

Age and Web Access: The Next Generation

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ABSTRACT

When today's young adults become 'older adults' will they exhibit difficulties with technology that appear to characterize the current older generation? This paper is intended to begin a discussion of technology experience as related to aging. The goal is to challenge some existing characterizations of older Web users and consider the implications for the future. Are technology difficulties an inescapable fact of aging? Or are there factors that will serve to equip future generations of older adults with skills that will erase or lessen these difficulties?

Categories and Subject Descriptors

H.5.2 [Information in interfaces and presentation (e.g., HCI)]: User Interfaces – *User-centered design*; K.4.2 [Computers and Society]: Social issues – *handicapped persons / special needs*.

General Terms

Design, Experimentation, Human Factors

Keywords

Web access, older adults

1. INTRODUCTION

It is nearly axiomatic for research on the Web browsing behaviors of older adults to begin with a list of difficulties that these users have. Despite the fact that some of these difficulties relate to cognitive, perceptual, and physical declines associated with aging, there appears to be a near consensus among younger technology-oriented consumers that difficulties with technology will not plague their generation when their generation becomes 'old'. This paper is intended to begin a discussion of technology experience as related to aging. Are technology difficulties an inescapable fact of aging? Or are there factors that will serve to equip future generations of older adults with skills that will erase or lessen these difficulties?

This paper begins with a discussion of the 'prototypical' older adult as often characterized in studies of Web usage. The paper will examine this typical user in light of a broader concept of aging that includes older adults as active users of technology at home and in the workforce. Next, this paper will present an

overview of cognitive, perceptual, and physical declines typical of aging and how these can affect ability to use the Web. Attempts to make the Web easier for older adults will be considered, along with presentation of recent studies that call into question the traditional view of older adults as deficient users of the Web. In this respect, experience and differing approaches to Web usage will be considered. The main point for consideration will be the hypothesis that the current views about older adults may require rethinking going forward. This paper will conclude with a discussion of forces that will likely shape the technology ability of the next generation of older adults.

2. OLDER USERS

It is not uncommon for people who have not yet reached the stage of being termed 'elderly' to have a story of a parent or other older relative or friend who is not interested in using computers and has never used one. This focus on older adults who have little, if any, computer experience has been reflected in much of the work with older adults. While certainly characteristic of many older adults, particularly the current eldest segments of the population, such characterizations are not universal and vary with age, experience, and functional ability of individuals. Consistent with the expectations of current tech-savvy younger adults, such difficulties may not be characteristic of the next generation of older adults. To say that future generations of older adults will exhibit the difficulties characteristic of the current older generation does not take into consideration current trends in technology uptake, nor, hopefully, improvements in design.

2.1 Age

At what age does one become an "older user"? The age of 50 is often used to define an older adult and there is clinical evidence to suggest that some age related declines begin at this time [18]. People who are 50, however, would deny a technological similarity to people who are 80 years old. In fact, baby-boomers are a strong-willed and demanding generation who are not defining themselves by limitations [31]. There are likely differences in ability that are missed when adults in their 50's are considered as a group with adults in the 70's and 80's. It is important for research on the Web use of "older adults" to carefully define the age of research participants and it is critical that literature reviews of "older adults" take into account the full continuum of experience and abilities of older users

2.2 Experience and Motivation

Although there is currently a digital divide between those over 70 and younger age groups in terms of Web use, this digital divide is shrinking. A recent study showed that the number of Americans ages 70 – 75 online rose from 26% in 2005 to 45% by the end of 2008 [48]. Older adults are the fastest growing demographic of

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Web users [20] [31] [45] [66] [73]. In some cases, the motivation is to gain experience needed for obtaining employment. In other cases, it is for the self-esteem and enjoyment.

For those older adults not online, the reasons are varied. In many cases they do not see the need to use the Web [74]. In some cases it is a matter of access, with computing requiring costly technology. To many, it is not clear what computers can provide that cannot currently be provided through personal (including phone) contact, letter writing, and interaction with the community. For many, such personal contact is considered desirable and there is no interest in replacing phone conversations with the impersonality of email or instant messaging or Web purchases. Older adults are generally not considered to be early adopters of technology and their voices generally under-represented in considerations of new technologies.

