Sympathetic Devices: Communication Technologies for Inclusion Across Housing Options

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Abstract. Encouraging wellness at home is a necessary step in alleviating the healthcare system, but also a vehicle for promoting independence and quality of life among older adults. Even though much healthcare research is focused on autism, asthma, diabetes, to mention a few, depression caused by isolation is a serious condition related to healthy aging and outcomes. Addressing communication patterns across housing options might bring us closer to understanding and preventing social isolation and loneliness among older people. This paper discusses a research-based iterative process of applied within subjects survey and action research studies for designing communication technology devices for older adults. The relevance of this project is to understand the role of design and technology for adoption, home care affecting an independent healthy aging.

Keywords: design, older adults, communication technologies, isolation.

1 Introduction

The number of aging adults above age 60 in the United States is expected to double by the year 2030 to nearly 45% of the adult population [1][2]. With this increase comes the challenge of a higher demand on the healthcare system. Researchers in academia, healthcare, government, and industry are searching for ways to reduce this impact by looking to the home as one solution. Both encouraging wellness at home and promoting independence and quality of life among older adults is a necessary step in alleviating the burden on the healthcare system. Even though much healthcare research is focused on autism, asthma, diabetes, obesity and cancer, depression is a serious condition related to healthy aging and outcomes. Data suggest that social isolation and loneliness might be a major cause of depression. Addressing communication patterns with the social activities and channels used between two or more individuals (interpersonal communication), but also with the effectiveness of communicating with oneself (intrapersonal communication) might prevent isolation and loneliness among older people. Moreover, this understanding of communication needs and designing of communication technology devices might create new opportunities for affecting social inclusion.

The purpose of the project described herein is to approach the design of communication technologies for older adults with a better understanding of the user needs across housing options. This paper discusses the research-based iterative process of applied within subjects survey and action research studies for designing communication technology devices. We hypothesize that providing more acceptable or "sympathetic" aesthetic and experience design, along with ease-of-use and understanding of the usefulness of technology devices will result in greater adoption by older adults. The significance of the project is to link research to design and design to research by not only identifying the causes of isolation, but also by executing solutions based on grounded findings and evaluation of the efficiency of the design and technology intervention. Importantly, the relevance of this project is to understand the role of design and technology for adoption, home care and independent healthy aging.

2   Background

Depression is a growing health concern among the aging population affecting nearly 7 million aging adults in this country. Depression has been identified by the Centers for Disease Control as one of four areas that should be addressed to improve older Americans' health and quality of life. Several studies have linked depression to loneliness (or emotional isolation as a subjective unwelcome feeling of lack or loss of companionship) and social isolation (defined as the objective absence of contacts and interactions with a social network) [3][4][5]. Data suggest that social isolation and loneliness is the major cause of depression and one of the major factors influencing premature death among elders [6][7]. Studies have shown that aging adults experience social isolation and loneliness as a result of death or loss of their companion [8], decline of their social networks due to: loss of mobility or disability [9], relocation to support disability or expected future care needs, or relocation or death of family or friends. Even in congregate living facilities, which afford social exposure, loneliness may still be experienced among older adults [10].

Successful communication patterns not only can be defined with the social activities and channels used between two or more individuals (interpersonal communication), but also with the effectiveness of communicating with oneself (intrapersonal communication).While studies of computing communication technologies within the aging population suggest that family communication and community support have a significant impact on reducing isolation and encouraging healthy aging, few studies have examined the role of intrapersonal and interpersonal communication and how technologies might be a portal to avoid social isolation and loneliness. Yet, many technology-enabled services aimed at health and wellness in the home have been slow to expand in the market due to a poor understanding of user needs and the manner in which services are delivered [11]. As such, this project aimed at identifying the communication needs of older adults living independently across a range of housing options and to design/develop inclusive communication devices to help older adults maintain personal and social connections.

2.1 Participant Population

This project focused on older adults who are living independently, with or without other residents, like spouses. A total of 26 participants were part of the sample population.   In determining the settings for the study, three housing options were chosen that included a population diverse in income and social organization: Continuing Care Retirement Communities (CCRC), Naturally Occurring Retirement Communities (NORC) and Aging in Place (AP).

CCRC are generally suburban private neighborhood designed facilities that target a faith-based population of older adults, age 70 and older. The CCRC provides a continuum of care including independent living options. For this project, we targeted a CCRC located in the suburbs of Atlanta, where independent living older adults are living in both duplex-style and apartment-style homes. As part of the services, the community also facilitates formation of clubs and organizes events both on and off campus for residents to participate in. Due to the funds needed to purchase a residence and cover the monthly fee, residents are considered to comprise the high-end of the study's income spectrum.

