Televideo for Older Adults with Mobility Impairment: A Needs Assessment

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ABSTRACT

Televideo technology has tremendous potential to support older adults' preference to age in place by helping them stay connected to family and friends, as well as with health professionals. Televideo may be particularly useful for older adults who are aging with mobility impairment. Yet, there is little research focused on older adults with mobility disabilities and their opinions and concerns about televideo. We conducted a qualitative interview study with older adults with mobility impairment to understand their perceived benefits and concerns as well as suggestions for improving televideo technology design.

INTRODUCTION

Due to advances in technology development, recent years have shown a dramatic increase in assistive technologies available for use in a home setting. In particular, televideo systems are designed to be teleoperated via a web-based application, and used to improve communication between individuals through two-way audio and video. Such systems are currently commercially available, such as Skype, Facetime, and Google Hangout.

Some televideo systems have been designed for older adults to be used in home and healthcare settings (Boissy et al., 2007; Tsai et al., 2006). Such systems have been shown to be potentially beneficial for the aging population to be socially connected (Beer & Takayama, 2011). Another study investigated the attitudes of retirement community employees with respect to the potential of telepresence technologies for older adults (Liles et al., 2015). Participants expressed potential benefits as well as concerns. They most frequently mentioned convenience, visualization, and socialization benefits. However, concerns were noted, such as the technology's appearance, technical limitations, and harm to the environment (i.e., collision with obstacles).

Although televideo systems are being designed for personal use, acceptance of such technology is still a relatively open question – particularly for older adults with impairment, a population often not considered in research and design. There is a common assumption that older adults do not adopt new technology. However, older adults are willing to accept new technology, as long as it is useful to them (Sharit et al., 2004). In fact, older adults have demonstrated a positive attitude toward home-based technological aids; however, that acceptance was associated with their specific needs (Giuliani et al., 2005).

Understanding technology acceptance is relevant to older adults with impairment, particularly since many technologies are being developed to help older adults maintain independence and remain socially connected. In particular, technology interventions, such as televideo, have the potential to help older adults aging with impairment stay socially connected. Users' perspectives on assistive technology may influence the way in which they interact with and use it (Davis, 1989). Additionally, by understanding the needs of older adults with impairment, designers can develop user-centered and user-friendly televideo user interfaces. Qualitative structured interviews provide the means to better understand users' attitudes and acceptance toward technology. The goal of the present research was to understand the needs of older adults with impairments relevant to televideo, their perceived benefits/concerns about existing televideo technologies, and how these systems can be improved to better fit their needs.

METHOD

Televideo Technology

In this study, we investigated three televideo systems: Skype, Kubi, and Beam (Figure 1). Skype, created by Microsoft, is an application that functions on computers, smartphones, or tablets, and provides two-way audio/video.

Kubi, created by Revolve Robotics, not only provides two-way video and audio, but it also has a motorized stand that holds a tablet and allows for the user to control pan and tilt (i.e., the tablet can move side-to-side and up-and-down). The stand itself is fixed in a location (i.e., it does not move around the room). Kubi is operated with an application that functions on computers, smartphones, or tablets

Finally, Beam, created by Suitable Technologies, is a telepresence system that allows the user to video/audio call while moving around the environment, akin to 'video conferencing on wheels.' The keyboard or the mouse of a computer controls beam. The primary difference of these technologies is their mobility. Beam, the most mobile, allows a user to physically navigate the environment. Kubi allows for pan-tilt capability, and Skype offers a standard camera view with no mobility.

Skype Kubi Beam

Figure 1: Examples of televideo used in this study.

