Access Tool? Accelerating Treadmill? Technology and the Aging Population

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Abstract. Smart homes, smart cars, and electronic interactions with family, merchants, and service providers promise to make the lives of the elderly and people with disablities much easier. Paradoxically, the constantly accelerating pace of technological change will eventually make the machines we live with inaccessible to everyone who has a normal life span. Thought, planning, policy formulation, and action will be required to insure that everyday technology maintains interfaces that will be accessible to aging users, who are among the people who need it most. The User Access community is uniquely qualified to formulate and pioneer accessible design principles, and to bring these principles and policies to the attention of the public, relevant non-government organizations like the AARP, and public officials.

Keywords: older adults, Web, interface, design policy, disabilities.

1 Introduction

We and our family and friends – and even our children - will likely outlive our ability to cope with technology as we know it. As seniors, we may be unable to click or touch the right place on a panel; we will need more time to read, and to hear; we will need bigger print, clearer contrast, and more repetitions of instructions. We will forget that what we need might be something that we can't see because it's behind the active window, off the screen, or to be found in a different display mode. We will lose track of what mode we are in if something doesn't remind us. Incoming stimuli will make us lose track of what we were doing and overwhelm important top-down cognitive processing. At the same time, inappropriate top-down processing will distort incoming signals and make it difficult for us to react to them correctly.

Meanwhile, the pace of change will continue to accelerate. What we learned to do on version 6.1.2 of some program may not work a month later on version 6.1.3. People are already on an accelerating technological treadmill, and we will, sooner or later, fall off unless we die before we get old. Or unless enough people in the technology community are humane enough, foresighted enough, and savvy enough to create a technological safety net underneath that treadmill. That is, technology, appropriately directed, may be able to help us deal with its own challenges as we age. What is the potential for this, and how can it be realized?

Our focus is not on the wide range of services that technology can provide, important those these are. For example, many seniors, and their families, benefit from

emergency alert bracelets or pendants that allow the wearer to summon help at the press of button, or even, in some cases, when the alert device senses that they have fallen. Services like this will become cheaper, and more widely available, as technology and communication infrastructure improve. But our special concern is how the problems ***created by technology itself***, problems of access and control that emerge as we age, can be dealt with.

2   Technology-Driven Challenges

Household appliances. Digital technology has made it possible for appliances like microwaves, dishwashers, or washing machines, to support much more complex functions than their predecessors of a generation ago. This trend brings with it three challenges as we age.

First, there are more controls. Space constraints mean that their labels are small and hard to read unless you have excellent vision. The controls themselves are likely to be buttons, rather than knobs, and, especially in the case of popular membrane devices, often offer no tactile cues in operation. Did I push that or didn't I? Did I push the wrong one?

Second, operations are harder to understand. Few devices are simply "on" or "off". Rather, multiple modes of operation, combining different settings applied for different amounts of time in some sequence, are common.

Third, many controls have time constraints: home entry alarms must be armed and disarmed quickly, with no way to adjust the time allowed, and many devices with multiple modes of operation revert automatically to default mode, again without a way to slow that reversion time down or put it under manual control.

Communication devices. The simple term "phones" no longer does justice to this category. Our "phones" can send and receive text messages or emails, take and share photographs, play music, and more. The problems mentioned for appliances surface here, too, in more acute form. Because portability, and hence small size, is crucial, controls, and displays, are small, and impossible to use for many older people. The wealth of features is, likewise, hard to understand for many older people - and other people, too.

Computers. As we all know, computers are no longer just tools for work. Rather, because of the emergence of the Internet, including the World Wide Web as an important life resource, computers are crucial portals for many people in their private lives. But operating and maintaining a computer is a major challenge for many older people. The treadmill in our title barely seems metaphorical: One has to continually upgrade the operating system itself, and one's virus protection, to protect against cybersecurity threats that can be utterly disabling. One has to upgrade or replace one's computer itself at frequent intervals, to accommodate upgrades of common software that require more memory, and/or a current version of an operating system, to work.

The Internet and Web. The Internet exposes its users to threats that can be difficult for older people to understand and counter. Phishing attacks and other scams are sometimes aimed specifically at seniors, as in the case of a phishing attack that simulated email from the Social Security Administration [1]. Protecting personal information

online is a challenge for users generally, not just older people for whom managing a stable of passwords may be especially difficult.

