Web Access for Elderly Citizens

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ABSTRACT

With elderly citizens becoming an increasingly large proportion of the population in many countries, social as well as economic considerations suggest that they must be considered in the development of current and future technologies. This paper addresses issues of Internet access, and discusses a research project designed to make the web more usable by elderly citizens. This project uses a proxy server to transcode web pages according to user-specified preferences and capabilities. Users access web pages as usual, with no specialized hardware required.

Keywords

Internet, seniors, disabilities, aging, transcoding

INTRODUCTION

Recent evidence indicates that elderly citizens constitute the fastest growing demographic group of Internet users [2, 26]. Despite the fact that these users are often inexperienced with the technology and may need the support of family members or classes to be able to get started on the Internet, they often are enthusiastic members of the online community [3, 13, 20]. The reasons for their Internet usage have been attributed largely to factors such as increased amount of leisure time, a desire to communicate (especially with grandchildren), and web facilities that provide access to desired information and services, e.g., comparison shopping, financial services, travel information, and heath services.

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AGE-RELATED DISABILITIES AND THE WEB

Specific physical and cognitive changes occur with age. Census figures show that by age 65, nearly half of us can expect to experience some disability; one quarter of us experiencing severe disability [22, 31]. To place our research project in perspective, this paper begins with a quick review of how age-related disabilities impact web use. In this review, the scientific literature is supplemented with insights shared with us during interviews with instructors at senior centers where Internet courses are taught.

Vision

Vision impairments provide the most common source of difficulty for seniors using the web. The types of vision problems reported for web usage include difficulties with small font sizes, font colors that make reading difficult (particularly in the context of certain background colors), and background images on web pages that decrease legibility. When we think about the fact that acuity, contrast discriminations and color perception are all reduced when we age, we can understand the underlying reasons for this difficulty [24, 28].

Dexterity

Elderly computer users have difficulty with mouse and keyboarding skills [11, 12]. Some of this is due to conceptual problems in understanding the mouse or due to inexperience with a typewriter or keyboard. Other difficulties, however, are due to arthritis, tremors, or other physical problems that make mouse manipulation and keyboard entry difficult.

A number of difficulties specific to mouse usage can be identified. For example, clicking on a target is difficult, particularly when the target is small [11, 19]. Other mouse problems include double-clicking, dragging, and using scroll bars.

Cognition

Cognitive problems inhibiting computer use by seniors include difficulty learning an unfamiliar domain, forming cognitive models of computer applications, longer required

training times, attention problems, interference from previously learned skills, and memory impairments [11, 12, 35]. Specific page layouts create navigational difficulties and visual clutter and irrelevant information are difficult for seniors to understand and navigate. Animations create distractions.

Hearing

Despite the fact that hearing problems are prevalent among older adults, hearing impairment is not considered to be a barrier to web access. As more and more web designers add multimedia and voice to their web pages, however, users with hearing impairments will experience access difficulties.

CURRENT SOLUTIONS

There are a number of existing technologies that can help seniors overcome difficulties they may experience with web access.

User device solutions

Mainstream hardware devices, such as large computer monitors, can help offset problems with reading of small font sizes. Many seniors use bifocals for reading. However, those who spend much time at the computer tend to develop stiff necks from tilting their heads at an awkward angle to read through the bifocals.

Certain mice can be used to ease difficulties with double-clicking and scrolling, and speakers or headphones can be used to improve the quality of auditory materials.

In addition, assistive technologies designed for specific disabilities can help with web access [25]. For example, special keyboards and other input devices can be helpful for users with motor impairments.

User software solutions

There are also a variety of client-side software changes that can be implemented to make web material more accessible. For example, font size and color changes can be made through browser settings. Blinking text and flashing banners created by animated gifs can similarly be eliminated. Screen magnifiers and talking browsers can help users with visual or reading disabilities [6, 18, 25, 36]. Problems with the mouse can be addressed by using mouse keys. System settings for keyboard adjustments reduce keyboarding errors resulting from limited dexterity.

