The Impact of Aging on Access to Technology

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Introduction

Two major demographic trends underscore the importance of considering adaptation to technology by older adults: the aging of the population and rapid dissemination of technological innovations. In the past decade, developments in computer and information technologies have occurred at an unprecedented rate and technology has become an integral component of work, education, communication and entertainment. Technology is also increasingly used within the health care arena for service delivery, in-home monitoring, interactive communication (e.g., between patient and physician), transfer of health information and peer support. For example, in 2003, 76 % of Americans reported that they used the Internet and 65% have Internet access at home (UCLA Internet Report – "Surveying the Digital Future", 2003). Use of automatic teller machines, interactive telephone-based menu systems, cellular telephones, and VCRs is also quite common. Furthermore, telephones, television, home security systems and other communication devices are becoming more integrated with computer network resources providing faster and more powerful interactive services. In essence in order to function independently and successfully interact with the environment, people of all ages need to interact with some form of technology.

At the same time that we are witnessing explosive developments in technology the population is aging. People aged 65+ yrs. represent approximately 13% of the population and this number will increase to 22% by the year 2030. Moreover, the fastest growing subgroup within the older cohort is the "oldest old" (85+ yrs.) (Federal Interagency Forum on Aging Related Statistics, 2000). Recent data for the U.S. indicate that although the use of computers and the Internet among older adults is increasing there is still an age-based digital divide. As shown in Figure 1, in 2002 about 34% of people age 65+ accessed the Internet compared to nearly 100% of 16-18 year olds (The UCLA Internet Report – "Surveying the Digital Future", 2003).

Not having access to and being able to use technology will increasingly put older adults at a disadvantage in terms of their ability to live and function independently and successfully negotiate the built environment. Furthermore, the full benefits of technology may not be realized by older populations. Technology holds the promise of enhancing the quality of life and independence of older people by augmenting their ability to perform a variety of tasks and access information and services. However, unless we have an understanding of why older adults have difficulty adapting to new technologies and older adults are perceived as active users of technology by system designers successful use of technology will continue to be a challenge for future generations of older people. Given that technology is not static people will continually confront the need to learn new systems or activities at multiple points during their lives. The varieties of technology that

are available are increasing at an unprecedented rate. Thus the topic of aging and technology will continue to be an important issue in the upcoming decades.

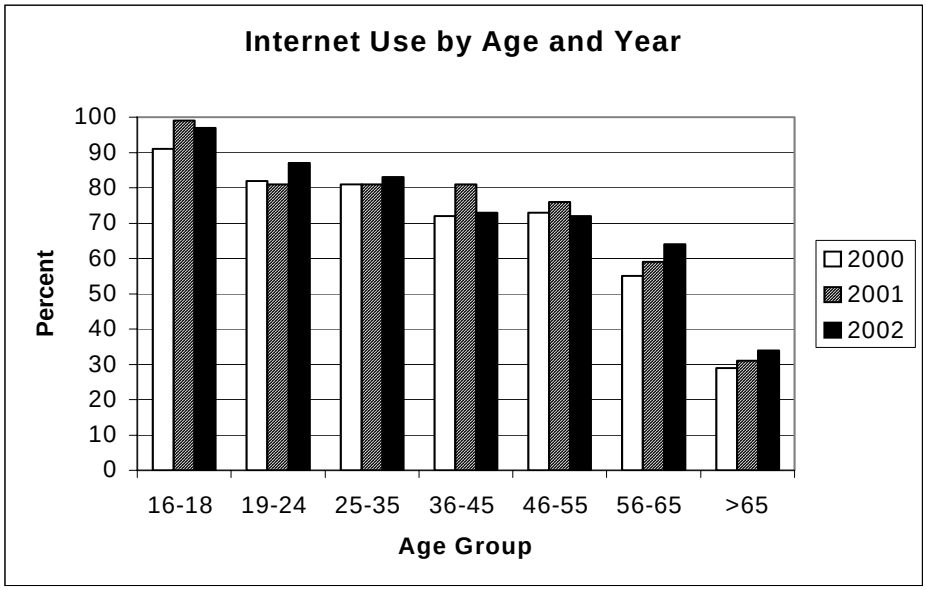

Figure 1. Data Source: The UCLA Internet Report – "Surveying the Digital Future" UCLA Center for Communication Policy, January 2003

A commonly held belief is that older people are resistant to change and unwilling to interact with "high tech" products such as computers. However, the available data largely dispute this stereotype and indicate that older people are receptive to using computers. However, the nature of their experience with computers, available training and support, ease of access and the type of applications that are available are important determinants of their receptivity.

To make technology available to people of all ages and abilities a challenge for the research and design community is to better understand: (1) why technology is difficult to use when it is; (2) how to design technology for easier and effective use; and (3) how to effectively teach people to use and take advantage of technologies that are available (National Research Council, 1997). This paper will discuss the implications of age-related changes in abilities that may have an impact on technology access. The focus will be on cognitive processes.