Websites can pose perceptual and cognitive difficulties. Small font sizes and cluttered screens can be difficult to read. Typical commercial sites feature multiple navigation paths, and multi-stage transactions, that can be difficult to follow.

Technology in public places. ATM's, elevators, vending machines, public transit ticket vendors, announcement boards, and even parking meters also present cognitive and sensory challenges.

3   Technology-Driven Remedies

We see we have quite a budget of challenges for older people posed by technology. How can technology itself help us to deal with these challenges?

Response of technology to market forces. As the population in many developed countries ages, we can expect that these challenges will be better met by new technology designed to appeal to older buyers. But progress may be slow. The economics of mass production, and the importance of insuring that there is very wide amortization of high design and development costs in meeting low price points for digital technology, work against products aimed at only a share of the market. Further, some vendors fear loss of trend-shaping "youth oriented" sales if they are associated with "granny" products.

*Assistive add-on*s. People with poor vision can buy screen magnifier software for their computer that increases font size, or software that allows them to have selected text read aloud. Blind users can buy screen readers that allow them some access to appropriately designed programs and Web sites. But many people who could use such aids do not have them, sometimes due to cost, and sometimes due to lack of awareness or help in understanding what tools are available and appropriate. Further, these tools are only beginning to be available for communication devices, and are not available at all for home appliances like microwaves.

The Universal Remote project [2], led by the TRACE Center at the University of Wisconsin, has developed a standard for home appliances and other devices that would change this situation, if adopted. The standard specifies an interface that would allow the device to be controlled by a remote controller, similar in concept to a TV remote. A user would have a single remote that could be used with all compliant devices, and that would be designed and configured with the user's needs in mind. For example, the buttons and display would be large and easy to see and operate, in the form of remote that would be chosen by many older people. The remote could help with the cognitive demands of operating complex appliances by offering simple controls only for basic operations.

Accessible infrastructure. Computer operating systems commonly offer some features that can ease use for older people, such as screen magnifiers and limited text-to-speech conversion. The Webanywhere project at the University of Washington builds on operating system support to demonstrate that screen reader support for blind users,

can be provided in a wide range of settings, including many public computers. The Raising the Floor Initiative, led by Gregg Vanderheiden and Jim Fruchterman [3, 4], aims to build such support into all commonly-used information infrastructure, including communication devices.

Technology that monitors itself. The same advances that have given us increasingly complex appliances can also give us appliances that can tell when things are going wrong. A security system could detect that the user is barely getting out of the house in the time that is allowed before the alarm is armed, and increase the interval that is allowed. A stove with complicated timed operations could detect that food is burning and shut down before the smoke alarm goes off, or could perhaps detect that food has not reached a safe temperature.

Once a device detects a problem it may be able to respond itself, as in the examples above. But sometime the best response would be to communicate the problem to a caregiver or monitor. For example, if someone has misadjusted their heating system, so that the temperature falls into the freezing range, an alarm could be dispatched.

Design for extensibility. The escalating complexity of all kinds of devices, often called "featuritis", is driven by the reluctance of consumers to buy products that lack what they feel are potentially useful features. In market surveys consumers sometimes say they want simpler products, but they don't buy them when offered. A potential response to this problem is to configure a product to offer only basic functions initially, but with an easy way to add new features if they are wanted. This avoids the need to market a low-volume, "basic" product, while supporting both consumers who really need a basic product, and consumers who really want a lot of special features and functions.

The application stores that have rapidly become popular for the iPhone and the Android G1 phone [5] are attractive from this point of view. Literally hundreds of applications can be added to a phone by anyone who wants them, but these do not complicate the lives of users who do not want them.

User support. Many older people rely on family or friends to help them manage their computers, including carrying out upgrades and solving problems. Technology such as GoToMyPC [6] makes it possible for this support to be provided remotely, a great convenience factor in our mobile society. When a user is stuck or confused, someone else can view their computer screen and take the actions needed to sort out the difficulty.

