# Making the Web Accessible for Seniors

**Vicki L. Hanson**
IBM Research, T. J. Watson Research Center

30 Saw Mill River Rd
Hawthorne, NY 10532 USA
vlh@us.ibm.com

## Introduction

Governments and industry are slowly recognizing demographic changes that will have profound effects throughout the world. As one example, the ever-increasing percentage of older adults will create a demand for seniors in the workforce to fill available jobs, a trend that has already begun (Kogan, 2001). The use of computer technologies will be an integral part of many of these jobs. If older workers are to be successful in this environment, it is incumbent on the computer industry to develop technologies that take into account to the needs and abilities of these workers.

One of the computer technologies that will be important for job success is the Internet. Despite the fact that seniors are often inexperienced with computers and may need classes to be able to use this technology (see http://www.seniornet.org), today's seniors constitute the fastest growing demographic group of Internet users (*Older Users Take to the Internet in Droves*, 2000; *Adults Over 50 Tune in to Technology*, 2000), and spend more time on the Internet than other demographic groups. One U.S. estimate puts their average online time at 8.3 hours per week (*Senior Citizens to Embrace the Web*, 2000). This compares to an average online time of 7.8 hours per week for college students. 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.

## Age-related disabilities and the web

Poor health is not inherent in aging, but there are specific disabilities that develop with age. Census figures show that by age 65, nearly half of us can expect to experience some disability, with one quarter of us experiencing severe disability (McNeil, 1997; Vanderheiden, 2001).

The most common disability is vision impairment and older adults typically will need glasses. Other changes in the eye are more subtle, however, and, because they occur gradually, we may not even be aware of the decline in visual ability. As we age, the eye goes through changes of pupil and lens structure resulting in reduced light and contrast perception, reduced color discrimination, and reduced acuity (Arditi, 1991). This is the result of normal aging, with older adults experiencing a world that is dimmer, has less vivid colors, and is somewhat blurred when compared with the visual experience of younger adults. Some seniors will experience greater visual problems, such as macular degeneration, that result in more severe impairments, sometimes to the extent of "legal blindness". Such severe disability, while the result of aging, is not characteristic of the majority of seniors.

Other common age-related disabilities include mobility, cognitive, and hearing impairments. To see how these disabilities impact seniors' access to the web, we began our work with seniors by interviewing teachers and regional instructors at senior centers that have courses for Internet instruction.

1. *Vision*. Vision impairments provide the most common source of difficulty for seniors using the web. Small font, some text and background color combinations, background images, and blinking text were all problematic for seniors. When we think about the fact that acuity, contrast discriminations and color perception are all reduced we age, we can understand the underlying reasons for this difficulty. Many seniors use bifocals that help with the reading of small font. However, those who spend much time on the computer develop stiff necks from tilting their heads at an awkward angle to read through the bifocals.
2. *Mobility*. Our survey indicated that mouse and keyboarding skills presented major obstacles to many seniors. Some of this was due to conceptual problems in understanding the mouse or due to inexperience

with a typewriter or keyboard. Other difficulties, however, were due to arthritis, tremors, or other physical problems that made mouse manipulation or keyboard entry difficult.

3. *Cognitive*. We learned that seniors experience a number of navigation, comprehension, and attention problems when using the web. Page layouts are often complex and difficult for seniors to understand, long articles are difficult to read, and flashing banners create distractions.
4. *Hearing*. Despite the fact that hearing problems are prevalent among older adults, hearing impairment was not considered to be a barrier to web access. This is almost certainly only true for the short run. As more and more web designers add multimedia and voice to their web pages, users with hearing impairments will experience access difficulties.

