keyboard (Hanson, 2001). They may have difficulties to move a mouse, position the cursor, click links and scroll a page (Becker, 2004).

Cognition is also a factor for the elderly to use the Internet. Working memory declines as people age. The ability to recognize the useful details from other irrelevant information on a page also decreases (Becker, 2004). The elderly may also be distracted by visual elements such as animations on the web pages (Hanson, 2001).

An important fact to be considered is that not all elderly people are the same. It was emphasized in Designing for Dynamic Diversity - interfaces for older people (Gregor et al., 2002) that there is great individual variability of physical, sensory and cognitive abilities among the elderly. Many are affected by different combinations of multiple

disabilities. The abilities of each individual also change over time. Therefore, we should consider this diversity when we design systems for the elderly. The standard User Centred Design principles often assume a relatively homogenous user group. Gregor et al. proposed a new paradigm called Designing for Dynamic Diversity and proposed a methodology called User Sensitive Inclusive Design to support it. The main difference of this new paradigm is to consider the characteristics of the user group to be diverse and dynamic. The authors applied this methodology to their research work on a system for visually impaired adults and they were able to identify individual differences and improve the design of their application.

FINDINGS ON USABILITY FOR THE ELDERLY

A Study of Web Usability for Older Adults Seeking Online Health Resources by Shirley Ann Becker (2004) was a study on health information web sites in the U.S to investigate the usability of these sites for the elderly. They set a list of usability issues that may hinder older adults to learn the health information they seek. They evaluated 125 web sites and noted the occurrences of these usability issues. These web sites included government web sites, commercial web sites, nonprofit web sites and online newspapers. It was found that many web sites had these usability issues. In particular, about 93% of web sites contain text with font size smaller than 12 points. They were further tested and it was found that 40% of the sites locked the font size and disallowed resizing by the browser. These were problematic for aging adults with declining vision. They found 24% of the sampled sited had pull-down menus and two thirds of the online newspapers required scrolling on their homepages. Elderly people with unstable hands would find it difficult to navigate. The study also assessed the performance, translation and reading levels of the web sites. A particular notable result was the vast majority of the sites had reading levels higher than the recommended 6th-grade reading level. About 30% of the sites require high school education (higher than 12th-grade) to understand. As the paper stated about 66% of adults age 65 and older have low-health literacy skills, they might not be able to properly interpret the information they find on these web sites.

Sayago and Blat started an ongoing research on ICT-based communication tools for the elderly. They published their initial results in A preliminary usability evaluation of strategies for seeking online information with elderly people (2007). The study investigated three different strategies of finding information on the Internet and compared how older adults used them. The three strategies were basic search, advanced search and directories. The authors stated that basic search was found to be the fastest

method for young and middle-aged people. However, it was found that older people were found to misspell their keywords in queries more often. It was because they may have less experience with the keyboard, compounded with reduced hand dexterity. Also, some elder people had received less education. Therefore, the study explored the possibility that other strategies could be faster than basic search for this age group. The study conducted a test with elderly people finding the same information with different strategies. The test results of this study showed that basic search was also the fastest strategy for the older adults. The participants reported the directory method presented too much information on the page and it took them a long time to read. They also needed to click many links and it was slow for them to point precisely and click due to reduced motor ability. Similarly, advanced search required more mouse pointing, clicking, and keyboard entry so it was slower than basic search. This study reinforced that the elderly were affected by their reduced cognition and motor abilities. Simpler interfaces that presented less information and required less hand actions would help them to find information faster.

Web Usability and Age: How Design Changes Can Improve Performance (Chadwick-Dias et al., 2002) studied how users of different ages would have different behaviour when using a web site. A second part of this research used the findings to change the design of the web site and studied how the user behaviour has changed. The participants performed tasks on a prototype employee/retiree benefits web site. Three versions of different text sizes were used. The results showed older people took more time to complete tasks and they completed fewer tasks successfully. The results relating to text size showed it did not affect performance significantly in all age groups. However, more older users indicated they preferred the version with largest text. This result is interesting. It may imply that the small texts presented in web sites, such as in the health web sites in the previously mentioned study by Becker (2004) might not actually hinder the older adults to find relevant information. However, they might find the interaction less satisfactory.

The results of Web Usability and Age (Chadwick-Dias et al., 2002) showed some different behaviour between younger and older adults when using the web site. The older adults were more cautious with their actions such as clicking. They were more likely to click on page elements that are not links. They had difficulty accessing data in highly detailed tables. They had less understanding of web terminology and technical terms. Older users spent more time reading texts and instructions and they tend to read all text on a screen. They were often confused with their location in the web site. They also had difficulties with

secondary pop-up windows, scrolling, and tabbed navigation.

IMPROVING USABILITY BY WEB SITE DESIGN

One approach to improve the usability for the elderly is to assist the web site designers to better the older users and design web pages that are more usable for them. In this case, the responsibility of improving usability is placed on the web site designer.

The previously discussed Web Usability and Age (Chadwick-Dias et al., 2002) used their findings in the second part of their work to redesign their prototype web site. For example, links were added to icons and bullets to suit the behaviour of clicking on non-links. The redesigned web site was tested. The results showed a decrease in task duration and an increase in task success rate. These improvements were found across all age groups.

Another research group developed more general guidelines. Research-Derived Web Design Guidelines for Older People (Kurniawan & Zaphiris, 2005) described a set of age-friendly design guidelines that was developed by the authors and how the guidelines were developed. The authors initially reviewed academic literature on HCI and aging and derived a set of 52 guidelines. Two categorization experiments were then conducted on the guidelines. The important experiment was the focus group with five HCI experts. The experts categorized and merged those design guidelines into 38 guidelines with 11 distinct categories. They became the final set of guidelines presented in this paper.