Cognitive science and innovation in accessible technology design. Some barriers to using technology are sensory. These, as we indicated at the beginning of this paper, are not limited to difficulties with vision. Feedback for touch controls has already been mentioned; multimodal feedback (tactile, visual, and auditory) is desirable. Auditory feedback has to actually be hearable: loud enough and low enough in pitch. Visual feedback about something that needs attention ought to blink like a cursor.

Other barriers are based deeper in cognition. Against the desire for central controls for everything is the brain's need for controls with unique functions that are clearly linked to the context in which they will be used and that can't be confused with the controls for something else (what, you've never picked up the TV remote when the phone

rang?) For people at risk of forgetting what they had intended to do by the time they get to the place to do it, stove controls should not look like the thermostat controls.

Security and updating. There are technical approaches emerging for many of these issues. Schemes for sharing authentication among different Web applications, like OpenID, can reduce the need for multiple passwords. Work at Intel Research is exploring ways to scan the information sent out from a computer, so that sending credit card numbers or bank information could be blocked, thwarting phishing attacks [7].

As mentioned earlier, keeping software up to date for security reasons is part of the treadmill we are all on. Cloud computing, in which nearly all of our software is stored on servers on the Internet, rather than our local machines, will simplify this problem, because updates will be done for us on the servers.

4   The Role of Regulation

Some of the supports just discussed cannot be provided without the cooperation of technology providers, and this cooperation isn't always forthcoming voluntarily. For example, improperly constructed Web sites fix the size of fonts, so that users cannot make them larger. Conscientious information providers avoid these problems by following Web accessibility guidelines [8], but not all providers are conscientious, or sufficiently knowledgeable, or prepared to deal with regulation [9].

Information technology in the US, including the Web, is subject to a patchwork of regulations at the federal and state levels. The Americans with Disabilities Act includes broad language about the rights of people with disabilities, including those with problems common among older people, like low vision, but whether these protections apply to the Web has been contentious. Recent legal action is encouraging, but not yet definitive [10]. Section 508 of the Rehabilitation Act [11] requires the federal government, and some other entities, to acquire and use only "accessible" technologies, and Section 255 of the Telecommunications Act [12] includes requirements for communication devices.

Section 255 provides a good illustration both of the need for regulation and the challenges of applying it effectively. The enormously popular iPhone cannot be used by many people with hearing aids, though hearing aid compatibility is a regulatory requirement. The iPhone has been held to be exempt from the regulation, because of a provision intended to ease the burden of regulation on small producers, those selling only one kind of phone. Apple sells only one kind of phone, but very many of them. (The iPhone also has other accessibility problems, including controls that are difficult to operate by touch – see [13].)

A good many technologists, including many in the Internet community, oppose regulation intended to increase access to technology for people with "impairments" on the grounds that innovations that are valuable for many people will be stifled. Other people argue that, without regulation, technologists will ignore the rights of participation by people with disabilities (including many older people). USACM, the policy arm of the ACM, the leading professional society for computer science, has adopted a resolution on Web access that attempts to balance these concerns [14].

The Universal Remote project, described earlier, may be an example of an initiative that will require regulation in order to succeed, because appliance manufacturers

may see no benefit in entering a market in which consumers don't have remote controllers (which can't control appliances that aren't yet available.) But this chicken or egg dilemma may be broken by the possibility of applications for the iPhone or similar devices that would allow them to be used as remotes.

5 Agenda

What can we do to improve the situation for older people today, and for our future selves? Political action in support the UN Declaration on the Rights of Persons with Disabilities may improve the situation in many countries, including the US.

Consumer organization will also help. The action of market forces will be enhanced if consumers express their need and preference for appropriate technology. The AARP, the largest US advocacy group for older citizens, does not currently have an interest group on technology and aging, but one could be started, using the Web support for groups that the organization already provides. Such a group could identify constructive technology trends, and publicize products that embody or block them.

Many members of this audience will be able to contribute to the development of the technology we are describing, not just help to define the needs. An interest group could help organize that response, as well. And in recruiting allies, remember that what benefits the senior population is also likely to benefit children, and people of all ages with a wide range of physical and cognitive difficulties, and all of us when we are tired, overloaded, and multitasking, so starting by creating a broad coalition may be a good move.

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