While discussions of digital exclusion assume negative consequences of this exclusion, there is evidence that this may not negatively affect the well being of at least the current generation of older adults [24]. This may change as services as diverse as government, healthcare, travel, entertainment, and communication increasingly move online. It is worth noting, however, that currently many older adults are not interested in using the Web for online services or e-commerce. Even more striking is the fact that social networking has failed to ignite the interest of older adults to the same extent that it has done for younger users [5] [48].

In terms of their approach to new technology, there is undeniably a difference in the novice five year old user and the novice sixty-five year old user. Typically, children come to computers with a spirit of exploration and a lack of fear. Older users often need more assurance and worry about ‘breaking’ the computer. Such anxieties for older users are often exacerbated by computer problems that may be mere annoyances to younger, experienced users. For example, the author has observed more than one older adult stop using the computer after receiving an error message that they had performed an “illegal operation.”

Older adults coming to the Web experience start-up difficulties not characteristic of younger learners. They typically require, for example, more practice and more instruction than younger users (see Section 2.3.1 below). Interestingly, however, there is reason to believe that the type of experience older users have will affect their ability to use the Web. Specifically, collaborative experiences such as workplace environments or learning as part of a class may lead to improved Web expertise [14] [43].

We know, however, that experience does not always equate with expertise [14]. Problems for older Web users include difficulty moving from page to page (including Back and History buttons), longer times to complete tasks, longer times to select targets and links, revisiting sites, and difficulties finding new information (e.g., [28] [53] [64] [71]). Older users also do not do well with functionality hidden in simplified interfaces that hide functionality [63].

2.3 Age-Related Changes

Most older adults have some declines that affect computer use (if only the fact that multi-focal glasses must be worn to read content on the screen). Research that addresses Web usage by older adults typically summarizes these problems. But how much do these well documented changes negatively affect an older adult’s ability to successfully use the Web?

2.3.1 Cognitive

An emerging research consideration is whether the constant bombardment of technologically-mediated input is changing the brains of young adults [68]. Underlying this work is the supposition that, in some sense, the brains of older adults are not able to cope with current technologies. Despite the preponderance of work related to visual declines and their impact on Web browsing (see Section 2.3.2 below), cognitive declines, arguably, present the greatest barriers to Web usage [36]. In particular, issues related to what has been termed *fluid intelligence* affect ability to learn new technologies [19]. Fluid intelligence includes abilities such as short-term memory and speed of processing that allow people to think quickly and reason abstractly. What is not subject to such age-related declines is *crystallized intelligence* – knowledge that we have gained through education and experience.

Given these findings on fluid intelligence, it is not surprising that the complexity of Web navigation and Web technologies, particularly some of the emerging Web 2.0 technologies, pose challenges for novice older users [15] [29] [57] [74]. While navigating the Web and dealing with new social interactions and dynamically changing content appears almost effortless for younger users, the cognitive declines typical of older adults make their learning and use of such technologies difficult. The *YouTube* experiences of *Geriatric1927* serve to underscore what older adults can do, but also the difficulties encountered with these new Web technologies [6].

In some cases, these older adults are active members of the workforce who use the Web regularly as part of their job. Changing demographics worldwide have created a workforce in which “older” workers are critical [16] [38]. Specifically, birth rates in many countries have resulted in critical shortages of workers, dictating the need to retain older workers. The individual reasons for remaining in the workforce vary, including both financial needs and various needs for self-fulfillment [32]. Part-time and volunteer work is often sought by older adults. The Web and other technologies are often needed for these positions. Remaining in the workforce may be an important element in remaining current with technology [72].

2.3.2 Perceptual

Perceptual difficulties related to vision and hearing can create a variety of accessibility problems for older users. Traditionally, issues with sound have not been a large problem for Web users with a hearing loss given the heavy reliance on visual information on the Web. As more multimedia, music, video, etc are utilized on the Web, however, difficulty with hearing will become more and more an issue. Little of the audio content on the Web is captioned. For older adults and others with hearing loss, this is of concern.

