Meaningful Devices –

Inclusion of Seniors in the Design of Assistive Technology

Margaret Rusnak

The Ohio State University

Abstract

Assistive technology helps many older adults complete essential tasks, thus providing them a means to remain functionally independent within their communities. However, many older adults either reject the use of devices or misunderstand their intention. The gap between design and need may be bridged through the active participation of elders in the design process. Previous studies have focused on older persons' attitudes toward adopting new technology, emphasizing how to promote and maintain usage. Recent research reveals the necessity of including older adults in the design, research, and application of assistive technology in an effort to meet the real needs of this diverse population instead of the needs perceived by the designer. Assistive technology developers' conceptualizations sometimes do not mesh with the needs of consumers, and this disconnect can negatively impact seniors' ability to age-in-place. Developers may focus on a narrowly defined idea of health while older adults often have broader characterizations of what it means to be healthy. Inviting older adults to participate in the design of assistive technology will encourage older persons' use of this technology and thereby improve their social interactions and support their aging-in-place.

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Introduction

Alice[*], an 83 year old woman living independently, calls it the "Cadillac of Walkers," and its sleek curves, shiny chrome, and sturdy workmanship mirror the qualities of a luxury automobile, But no matter how fancy the walker, it just doesn't work for Alice. "It's too bulky and heavy. I can't fold it by myself and put it in my car. I have to hunch over it and can't stand up straight." (Alice, personal communication, February 3, 2015). Regardless of how beautiful to look at or expensive to acquire, this piece of assistive technology does not work adequately for Alice.

Would it have made a difference to Alice if the designer of her walker asked for her input on its construction? Could Alice's unique needs have been incorporated into a device that serves her more appropriately? If the answers to these questions are "Yes," then why are designers not asking them?

Or are they?

"Participatory design" incorporates a product's future customer as a co-designer with researchers, developers, and engineers. Co-design can occur anywhere along the design continuum: from conceptualization to prototype testing to post-launch redesign. In this model, exploration of possible solutions occurs in tandem with the design process so that the result is a final product that meets a defined need. Participatory design has pushed designers from creating products for a generic consumer to "designing for people's purposes" (Sanders & Stappers, 2008, p. 617).

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[*] Name changed to protect confidentiality.

Co-designing with older adults could prove invaluable for identifying answers to the persistent problems of aging. By responding sensitively to this segment of society, which is sometimes ignored or condescended to, design professionals can support the aging-in-place of older adults with inventive concepts inspired by the rich contributions of their audience.

One area of aging where participatory design could be influential is in the realm of assistive technology. Assistive technology and adaptive equipment – like Alice's walker – play an important role in the functional independence of older adults. *The Older Americans 2012* report shows that using assistive equipment allowed Medicare enrollees over the age of 65 to maintain their independence and remain living within their home communities rather than in long-term care facilities (Federal Interagency Forum on Aging-Related Statistics, 2012).

However, assistive technology is not a one-size-fits-all solution – as Alice can attest. Despite the best intentions of designers, many older adults reject the use of devices, misunderstand their intention, or become frustrated at their ineffectiveness. The gap between design and need may be bridged through the involvement of elders in the design process. Current research reviewed in this paper emphasizes the need for including older adults in the design, research, and implementation of assistive technology in an effort to meet the various needs of this diverse population.

What are Assistive Technology and Gerontechnology?

Assistive technology provides a way for seniors to successfully engage in essential tasks. It helps someone perform an activity that may otherwise be beyond her functional ability. Activities of daily living (ADLs) are tasks of self-care like bathing, toileting, and feeding. As people age, their ability to complete these activities can diminish due to physical or cognitive

limitations. Assistive technology supports seniors' ability to complete ADLs independently rather than to seek help from others.

The variety of such equipment is extensive. A systematic review of 184 articles showed wide variability in what was considered assistive technology (Piau, Campo, Rumeau, Vellas, & Nourhashemi, 2014). Assistive technology is a broad term that includes items like reachers, computers, and entire homes designed to assist the independent living of older adults. The term gerontechnology likewise encompasses electronic, "smart" solutions ranging from social networking apps to remote health monitoring systems to soiled underwear detection patches. With such variability among devices, the research into their efficacy can be equally as varied. The goal of these myriad devices is to support the functional independence of seniors.