Participants

Nine participants with mobility impairments were recruited, 6 male and 3 female, mean age 62 (*SD* = 9.26). One participant was African-American and the remaining were Caucasian. They were well educated, with all but one participant having some college training. Mobility impairment was operationally defined as having any self-identified mobility impairment since before the age of 50. All of our participants used a wheelchair at least a few times a week. Six participants lived in a single-family home, whereas the other 3 lived in an apartment. In a health questionnaire participants on average rated their health as "good" (M=3.0, SD = .86), but when asked to report difficulty (1=none; 3=some; 5=cannot do) in performing 33 common mobility/strength tasks, they reported experiencing "quite a lot" of difficulty (M=4.17, SD=.75). Participants reported their mobility impairment as quadriplegic, spinal cord injury, or post-polio. Some of the participants had experience with video conferencing software; 3 participants reported owning a smartphone, 5 participants had experience with Skype, and 4 with Facetime.

Interview Study Design

Before the interview, we mailed questionnaires that covered information on demographics, health, and technology experience. We then met each participant at a location of their choosing (typically their home or the campus laboratory) to conduct a semi-structured individual interview, which lasted approximately 2 hours. In this interview, we showed each participant a demonstration video about each of the televideo systems (Skype, Kubi, and Beam, in that order) that described the system's potential uses and capabilities. After each demonstration video, participants were asked about their opinions on the televideo. Questions we asked, which are a focus of this paper, include: What is your first reaction? What are some benefits/concerns? Lastly, a closing questionnaire was administered for input on design suggestions.

ANALYSIS

Audio recordings were transcribed, with participants' personal information omitted. Using MaxQDA software, the transcripts were segmented into analysis segments, which were defined as an uninterrupted statement or description that included participants' thoughts or feelings. For example, statement such as "Kubi is more interactive. You can see what you want to see when you want to see it." was coded as one segment. A coding scheme was developed to categorize each segment; the coding scheme was partially developed using a top-down approach, by basing categories on previous research studies (Beer & Takayama, 2011; Mitzner et al., 2010). The high level categories were first reaction, benefits, concerns, and advice for developers. On two randomly selected transcripts, two coders conducted two rounds of analysis independently. Discrepancies were discussed after each round, and a final inter-rater agreement of 85% was met between the two coders. The remaining transcripts were then divided between coders and analyzed.

RESULTS

Perceived Benefits

After playing each of the demonstration videos, participants overall had positive first reactions, indicating that they could imagine using televideo technology, to contact family, friends, and healthcare providers. To understand participants' first impressions, we asked them to elaborate on what benefits they saw in each technology. Visualization was a benefit mentioned for all three technologies. Specifically, participants liked that the technologies offered the ability to see, through video, the other person and environment, a capability above and

beyond the traditional telephone. Visualization was related to another perceived benefit: socialization. Participants discussed the benefit of the ability to communicate with others and see their facial expressions. One participant stated, "*you can see the emotion of somebody and it feels more like they're there by using Skype,*" and another said *"…my best friend in Louisiana I could see her and she can take me around her house a little bit.*" A "sense of presence" was also mentioned as a benefit. Participants indicated that televideo allowed them to feel present in another location.

For Kubi and Beam, mobility was identified as a potential benefit. Mobility included comments related to the ability to move the system around the environment, and/or control over where the camera pointed. A participant said,*"[Kubi] is more interactive. You can see what you want to see when you want to see it – control*."

Perceived Concerns

The most mentioned concern for televideo was perceived difficulty of use, indicating that participants would like a system that is easy to operate. Specifically, participants were concerned with the complexity and learnability of each technology's hardware and software. One participant stated about the Beam, "*you'd have to make it accessible for the unit. It just looked a little bit more technical for me to have to get around and operate*."

Concerns about security and privacy were also discussed, particularly misuse of technology to gain sensitive information, cause embarrassing exposure, or incur harm. One participant was concerned that Skype would accidently record a conversation or that the contacts list could be compromised if someone tried to steal information from his or her account. Furthermore, participants had concerns that the ability to tilt and rotate the Kubi might allow people on the other end to see things in the environment that the local user did not intend to let people see. For example, one participant said, "*Well, if I was in bed … I might expose myself accidentally [on the Kubi]*."