Declining vision, in contrast, is often discussed as a problem for older Web users. Reduced acuity, color perception, and contrast discrimination accompany normal aging. These declines lead to difficulties in reading small text, text that is closely surrounded by other visual elements, and text that has complex font styles or lowered contrast due to poor color choices on pages. Although older adults wish to use their available vision as much as possible for browsing, speech is often helpful in augmenting reading. Potential problems with understanding synthetic speech [21] and long messages [75], exacerbated by faulty memories and

erroneous models of navigation [39] [75], suggest that speech, while useful, will not ensure the needs of older users are met.

2.3.3 Motor

In addition to these perceptual problems, older users may have difficulty using a mouse and keyboard due to illness or injuries that limit dexterity. There is evidence that older adults use different movement strategies than younger adults, with lower peak velocities and many submovements, and that fine positioning over a target is particularly difficult for this group [49]. Many would be well served by having larger targets on the screen that would not only make clicking easier, but would also make seeing the targets easier [46].

2.3.4 Dynamic Diversity

As declines for older people are often in more than one area, their combination can make accessibility more challenging than for users with a single disability. Consider, for example, an older adult who has both low vision and hand tremors. This combination can make it even more difficult to use the Web than might be predicted based on either disability alone. Moreover, these difficulties may vary from day to day ('good days' and 'bad days') and even within a day. The challenge of designing for a diverse set of user needs, which is typical of the older population is indeed great [34]. Particularly promising are techniques that monitor user input for the purpose of adapting to individual needs [70].

2.4 Summary

While the problems of novice older Web users are real and significant [58], it is important to separate the issue of experience from that of *ability* to use the Web. Changes in ability due to age are well known. Interestingly, despite these changes, older adults do not tend to view themselves as 'disabled'. This fact is critical in understanding that this population is less likely than their younger counterparts having disabilities to use special devices and software, including those built into browsers and operating systems. Particularly among novice users, there is a tendency to view problems as due to their own lack of understanding of the technology. This rarely leads to the realization that assistive technologies are available and can make computers easier to use. As such, older users tend to struggle with unmodified mainstream technology.

3. SUPPORTING OLDER USERS

One of the common means of getting older adults started with computers and Web browsing is to involve the person in a class. A number of organizations worldwide help novice older users get past the initial hurdles and get connected online (for example, [3] [8] [60] [65]). In large part, these classes benefit from having older adults as instructors.

In terms of software, there are a number of technologically-driven attempts to assist older users in gaining access to the Web [42]. Among these are guidelines for page content and browser modifications.

3.1 Web Guidelines and Aging

W3C guidelines for making Web content and browsers more accessible to people with disabilities are well known [12] [50]. While important in enabling access for specific disability issues, these guidelines have not addressed problems of older users. The

current W3C initiative regarding aging is stepping up to this challenge [2] [4].

Previously, a number of best practices and guidelines for website design have been published to guide developers in their creation of senior-friendly websites (such as [1] [17] [26] [44] [45] [51] [55]), and a checking tool, similar to the Bobby [11] tool for accessibility checking, was developed that tests for page adherence to such designs [10]. While these various guides differ in how they were created and in the full set of recommendations, there are a core set of common elements. The core recommendations for design typically include:

- use of appropriately designed text in terms of large font sizes, and appropriate color options
- design of uncluttered page content, including sufficient spacing between lines of text
- use of consistent page navigation within a site
- use of large and clearly labeled buttons, graphics, and links
- provision of clear and consistent navigation

Few websites, however, have been designed with these guidelines in mind. Even those targeting older users often do not design with the needs of these users in mind [22]. Despite the numbers of older users, particularly potential older users, the message that older adults have special design considerations, to date, is not a message that has reached most who create websites.

The *NIH SeniorHealth* website provides an example of a website specified designed for and tested with older adults [59]. The site has easy to read pages and consistent navigation.

3.2 Browser Modifications

A number of browser solutions have been used to address the cognitive, perceptual, and physical changes related to aging. Both specialized browsers and adaptations to mainstream browsers have been created.