While many older adults may seem resistant to technology use, there is evidence that the so-called "digital divide" between the older and younger cohorts is not as wide as some think (Wallace, Graham & Saraceno, 2013). As the Baby Boomers enter the senior generation, their familiarity with technology should increase the number of equipment options available. This group is already comfortable using cell phones and personal computers. Integrating technology into daily living – even for people with functional limitations – may be easier for Baby Boomers than for their older siblings.

Inclusion Along the Design Continuum

Current social research focuses less on the devices themselves and more on the psychological aspects involved in the older cohort's decisions to both begin using and to continue using assistive technology. Suggestions for future research in this area point toward the inclusion of older adults in the development of gerontechnology that best fits their unique needs.

Peek et al. looked at what specifically influences older people to use assistive technology to allow them to remain in their communities (2014). They found that much attention has been paid to the pre-implementation stage of gerontechnologies (when a technology has not been used) but not to the post-implementation stage (after a technology has been adopted); the concerns and understanding of technology differ in the two stages and can have different effects on the continued use of the adaptive devices.

The pre-implementation stage might focus on the fear of the unknown (for example, privacy intrusion and ease-of-use considerations), whereas, the post-implementation stage might be based on usability factors (for example, device satisfaction in real-life situations). Peek et al. found that more research is being done on how to convince older adults to use technology in the pre-implementation stage than on how well that technology suits their needs in the post-implementation stage (2014). The authors recommend more quantitative research into the post-implementation stage.

Botero and Hyysalo are product designers who agree with this assessment. Working with The Active Seniors Association, a group of older people building an intentional community in Finland, Botero and Hyysalo discovered that the design process could not simply stop once a product was delivered. Working together with the association coordinating the housing community, the designers went through several iterations of a community calendar, some of which included a website, an electronic bulletin board, and a digital meeting book. Eventually, the entire group decided upon a paper-based system that met the needs of the senior population. The final result was far from what the designers originally envisioned; however they discovered that maintaining a collaborative relationship with the end-users allowed their initial design to evolve to better fit the expressed needs of the seniors (Botero & Hyssalo, 2013).

Cultural Considerations: What is Old Age?

As they age, many older adults prefer to remain at home (Hooyman, Kawamoto & Kiyak, 2015). Providing a way for them to do that can increase their quality of life (U.S. Census Bureau, 2014). Independence increases feelings of satisfaction and motivation to continue with a task. Independent older adults will likely be both physically and emotionally healthier (Hooyman et al., 2015).

Perception of health impacts the choices seniors make when integrating assistive technology into their lives. Older people wish to remain independent and living at home, and sometimes this emphasis on "productive aging" can lead them to eschew adaptive equipment for fear that they will be labeled sick or unable (Joyce & Loe, 2010). The Western cultural value placed on remaining busy and economically viable contrasts sharply with the glorified ideal of a peaceful retirement. The emphasis on productivity can lead older people to feel worthless. "There is a strong incentive to encourage continued economic contributions from all citizens and to minimize their dependence and drain on resources" (McLean, 2011, p. 315). Society tends to value older people less after their retirement and accuses them of taking undeserved entitlements through Social Security and Medicare (Hooyman et al., 2015). Such attitudes could be especially harmful to people with chronic conditions who are simply unable to be active. Designers of assistive technology should be aware of the "full range of variation—from vitality to frailty—that exists among older people" (Cole as cited in McLean, 2011, p. 316). An important lesson for developers of gerontechnologies is to be mindful of the different needs of individual end-users and to not exclude them based on stereotypical cultural notions of what it means to successfully grow older.

Biopsychosocial Considerations: What is Healthy?

The idealization of the young has turned the normal process of aging into one of pathology (Joyce & Loe, 2010). While aging can bring diminished physical function, the older population is heterogeneous, with varying degrees of ability (Hooyman et al., 2015). Health is more than the absence of disease; it can also be defined as the "presence of physical, mental and/or social well-being, participation in specific activities, or a holistic concept related to reaching one's personal and social potential in life" (Thielke et al., 2012, p. 484).

In an American hospital-based walking group for older adults, fitness researcher Denise Copelton was surprised when members refused her gift of individual pedometers. For Copelton, she saw the tools as supportive of the healthy goals of the members, whereas the group feared that the pedometers would foster competitiveness in an otherwise satisfying social activity (Copelton as cited in Joyce & Loe, 2010). Clearly, there was a disconnect between what the researcher assumed would be useful and what the group members needed to meet their health goals.