In looking at the kinds of problems experienced by seniors, knowledgeable technologists can suggest a variety of solutions that users can adopt:

- *Hardware solutions*. There are a variety of non-specialized hardware solutions that can be used. Large computer monitors used at senior centers help overcome vision problems, but these large monitors are not common for home computing. Mice that make double-clicking and scrolling easy are also helpful. Speakers or headphones can be used to augment audio material. In addition, assistive technologies designed for specific disabilities, e.g., screen magnifiers or text-to-speech technologies designed especially for users with low vision, can be extremely helpful (Paciello, 2000).
- *User software*. There are also a variety of client-side software changes that users can implement to make web material more accessible to them. For example, font size and colors changes can be made through browser settings. Blinking text and flashing banners created by animated gifs can similarly be eliminated. Mousing problems can be addressed by using mouse keys. Keyboard accessibility settings can eliminate repeated keys and other errors caused by users with tremors and arthritis.
- *Developer software*. Another approach to solving problems experienced by seniors is software implementations that reformat 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 (http://www.flatline.org.uk/~silas/access.html, http://www.bbc.co.uk/education/betsie). Another approach to page simplification is to have web authors or other interested parties provide page annotations (Asakawa & Tagaki, 2000; Tagaki & Asakawa, 2000).

The obvious difficulty with the first two solutions, however, is that the burden is placed on individual users to keep informed of the solutions and make the necessary changes and/or buy the necessary enhancements. 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 alt 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 takes a different approach to the problem of accessibility for seniors. We are exploring the use of server technologies to provide reformatted web pages to users, based on user specifications. This has the advantage of removing the burden from individual users for knowing about, installing, and paying for ever-changing technologies that will make the web accessible to them. Our approach also does not require web authors to make their pages accessible (although following web accessibility guidelines would provide added benefit).

The goal of our research is to devise a system meeting the following requirements:

- *No specialized hardware or software*. Our design point is that through any standard browser a user should be able to access web pages reformatted in a manner most readable for them.
- *Individual configuration*. The system must be flexible in order to afford individual configuration allowing web pages to be rendered in a manner most usable by each individual. Privacy issues must be considered here, so that sensitive medical information is not revealed. In addition, the interface must allow for easy changing of user settings (Hanson, Richards, Fairweather, Brown, Crayne, Detweiler, Schwerdtfeger, & Tibbitts, in press)
- *Target multiple disabilities*. As mentioned previously, seniors experience not only a variety of disabilities; many experience a combination of disabilities. Many approaches to accessibility target only one

limitation. Take, for example, software that uses text-to-speech for problems of low vision, dyslexia, or cognitive impairments. For older adults who commonly have hearing impairments, an assistive technology that works by simply reading words aloud may not be an acceptable solution. 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.

- *All web pages should be accessible*. This is our most ambitious goal. In addition to not consistently following W3C guidelines for accessibility, web authors use a variety of scripting and multimedia technologies that provide severe challenges for us.

To address these goals, our research employs an intermediary server to reformat web pages. Using a browser set to go through this HTTP proxy server, seniors access web pages the same as they would normally. The difference is that the pages served to them pass through this proxy and are reformatted according to their individual preferences. We use Cascading Style Sheets (CSS) to apply style modifications (e.g. fonts, colors, inter-letter spacing) to the entire page. We also provide for changes to the document HTML to apply changes such as magnifying images and removing backgrounds.

The advantage of this centralized server architecture is that individuals no longer bear the burden of being their own technologists. The changes they need for web page presentation are available to them simply by going through this proxy.

The focus of this initial phase of our research has been on users with vision impairments. While our preliminary tests with users at senior centers have validated our approach, we know that the changes we have so far provided are only the beginning. We are working to expand the types of features we provide. We are turning our attention to smart keyboards and mice that adjust settings for users with motor difficulties (Trewin, 2000). We're looking at text-to-speech implementations for users who are blind, dyslexic, or cognitively impaired. We're exploring automatic captioning of multimedia materials for users who have hearing impairments. And we are researching page simplification techniques for users who are blind, dyslexic, or have low vision or attention difficulties.

Our server-based approach is not without its difficulties, however. There are the technical challenges that await us, particularly in the realms of voice enablement and multimedia. At present, however, legal challenges are even more formidable. Web authors retain copyright to their pages – not just to the content, but also to the *presentation* of the content. If users with disabilities are to have access to the content, however, content and presentation must be decoupled.