3.2.1 Specialized Browsers

Specialized browsers attempt to simplify complexities of standard browsers. For example, scrolling, which experienced computer users tend to take for granted, is not intuitive. Specifically, it is counterintuitive to "scroll down" to move the "page up" when navigating Web pages [54]. For novice older users, accustomed to paper, the terms "up" and "down" are interpreted just the opposite of how they are used by browsers. Consider how browsers work – in order to move "down" on a Web page (to see what is below the content of the current window), the page has to move up. To see "up" on a page (the content above the current window) the page has to move down. Not surprisingly, this difference in "up" and "down" as used with paper and the Web is a large source of confusion to older Web users when they first begin navigating pages.

Typically, specialized browsers provide a limited number of options in an interface that replace a standard browser interface. As a means of getting novice users started on the Web, such specialized browsers can be effective [7] [23] [25] [35] [76]. A number of commercial and free browsers have been developed that specifically target the needs of novice users (such as [27] [33] [54] [56] [67] [69]). In some cases, these browsers provide

specific features that address disability or other needs of older users.

While these serve the needs of some novice users, such simplified browsers tend not to be used by the larger population of older adults, regardless of disability. The reasons for this include:

- Lack of ability to use the full internet functionality
- Difficulty in getting help from friends and family unfamiliar with the simplified browser
- Not wanting to use technology that marks the user as 'different'

An interesting variation on simplified email is the approach taken that bypasses the need for the older user to have a computer at all [13] [61]. Caring Family [13], for example, has developed a way to connect an elderly user with a set of family and friends. Members of the elder's family and friends are able to use their own email system to communicate with the older relative. The older relative receives the email in the form of a fax, thus not requiring the use of a computer. The older user can send 'email' by handwriting a letter on pre-coded stationery. This stationery has a picture of the family member for easy use, with bar coding on the page to automatically send the fax to the correct member of the older user's list of family and friends. The Caring Family system scans the faxed mail and sends to the email of the family or friend. Thus, the system has the ease of use for family and friends, while not requiring the elder to own or learn to use a computer. Such a design may be ideal for those older adults not interested in using computers but who have family and friends with ready email ability.

3.2.2 User modification of page presentation

The fact is, no one page rendering will be accessible to all users. While W3C guidelines have specified, for example, markup needed to make pages accessible to screen readers, it is not possible to specify one page rendering that will be able to be easily readable by everyone with vision impairments. Some, for example, will need text larger, some will need different contrasts, some will need less clutter, and some will need a combination. Thus, there is the need for individual users to be able to indicate the optimal rendering *for themselves*. In this sense, means of providing flexible rendering of pages, customized to individual users is vital [41] [47]. The W3C has specified User Agent Guidelines for this purpose [47]. Various means for this have been devised to enable such flexibility, including transcoding [52] [62] and browser augmentation [30] [37] [40].

Current browsers (such as Internet Explorer, Firefox, Opera, and Safari), have incorporated several useful accessibility features. These features generally include font enlargement (at least over a small range of sizes), text, link and background color modifications to enhance contrast. They are typically accessed via multiple levels of menus and complex dialog boxes, making it difficult for older adults to find and utilize these features [62].

These features, while having the advantage of being built-in, do not include the full complement of adaptations that an older user might want or need. Moreover, the built-in features do not always correct as needed. For example, many websites specify a font size and, thus, do not allow for font size increases through built-in browser functionality [9]. In order for font size to be changed in these cases, it is necessary to have browser augmentations that will override these specified font sizes and adjust per user needs

[62]. Current add-ins and other forms of augmentation have been designed to fill such usability gaps for older users [40]. Their functionality provides a number of features for visual and navigational enhancements to Web pages.

3.3 Summary

Many methods have been devised to support older adults who wish to use the Web. In general, these methods can be grouped into two categories: 1) Web pages personalized for individual needs (either through specification in guidelines that can direct design or browser augmentations that can modify pages), and 2) simplifications to reduce UI complexities of the browser itself. Despite all these options, most older adults, even many novices, continue with unmodified browsing. This may result from lack of knowledge of technology options, but also results from a desire to use standard technology. If older adults are not going to widely adopt specialized technologies, how can mainstream technologies be made more usable for this population?