Thielke et al. examine how assistive technology can meet the health requirements of older adults through the psychological framework of Maslow's Hierarchy of Needs (2012). In the pedometer example above, Copelton sought to meet the lower need of physical health but the group members wanted to retain the higher need of love/belonging that their friendships brought them. "Even though a technology might give them some potential 'improvement', it did not provide benefit in the areas which the users considered valuable" (Thielke et al., 2012, p. 475). When developing technologies for older adults to use, it is important for researchers to be aware that "personal preferences and adoption are driven by perceived needs" (Thielke et al., 2012, p. 472).

Ethical Considerations: Access and Misuse of Assistive Technology

Developers, researchers, and policymakers need to be aware of the ethical implications of assistive technology. The ethical considerations are two-fold: "creating justice through fuller, more equitable access" and guarding "against potential abuse or misuse" of technologies and the data gained from them (McLean, 2011, p. 319). For many older adults, especially the oldest-old, technology is still an alien concept that threatens their perceived world order. There is real fear that machines will replace human contact, which many older adults believe to be essential to their well-being (Thielke et al., 2012). Education is needed, of course, but first access must be prioritized so that technology can be integrated into daily life, thus losing its foreign nature.

With public perceptions of senior entitlements, accessibility to gerontechnologies for the poor and marginalized might be a tough sell in today's political climate. An argument can be made for the cost-effectiveness of assistive technologies: it is usually less expensive for an elder to remain in his community than to be cared for in a nursing home. Assistive technology helps older adults to age-in-place and keeps healthcare costs down (Hooyman et al., 2015). Designers might invent various solutions that fulfill the needs of different segments of the population by remaining sensitive to differences in geographic locations (rural or urban), socio-economic statuses, and technology literacy levels (Wallace et al, 2013).

The misuse of technology has ethical implications. A remote healthcare monitoring system may provide peace of mind to caregivers, but its intrusion into seniors' homes may violate their right to privacy. However, it can also be argued that remote monitoring would allow older adults to remain in the community instead of being placed in an institution where loss of privacy would be guaranteed (McLean, 2012). Advocates for geriatric rights must balance the desire for independence with the protection of an individual's civil rights.

Policy Considerations: Awareness of Diversity

Well-meaning policymakers want to regulate the aging process, which leaves little room for the needs of the individual. But as the number of older adults grows with the proportion of Baby Boomers entering this population, it is likely that policymakers will become more aware of the diversity of this population. As a whole, the Baby Boom generation is more comfortable with both technology and speaking its mind. This cohort will not hesitate to ask for and expect equitable treatment from the agencies designed to serve them. An increased demand for services will affect the development and accessibility of gerontechnologies to older adults.

Accessibility is a concern with the increased availability of gerontechnologies. Cost could be a deterrent for lower income groups, which might create a disparity in services among socioeconomic classes. Policymakers may need to investigate how these devices will be covered by health insurance (Hooyman et al., 2015). While the initial cost may seem prohibitive, the aggregate cost of maintaining an elder in a long-term care facility could be significantly more.

Another concern is individual literacy levels – both with technology and healthcare. Though Baby Boomers tend to be more educated than the cohort before them, individual competency will vary. Sufficient training and follow-up safety checks on the assistive technology will help increase its effectiveness.

Barriers to Overcome when Including Seniors in Design

The research reviewed in this paper provides evidence that including older adults in the assistive technology design process can result in positive outcomes. More creative ways to solicit input exist than the traditional methods of focus groups and user satisfaction surveys, but these alternative methods do require more work to achieve.

Challenging the designers' mindset about what it means to be older might be the most difficult method to implement but also the most important for successful participatory design. Some designers might see senior co-designers as unsavvy or unsophisticated, especially in regard to technological concepts. Letting go of assumptions about older people's abilities can open the door to meaningful dialog. However, younger design professionals must be cautious in going too far in the other direction, where they might disregard the difference between themselves and their elderly participants. To do so runs the risk of minimizing the uniqueness of the aging experience (Hawthorn, 2007). The development of a middle ground of mutual respect for the creative insights of older adults produces results that are beneficial for both groups.

This middle ground may be fostered through facilitating small group discussion from which rich data can be mined. Designers may initially have different expectations for a project than do the older adults for which the project is being designed (Demirbileka & Demirkan, 2004). Approaching the problem qualitatively gives credence to the opinions of the participants and allows designers to gauge the effectiveness of their design.