Lastly, mobility was discussed. Although mobility was also mentioned as a benefit, the ability of the Beam to move around the environment made participants concerned that it could potentially damage the environment, like breaking items in their home or being in the way; "*it would be an obstacle for me when I use my wheelchair.*"

Advice for Developers

Concluding questions were asked about televideo in general (i.e., not limited to Skype, Kubi or Beam): advice for developers who design televideo technology for older adults and things participants would like to know before owning televideo (Figure 2). Ease of use was identified as the most important design consideration. Voice activation was another function that participants thought should be included in the future design. For our target group, some participants not only had mobility impairment but also reported having difficulties using their hands; in this case, voice control would allow for hands-free operation. Participants recommended large font size, which is not surprising due to the likelihood of age-related vision declines. Lastly, participants indicated that before adopting televideo, they would like to have a clear understanding on how the technology works and what it is capable of doing.

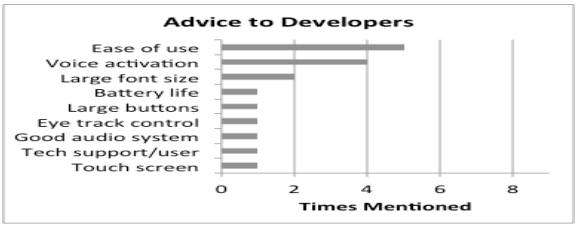

Figure 2. Advice for developers from participants.

DISCUSSION

In this qualitative study, older adults with mobility impairment discussed their attitudes toward and acceptance of televideo technology for staying connected with others. The televideo examples included in this study are commercially available technologies; nonetheless, acceptance of televideo by older adults with impairment is a relatively open question. Understanding acceptance of technology is a predictor to whether users are willing to adopt the technology into their daily lives (Davis, 1989).

We found that the older adults with mobility impairment were generally open and positive toward the use of televideo. The participants perceived potential benefits for all three telepresence technologies, including visualization, socialization, and mobility. These benefits are

particularly useful for not only the older adult, but also their family, friends, and health providers by offering two-way visualization (above and beyond a telephone), and also the autonomy of allowing the user to control camera angle, or movement around an environment (i.e., Kubi and Beam).

However, several concerns were also identified in this study. First, fear of damage to the environment by the system indicates that in the future, design developers might need to consider robust telepresence obstacle detection and avoidance (Takayama et al., 2011). Although this feature was mentioned in the telepresence demonstration video, participants still expressed this as a concern. Additionally, ease of use is crucial; ease of use is an important variable for predicting technology acceptance (Davis, 1989). Lastly, the fact that televideo offers users the ability to see, hear, and sometimes move, facilitates the potential for lack of privacy. Participants suggested that developers should design a system they can limit what and when the caller can see or record to eliminate invasion of privacy (Caine, Fisk & Rogers, 2006). Furthermore, knowing that difficulty of use is an important issue would suggest that if one were to introduce this technology into an older adult's home, acceptance would likely increase if training were provided.

This study is a first step in investigating televideo technology for use in the home for older adults aging with mobility impairment. Future research should have participants operate the televideo technologies, and conduct a thorough usability assessment to better understand what aspects of design contribute to ease of use. While demonstration of each technology through a video did prompt ample interview discussion, actual long-term usage of each system will yield a better understanding on adoption and sustained acceptance. Lastly, our target sample was limited to older adults with mobility impairment. Older adults with other kinds of disabilities will likely have different needs and uses of televideo.

ACKNOWLEDGEMENTS

This research was supported in part by a grant from the National Institute on Disability, Independent Living, and Rehabilitation Research (Department of Health & Human Services, Administration for Community Living) Grant 90RE5016-01-00 under the auspices of the Rehabilitation and Engineering Research Center on Technologies to Support Successful Aging with Disability (TechSAge; www.techsage.gatech.edu). The contents of this paper were developed under a grant from the Department of Health & Human Services, Administration for Community Living. However, those contents do not necessarily represent the policy of the Department of Health & Human Services, Administration for Community Living.

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