4. EMERGING EVIDENCE

Fairweather recently commented that older web users are not simply deficient younger users – they browse differently [29]. This is a critical point, and one generally overlooked by those who do work on aging and technology. Rather than simply cataloging what older users do less well than younger users, research into the navigational and cognitive processes of older Web users has the potential to greatly illuminate the supports most appropriate for this segment of the population.

Fairweather tested younger and older adults on the performance of a goal-directed task, specifically, looking for jobs in an online newspaper. This task was relatively open-ended and did not constrain the particular pages or order of pages viewed by participants. His reasoning that was most previous studies that have found processing deficits have compared younger and older adults when visiting the same Web pages, using the same controls, and navigating the same. When working towards realistic goals, Fairweather found that age did not predict success.

Fairweather proposed an interesting hypothesis as to the reason that he did not find age (or computer experience) to affect success in this task. Specifically, he noted that solution of this problem relied a great deal on participants' specialized knowledge, experience, and vocabulary about the domain. As reviewed above, these are specific characteristics that do not show general declines with age (see *Section 2.3.1*).

In other work, eye tracking research has indicated differences in the page viewing of older and younger users. Specifically, older adults attend longer to areas of pages before initiating an action than do younger users [71]. Perhaps this finding can be considered a strength when considering that older adults may be spending this additional time synthesizing the content.

5. THE NEXT GENERATION

To return to the original question: When today's young adults become 'older adults' will they exhibit difficulties with technology that appear to characterize the current older generation? Despite the optimistic views of the current tech-savvy generation, research suggests that this generation, too, will experience difficulties with technology when they age.

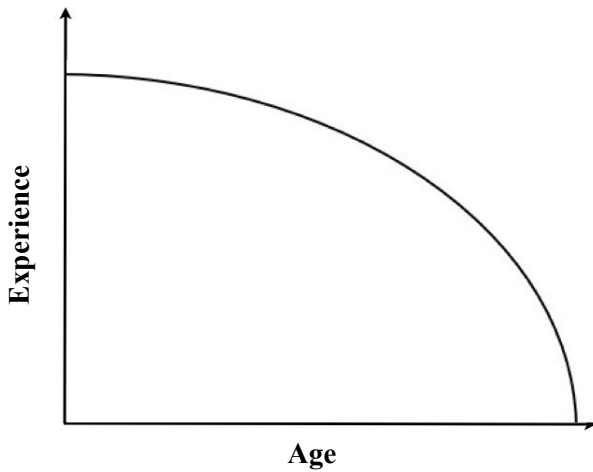


Figure 1. Projection of computing experience as a function of age.

5.1 Experience Changes

The next generation will have technology skills not in the repertoire of the current generation of older adults. This will provide some specific Web experience and likely some general ability to deal with computer applications. The trend towards remaining in the workforce will help ensure that this generation continues to be in touch with technology changes.

Figure 1 shows a hypothetical curve of experience as a function of age. It projects that ability to deal with technology will decrease with age as people retire and otherwise increasingly lose touch with changes in technology. This hypothetical curve is predictable on reasonable assumption that technology will continue to evolve, thus making existing skills obsolete as users lose touch with these changes. Notice that this curve is smooth. Such a trajectory assumes that the type of technology used remains of the same general functional category. This assumption may not be correct, however. The current generation of older adults used a number of technologies in the past. Despite this, they experience well documented difficulties with the current Web. Major shifts in future technologies may cause the hypothetical curve shown in Figure 1 to have a distinct stair-step break at the point of this change.