Hawthorn discovered that allowing elders to pair up to test a computer program dispelled previously held notions that they were individually bad at using technology and allowed them to see that the problem was in the computer program's functionality (2007). The older adults were not inept with technology; it was the technology that did not meet their needs. Without respect for their input and the means to allow that input to be expressed, the information would not have come to the designer's attention and the project would have been rejected by the intended users.

Deciding whom to invite into the participatory design process is critical. The types of seniors who volunteer for a study might bias the study in favor of those who are more able to contribute; whereas, solitary, frail, or introverted elders might miss out on the opportunity. In

designing a computer-training tool, Hawthorn attempted to reach older adults who were

uncomfortable using technology because he felt that they were more representative of the general

population (2007). It is also important to remember that "older" can be a general and generic

term that contains individuals from their middle 50's through their 70's and 80's and past their

100th birthdays.

Although it may seem daunting to initiate a participatory design project, the advantages

outweigh the obstacles. Designers of assistive technology gain valuable insight into the usability

of their concepts by inviting older adults to lend their experience, opinion, and appreciation to

the process.

Rehab Therapists' Role in Integrating Assistive Technology

Occupational therapists are concerned with maximizing independence for clients in spite

of any functional limitations that the clients present. Occupational therapy promotes holistic

health and wellness through the client's involvement in personally meaningful activities

(occupations). Assistive technology may be used to modify the environment in order to increase

participation in the occupation (American Occupational Therapy Association, 2014).

Occupational therapists can allay older clients' fears of the use of assistive technology

through their professional endorsement. Getting professional buy-in from therapists to the idea of

incorporating new technology into rehab treatment would increase patients' acceptance and use

of those devices.

Liu et al. surveyed a cross-section of occupational and physical therapists in a large

Canadian rehabilitation hospital on their adoption and acceptance of technologies into their

therapeutic interventions. In this study, the therapists worked predominantly with adults aged 65

and older. The results were viewed through the Unified Theory of Acceptance and Use of

Technology (UTAUT), which explores the behavioral intention of utilizing a new technology (Liu, et al., 2014).

The research found that performance expectancy (how a technology is perceived to help the therapist achieve goals) was the main factor in the acceptance of new technologies. Interestingly, the difficulty of using the technology and its cost were not considered by the therapists to be important factors for either accepting or rejecting the technology.

It appears that rehabilitation therapists need to understand how assistive technology can support their work in order for them to incorporate it into their therapy toolbox. If more therapists get a better understanding of the use of assistive technology then they can advocate for their clients to use it, too. Therefore, designers of assistive technology should include healthcare providers in the design and implementation of assistive equipment.

Conclusion

The future is exciting for the development of assistive devices. The new field of gerontechnology explores solutions that until recently sounded like science fiction. In Canada, researchers are working on remote monitoring systems that can prevent falls and manage medications in order to allow older Canadians to remain independent longer (Sheets & Gallagher, 2013). Remote patient monitoring can allow elders with cognitive impairments to stay in their homes, thus alleviating the caregiving burden on spouses or other family members (Hooyman et al., 2015).

Piau et al. raise important questions about clarifying what assistive technology is and how to include its intended users in the testing of the devices (2014). The authors believe that future research studies will benefit from inviting this population to participate in the continued testing

and utilization of adaptive equipment. The advantage to inclusion is that assistive technology devices can be designed to fit the real-world needs of the eventual end-users of the products.

Developers' conceptualizations oftentimes do not mesh with the end-users' needs. Developers tend to focus on a narrowly defined idea of health while the older adults who will ultimately consume the products have broader characterizations of what it means to be healthy.

Gerontechnologies can work to change what it means to be old. Their use supports continued function, thus "reposition[ing] ageing individuals as experienced and active instead of doddering and feeble" (Joyce & Loe, 2010, p. 173). In order to be most effective at challenging these notions, elders must be included in the design, production, and testing of the equipment. The aim of assistive technology is not to regain the ease of youth or to become dependent upon a machine as a crutch, but rather support the body and mind as each changes across the lifespan (Joyce & Loe, 2010).

Assistive technology should not be an end unto itself but rather a means by which older adults retain their dignity and agency while aging. Engaging the end users with the development process allows their needs to become known, integrated into the design, and tested within the real world. Returning to the example of Alice, who was unsatisfied with her elaborate and expensive walker, it is interesting to consider what she might have said to the walker's designers about her experience using their product. Incorporating her constructive critique could have resulted in a device that was more functionally appropriate for her. Participatory design offers seniors a way to contribute to the creation of personally meaningful devices, which work exclusively for them.

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