Web author solutions

Web page authors have a number of guidelines and tools they can use to make web pages accessible. The web accessibility initiative of the W3C has provided guidelines for accessible web pages [14]. These guidelines and checklists for accessibility can be found at a number of locations [e.g., 32, 33]. In addition, tools and organizations exist for auditing web pages for accessibility [e.g., 9, 15]. Moreover, the U.S. National Institute on Aging has conducted studies on the use of information technology and has compiled guidelines for designing web sites specifically for elderly users [21; see also 10, 37].

Another accessibility approach for web authors is provided by software that supports alternate versions of web pages. For example, software exists that allows web authors to provide a version of their pages that is more readable to users with low vision or who otherwise require page simplification, e.g., for use with screen readers [1, 7, 8, 27].

Problems with current solutions

The obvious difficulty with user solutions is that the burden is placed on individual users to keep informed of the device and software advances, upgrades, and changes. They also need to make the necessary changes and/or buy the necessary enhancements. Tracking the rapidly changing technology terrain is a formidable task for anyone, let alone seniors who are unfamiliar with the multiplicity of new technologies.

User device solutions. Assistive devices present two additional problems to the user. The first is that these devices tend to address a disability in isolation. Seniors, however, will often present a combination of disabilities. For an elderly user who may suffer both from low vision and tremors, finding assistive devices for magnification, speech, and mouse correction that work in conjunction with each other may be difficult as these devices are not tested with each other

As another example, we can look at scrolling. Scrolling is particularly difficult for seniors for a number of reasons related to a combination of visual and motor factors. In terms of visual impairments, the small size of the scroll bar, particularly the target box, can be problematic. In terms of motor skills, scrolling requires the complex sequence of moving the mouse to the small target box, holding down the mouse button, and continuing to hold down the button while moving the mouse in the direction needed for scrolling. Solutions that address only one of these aspects of scrolling difficulty may not succeed for seniors.

The second problem with assistive devices is that they can have a stigmatizing function by marking the user as someone in need of special help.

User software solutions. Some software solutions do not require the user to purchase additional software. Some modifications such as mouse and keyboard settings, screen magnifiers, and basic formatting capabilities are built into operating systems. Such solutions, however, do require that users be aware of these options. Sometimes these functions can be buried in a complex series of dialog boxes, as with setting colors, font, and accessibility options in some browsers. Moreover, for users who have disabilities that impact their hand movement, simply trying to set the options can be extremely difficult [30].

Web author solutions. The difficulty with approaches that place the burden on developers is that they are unlikely to find large-scale adoption by web authors. Given the fact that the simple inclusion of alternative text tags for images is not widely utilized by web authors, it seems unrealistic

to expect that they would adopt the more time-consuming tasks required to provide alternate forms of their pages for users with disabilities.

ANOTHER APPROACH TO WEB ACCESSIBILITY

A group of us are currently engaged in a research project that takes a different approach to the problem of accessibility for seniors. We are exploring the use of server technologies to make web content more accessible to seniors by providing reformatted web pages to users according to their specifications. This has the advantage of removing the burden from individual users for knowing about, installing, and paying for ever-changing technologies to access the web. Our approach also does not require web authors to make their pages accessible (although following web accessibility guidelines would provide added benefit).

Four primary considerations guided our design:

- ***No specialized hardware***. Our design point is that through a standard browser a user should be able to access web pages reformatted in a manner most accessible for them.
- ***Personalization***. The system must be flexible in order to afford individual configuration. Privacy must be protected so that settings information that might indicate medical conditions is not revealed. In addition, the interface must allow for easy changing of user settings [16].
- ***Target multiple disabilities***. Elderly citizens experience not only a variety of disabilities; many experience a combination of disabilities. Thus, we must provide transformations of content that will work in combination with each other. We are aware, however, that a goal of true universal accessibility is probably not attainable for users with a multiplicity of disabilities that have competing requirements.
- ***Support common browser services over pages that have not been specially authored to be accessible***. This is our most ambitious goal. In addition to not consistently following W3C guidelines for authoring and accessibility, web authors use a variety of scripting and multimedia technologies that pose severe challenges for us.