5.2 Age-Related Changes

Importantly, the age-related disabilities that characterize the current older generation will not disappear in the next generation. While successive generations tend to live longer, this has not abolished issues of cognitive, perceptual, and motor disability that become more prevalent with age. Figure 2 shows a hypothetical graph of disability as a function of age. It projects that disability will continue to increase with age. As with the current generation of older adults, these disabilities will present difficulty with UIs and the learning of new technologies – unless design changes are made. The challenge for technologists will be to design for age-related change to ensure that older adults are not locked-out of Web access in the future. In this vein, a promising research area will be how to capitalize on strengths of older users (such as

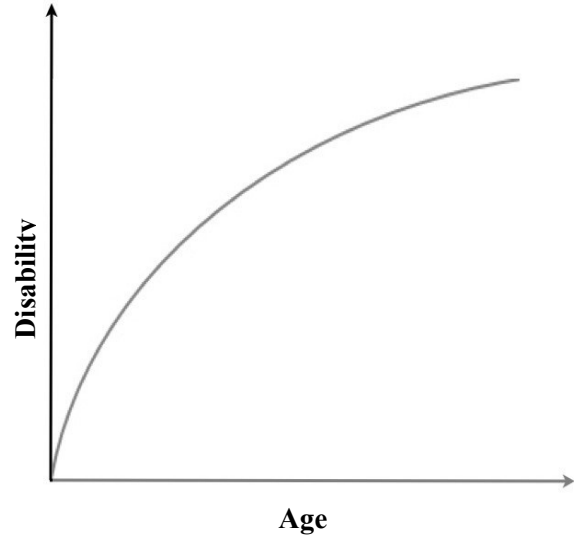


Figure 2. Projection of disability as a function of age.

knowledge and experience) to support learning and use of new technologies.

5.3 Conclusions

Will difficulties with technology plague the current tech-savvy generation when their generation becomes ‘old’? Yes. Many of the issues are likely to be the same, although the specifics will change. It is unlikely that the confusion of page “up” and “down” [54] will be problematic for a generation steeped in current browser UIs. However, what will technology look like in 20 years? It will not be the same as it is now. In 20 years, the technology is likely to have changed such that the “older” generation finds themselves confronting an array of technologies they little understand and find inaccessible.

Figure 3 is a hypothetical graph of the two factors mentioned that will affect the Web usage of older adults of the next generation. Notice that while the x-axis is labeled ‘age’, no specific ages are

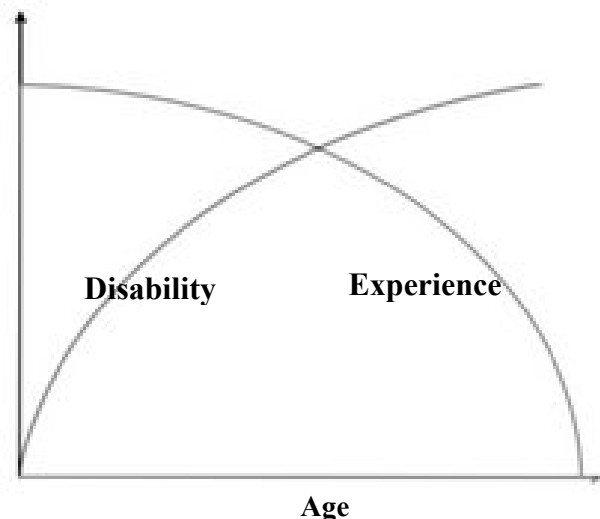


Figure 3. Ability as a function of age.

marked. The trick will be to determine how the line for experience and disability intersect. Figure 3 depicts this at a single point in time. As generations become more experienced with current technologies and assuming health conditions improve, this point of intersection might well gradually move to the right. Another scenario is possible, however. As technologies develop, there may become a point (or multiple points) where the older generation is simply no longer able to use the technology. Specifically, 20 years from now it is possible that computers as we know them may have evolved to the state where today's experience with the Web and other computing applications no longer serves the older generation. Like today's older generation, they may find the new technology baffling in many respects. In such a case, the intersection of the two lines may not proceed in a relatively smooth course from left to right, but rather may be characterized by static or even less ability of the older users over time.

Designers of developing UIs and evolving browser technologies can do much to help ensure the usability of the Web for future generations. Considerations of age-related changes are important. In short, the answer is user involvement from the beginning. Designers and developers must consider the needs of older users (a growing percentage of the population) in initial design and through subsequent phases of test. This may sound simplistic in its recommendation, but, to date, the needs of older adults have been little considered. We can ill afford to continue ignoring the clear demographic trends and needs of older users.

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