Age-Related Changes in Abilities: Implications for Design

In general, today's elderly are healthier, more diverse and better educated than previous generations. For example, between 1970 and 2000 the percentage of adults aged 65+ who have completed high school increased from 28% to 70%, and in 2000 at least 16% had at least a bachelor's degree. Consistent with demographic changes in the U.S. population as a whole, the older population is becoming more ethnically diverse. Currently about 84% of people aged 65+ are non-Hispanic white; this proportion will drop to about 74% in 2030 and 64% by 2050. The greatest growth will be seen among Hispanic persons, followed by non-Hispanic blacks. With respect to health, on some indices, today's older adults are also healthier than previous generations. The number of people 65+ reporting

very good health and improvements in physical functioning, such as ability to walk a mile or climb stairs, has increased in recent years. However, the likelihood of developing a disability increases with age, and many older people have at least one chronic condition (Administration on Aging, 2002). The likelihood of developing a cognitive impairment also increases with age. For example, one in 10 people over 65 and nearly half of those aged 85+ are affected by Alzheimer's Disease (Alzheimer's Association, 2005). Disability rates among older adults have important implications for the design of technical interfaces. For example, use of a mouse or keyboard may be difficult for some older adults and many older people may need adaptive devices such as font enlargement software or amplification systems. People with disabilities, especially disabled elders and minorities with disabilities are also less likely to use technology such as computers and the Internet (Pew Internet and American Life Report, 2004).

There are also a number of changes in abilities associated with "normal" aging that have implications for the design of technical systems. For example, although most older adults do not experience severe visual impairments, many older people experience declines in eyesight sufficient to make it difficult to perceive and comprehend visual information. Age-related changes in vision have implications for the design of written instructions and manuals and display screens. Many older adults also experience some decline in audition and changes in motor skills, including slower response times, declines in ability to maintain continuous movements, disruptions in coordination, loss of flexibility, and greater variability in movement (Rogers & Fisk, 2000). These changes in motor skills may make it difficult for older people to use current input devices, such as a mouse or keyboard. Changes in perceptual motor abilities may also make it difficult for older adults to successfully interact with on-line training programs or multi-media programs.

There are a number of age-related changes in cognitive abilities that are relevant to the design of technology. The existent literature of aging and cognition indicates that many component cognitive abilities such as working memory, attentional processes and spatial cognition, show decline with age especially under conditions of complexity or when a task represents an unfamiliar cognitive domain such as is the case when confronting new technology (e.g. Park, 1992; Park 1994). Age-related declines in cognition have important implications for technology access. Declines in working memory may make it difficult for older people to learn new concepts or skills or recall complex operational procedures. Declines in attentional capacity may make it difficult for older people to perform concurrent activities or switch their attention between competing displays of information. They may also have problems attending to or selecting task targets on complex displays such as overly crowded websites.

Essentially, human-technology interaction is an information-processing task. In most cases during an interaction with technology the user is required to search for and identify displayed information, select responses based on this information, recall commands and operating procedures associated with those responses and execute the response (Protor & Vu, 2003). Several studies (e.g., Czaja & Sharit, 1999, 2001) have shown that cognitive abilities such as working memory, attention and spatial abilities are important predictors of performance of computer-based tasks. Thus, ultimately age-related changes in cognition may have a negative impact on access and use of technology. To date, little is

known about how age-related changes in cognition influence performance of technology-based tasks.

The literature also suggests that there is a certain amount of reserve capacity held by older adults and that the performance of older people can be improved through training and design manipulations. For example, a recent study by Sharit and colleagues (Sharit *et al.*, 2003) found that use of a graphical aid improved the ability of older people to navigate telephone menu systems. Investigators have also shown that the nature of the training protocol impacts on learning success for older people. Mead and colleagues (Mead & Fisk, 1998) in a study examining training for ATM machines found training interactions with age such that there were greater gains for older adults for procedural ("action") versus conceptual training. Unfortunately, there is only limited data available on training for technology-based tasks. It is also important to note that there is considerable variability in performance with age. Thus one can not draw conclusions on age-technology interaction on the basis of chronological age.

Conclusions

Clearly computer and information technologies hold promise for improving the independence and quality of life for older adults and their families. However, for the full potential of technology to be realized for these populations the needs and abilities of older adults must be considered in system design. Unfortunately to date, designers of most systems have not considered older adults as active users of technology and thus many interfaces are designed without accommodating the needs of this population (Czaja & Lee, 2002). Usability problems relate to screen design, input device design, complex commands and operating procedures, and inadequate training and instructional support. In essence to insure that older people are able to successfully adapt to technology we need detailed information on user preferences and needs, problems with existing systems and the efficacy of design solutions.

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