The set of guidelines was then evaluated to find out the usefulness of the guidelines to age-friendly designs. Firstly, the 38 guidelines were used to conduct heuristic evaluations on sample web sites targeted at older population. The original set of 52 guidelines were also used to evaluate the sample sites. The results showed that the when the 38 categorized guidelines were used, the inspectors gave more consistent evaluation. The older adult participants also evaluate the guidelines to be useful. It was concluded that this set of guidelines would be beneficial for the web site designers to follow when they design for the older users.

IMPROVING USABILITY BY BROWSING INTERACTIONS

The research works in the previous section improved the usability for the elderly by improving on the source of the web pages. They relied on the web site designers to make the improvements. The research works in this section took

different approaches. They focused on improving the browsing interaction for the users. Each work constructed a different system to mitigate usability issues resulted from declining abilities.

Web Access for Elderly Citizens by Hanson (2001) described their work to improve usability by using a proxy server to format the web pages. Hanson mentioned other methods to assist the elderly to use the web. User device solutions used custom hardware devices to assist particular disabilities. User software solutions use client-side software to change the presentation of web pages. Web author solutions provide a set of guidelines and tools for the web site developers to design the site to be more accessible. This method relies on the web authors. This was the case for the work by Chadwick-Dias et al. (2002) which they redesigned the prototype web site. The work described in Web Access for Elderly Citizens (Hanson, 2001) took a different direction. They used a proxy server to format the web pages before they are presented to the users. Each user can set their own preferred settings. The settings include font size, inter-letter spacing, font and background colours, remove background images etc. A preliminary test showed that the older users liked these customizations. In particular, many preferred to enlarge font, increase inter-letter spacing and remove background images. This system was able to solve some usability issues with visual elements on various web sites. It did not require individual web authors to change their sites. However, other problems would not be solved this way, such as the reading complexity described in the study by Becker (2004).

The same research group continued their work and developed a new approach in A Web Accessibility Service: Update and Findings (Hanson & Richards, 2004). They found it was difficult for the proxy server to correctly interpret and transform all the web pages. The effort to develop and maintain such a server was too high. Therefore, their new approach was to rely on the browser to interpret the web page first, then it performs the transformation on the web page's Document Object Model (DOM) on the client machine. The system provided similar transformation as the previous system. They designed a settings panel in the browser window and the user can change the settings and see the effects immediately. This system was also well received by the older users.

Another work I reviewed was Approaches to Web Search and Navigation for Older Computer Novices (Dickinson et al., 2007). It aimed at helping older adults with little experience of computer and Internet to more easily start using the Internet. They developed a web search and navigation system, Cybrarian. The authors followed the

previously mentioned User Sensitive Inclusive Design principles (Gregor et al., 2002) and acknowledged individual differences. A layered structure was designed so the users could advance to the next layer at their own pace. The system provided three layers of content. The first layer provided very limited content, presented in a simple interface with concise help instructions. The accessible content in this layer highly conformed to usability guidelines. The second layer contained content of a wider range of subjects and they were also highly accessible and navigable. The third layer provided content from the web in general and they might not all have high usability. The users started from using the first layer. As they became more familiar with the Internet, they could move on to the second and the third layer. When using the Internet in all three layers, the system framed the content to maintain consistent page layout and navigation structures.

This Cybrarian system was tested to find whether it made it easier for older computer novices to find information. The results showed the participants were more successful at completing tasks on this system than using the traditional portal of an ISP. The participants rated the Cybrarian system with higher ratings for ease of use, pleasantness and ease of remembering. Many users commented its simple interface helped them to navigate and find information easily, whereas the ISP portal overwhelmed and confused them with too much irrelevant information.

In contrast to modifying the visual elements of the web pages as described in the previous work, the next work used speech as an alternative mode of interaction. Interface Design for Older Adults (Zajicek, 2001) described a speech output browser, BrookesTalk, that was used to assist visually impaired older adults. This system was built upon a speech output browser that was aimed for blind users. The main improvement was to add voice help into the original system. The old adults had declining short term memory and often forgot the sequence of actions they had performed. They also found it difficult to construct a conceptual model of the functionalities of the system. The originial system was extended to provide voice help which made the users more easily realize what the available functions there were. They also tested different numbers of functions and different lengths of voice help messages. It was found that shorter help messages and less functions helped the older adults to better accomplish tasks using the browser. The system was adjusted accordingly. This design process used the previously mentioned Designing for Dynamic Diversity paradigm (Gregor et al., 2002) to account for the different memory abilities within the user group. The improved system were usable by more visual impaired older people than the original system did.

SUMMARY

The research works I have discussed aimed to improve usability for the elderly in different ways. Web Usability and Age (Chadwick-Dias et al., 2002) used one prototype web site to investigate how older users interact with the system and then used the results to improve the system. The improvements included issues with vision, cognition and motor skills. Research-Derived Web Design Guidelines for Older People (Kurniawan & Zaphiris, 2005) described a set of age-friendly design guidelines to encourage web site designers to improve usability. Web Access for Elderly Citizens (Hanson, 2001) attempted to format any web page to suit the user. It mostly focused on assisting the difficulty with vision. Approaches to Web Search and Navigation for Older Computer Novices (Dickinson et al., 2007) designed simple interface and consistent navigational structures to help inexperienced older adults. The improvements were related to the difficulty with cognition. Interface Design for Older Adults (Zajicek, 2001) assisted visual impairment by providing speech output and voice help.

FUTURE WORK

Effectiveness of the design guidelines for the elderly could be further investigated. Further work could be done to investigate and improve specific types of web usage. For example, online shopping, Internet banking. Also, other related topics could be investigated, especially concerning communication. For example, email usage, instant messaging and voice communication on the Internet.

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