**Conclusion**

We believe a server-based approach has distinct advantages over technologies that place the burden on individual users or web developers. Importantly, we also believe that it has advantages for users who wouldn't consider themselves disabled. For example, many of the seniors we work with, while wearing glasses for slight vision impairment, would not state that they have a "disability". This type of user would not seek out assistive technologies. However, when given the option to make changes to web pages, these seniors are delighted with minor enlargements of font size and inter-letter spacing that render web pages more easily readable. This type of usage by non-disabled persons is consistent with examples of accommodations or technologies that have been developed for persons with disabilities but nonetheless are useful to the population at large (Newell, Gregor, & Alm, 2001; Vanderheiden, 2001).

Our current work focuses on information delivery to computers. We realize, however, that we cannot ignore mobile devices. Our society is changing not only in terms of demographics, but also in terms of the explosion of technologies available to consumers. We, therefore, are building the infrastructure that will allow connections with the web on portable devices, again taking into account individual accessibility requirements.

**Acknowledgements**

The project described here is a collaborative effort bringing together researchers from several different groups at IBM. Each lending their unique talents to the project are Peter Fairweather, Aries Arditi, Fran Brown, Susan Crayne, Gregg Daggett, Sam Detweiler, John Richards, Rich Schwerdtfeger, and Beth Tibbitts.

**References**

*Adults Over 50 Tune in to Technology*. (2000). NUA Internet Surveys, http://www.nua.ie/surveys/

Arditi, A. (1991). A simple classification for functional aspects of age-related vision loss. In *Proceedings of the Symposium on Aging and Sensory Loss* (pp. 64-80). Mount Eliza, Victoria, Australia: National Centre for Ageing and Sensory Loss.

Asakawa C, & Takagi H. (2000). Annotation-based transcoding for nonvisual web access. *Proceedings of the Fourth International ACM Conference on Assistive Technologies, ASSETS 2000* (pp. 172-179). New York, NY: ACM.

Hanson, V. L., Richards, J. T., Fairweather, P. G., Brown, F., Crayne, S., Detweiler, S., Schwerdtfeger, R., & Tibbitts, B. Web accessibility for seniors. In C. Stephanidis (Ed). *Universal Access in HCI: Towards an Information Society for All.*

Kogan, S. L. (2001). Human-computer interaction and older adults. Paper presented at the *State of the Science Exchange on Modality Independent Interaction*, Seattle, WA.

McNeil, John M. (1997). *Americans with Disabilities: 1994-95.* Washington, CD. Bureau of Census, U.S. Department of Commerce. http:// www.census.gov/prod/3/97pubs/p70-61.pdf

Newell, A. F., Gregor, P., & Alm, N. (2001). Realising our potential in ordinary and extraordinary human computer interaction. Paper presented at the *State of the Science Exchange on Modality Independent Interaction*, Seattle, WA.

*Older Users Take to the Internet in Droves* (2000). NUA Internet Surveys, http://www.nua.ie/surveys/

Paciello, M. G. (2000). *Web accessibility for people with disabilities.* Lawrence, KS: CMP Books.

*Senior Citizens to Embrace the Web.* (2000). NUA Internet Surveys, http://www.nua.ie/surveys/

Takagi H., & Asakawa, C. (2000). Transcoding proxy for nonvisual web access. In *Proceedings of the Fourth International ACM Conference on Assistive Technologies, ASSETS 2000* (pp. 164-171). New York, NY: ACM.

Trewin, S. (2000). Configuration agents, control and privacy. In *Proceedings of the Conference on Universal Usability* (pp. 9 – 16). New York, NY: ACM.

Vanderheiden, G. C. (2001). Why do we? Why can't we? Future perspectives and research directions. Paper presented at the *ACM Conference on Human Factors in Computing Systems*, Seattle, WA.