To address these goals, our research employs an intermediary server to dynamically reformat web pages according to individual users' preferences and capabilities. Using a browser set to go through this HTTP proxy server, users access web pages the same as they would normally.

How the gateway works

Our gateway software is built on WebSphere Transcoding Publisher [34]. This software bridges information across multiple devices and formats, commonly to make web content available on a handheld or other small device. Here we extend the WebSphere function to include transformations for accessibility.

When a user begins a session, they login with ID and password. Once the login is authenticated, the request is used to retrieve the document from the document's web server. The proxy intercepts the returned results and reformats the content. Based on the user's specifications for how they want web pages presented, the appropriate transformations are applied to the retrieved document and the result is then sent back to the user[1]. Importantly, web pages do not require editing, re-authoring, or annotation. Note that in this respect our work differs from other transcoding systems that work only on a subset of web pages that have been annotated for correct formatting [7, 27].

PRELIMINARY INVESTIGATIONS

The focus in these early stages of our research has been on testing visual transformations. We recognize that in order for seniors to use our system, the transformations must be both useful and usable. Therefore, our initial tests with seniors have focused on these issues.

We recruited seniors for this investigation through centers where Internet classes are taught. As would be expected, these seniors were both free of severe disability and interested in using the Internet. Although most wear glasses, they typically consider themselves free of disability. These seniors would fall into the classification of non-disabled seniors [23].

We provided our early users with a variety of transformations based on the changes requested by our informants or indicated by the literature [4. 5]. These transformations included the ability to change font size, increase inter-letter spacing, change the font and background colors, remove background images, and magnify and sharpen images.

Our software allows individual users to select which transformations are useful for them. To make this determination, users click to go to the settings panel which shows available options. When in this panel, the different settings options are displayed on the left-hand side of the screen. The current web page is displayed on the right-hand side of the screen. Users are able to see changes immediately applied to the page they are viewing by clicking on different options from the settings panel.

For example, one button allows a user to make changes to backgrounds. By clicking different background options, users can try out different combinations of background colors (with optimal font, link, etc colors determined by the background color choice) or can elect to remove background patterns. When the user has selected an

[1] If the web author, however, specifies that content is not to be transformed, then no transformations are carried out on the content [17].

optimal background, s/he can save this setting for application to all subsequent pages viewed. These individual user settings are saved in a secure database on the server. In this way, the user need not generate their settings each time they start a new web session. Moreover, their settings are available to them if they login to the server from a different client machine.

Perhaps it should not be surprising, given the characteristics of the seniors in our initial population, that most preferred only simple changes of font enlargement and inter-letter spacing. Removal of background images was also highly desirable.

Since most of the seniors in our test population would not consider themselves disabled, it is interesting that they found the transformations we provided to be useful. This type of user would not seek out assistive technologies. However, when given the option to make changes to web pages with our software, these seniors were delighted with minor enlargements of font size and inter-letter spacing that rendered web pages noticeably more readable.

CURRENT QUESTIONS AND CHALLENGES

A server-based approach has distinct advantages over technologies that place the burden on individual users or web developers.

We realize, however, that we face several challenges in making the web accessible. Current efforts involve addition of new technologies. Extremely promising is work on keyboard error correction for users with dexterity problems. Based on research on keyboarding errors and error correction [29], this software assesses a user's problems with keyboard input and then makes recommendations for settings changes to improve typing accuracy.

Also underway is work to provide speech support such that users with limited vision or reading difficulties can elect to have text read aloud.

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