In contrast to a community designed to deliver retirement living and services, NORC are neighborhoods, where many of the residents are older adults, who have either lived in their homes over several decades, or resulted from a significant natural migration, due to ease of access to other older adults or various amenities such as shopping, faith-based organizations, entertainment, etc. They are organized communities with centers providing services to support the needs and interests of a concentrated area of the older adult residents. For this project, we identified two NORC in the Atlanta area that addressed different demographic groups: one supporting a faith-based neighborhood area and the other supporting an inner city neighborhood area. Both communities were representative of older adults with different income levels, from average to below the poverty line.

AP was another housing option included in our study that consists of older adults distributed around the city and suburbs generally aging in their homes over several decades. These individuals were recruited through a list available through a center located at our institution.

2.2 Survey and Action Research Studies

The project was based on a volunteer sampling design. A total of 26 participants comprised the sample population across the aforementioned housing options. To address the topic of isolation across housing options, we proposed a number of iterative within subjects research study. For example, a participant from one phase of the study may also participate in another. The study was divided into different phases: survey research phase (1), action research product design phase (2).

In phase one of the study, participants were each given a cell phone linked to a system that called them three times a day and asked them questions related to isolation. This project used Jitterbugs as a designed cell phone device targeted for older adults. Jitterbugs are easy-to-use cell phones with simple interactions and suitable tactile button interfaces. Participants were trained on the use of these cell phones prior to the data collection in order to guarantee the successful performance of the phone survey

study. During the survey, participants were asked questions about the number and type of activities performed daily as well as their emotional state. The survey took on average 20 minutes daily, and ran for five consecutive days.

After the survey was completed, participants had a 30-minute face to face follow-up interview at their homes to assess their attitude towards technology and its use. The findings of this phase were used to inform the design criteria for the communication technology which would come to be known as Sympathetic Devices. The design and development of these devices was carried out with the Industrial Design Graduate Studio course at the Georgia Institute of Technology. By the end of the course, a variety of devices were designed.

For phase two of the study, participants engaged in a focus group that lasted approximately two hours. Participants were presented with prototypes of the designed devices so as to gather their feedback and select a concept to be developed and evaluated in subsequent studies. However, before approaching the aforementioned phases, a careful literature review was conducted to understand current communication technologies and answer how their design and functions can have a significant impact of older adults and their adoption of the technology.

2.3 Communication Technologies

Communication technologies such as video conferencing, email, photo-sharing, social networking, and medical information sites would all benefit older adults, but many don't have the knowledge or patience to learn how to use the computer, let alone setup and learn to use these applications. As such, in order to bring these applications to the older adult, technology must be designed in a manner that older adults can relate to, understand the benefits, manipulate, and enjoy the technology. Several previous projects have focused on the need for more tangible means of delivering communications, such as ECHOES [8], Fridgets [12], and The Jive [13].

In the ECHOES project, a TeleTable concept targeted populations, age 65 and up, to understand and improve companionship, with a goal of preventing loneliness and depression. The researchers developed multiple touch screens embedded in a kitchen table, and a small, portable box, called a Pitara, full of interesting objects and digital media readers to identify them. This product would allow older adults to interact virtually with others, such as playing games, organize photos, and perform communication related tasks, such as writing a digital letter with a stylus and sharing with friends and family. The focus of the research was primarily on providing an outlet for grief at the loss of one's spouse and resituating the individual socially to avoid onset of loneliness and depression. Many of the interaction aspects of the project were tested through usability studies, indicating that touch screen interaction can be useful for organization and gestures. The concept was clever, but as designed would prove expensive for older adults. While they performed user studies on the basic concepts of the interaction, it is not evident they considered how older adults would accept transforming or changing out their kitchen table.

The Fridgets project focused on designing a technology that would increase independence and connectedness among older adults. The project featured refrigerator magnets that each had a different function, such as weather notifications, reminders, sports information, cooking information, etc. One central 10 inch LCD screen served

as the primary means of delivering visual content, while touching other magnetic add-on modules on the refrigerator will change out the information on the screen to the context of the module they tapped. The concept device could also receive email and photos from friends or family, and touch screens are used to interact with information.

The Jive project focused on providing older adults the possibility of creating their own social networking sites by tapping into friends' and family's feeds. Each person's information was associated with a sensor tagged photo block, that when stuck to the screen provided the social networking site page for that friend or relative. The project study did indicate that older adults can feel more connected with the device; however, there was no evidence on older adults building a social networking presence.

3   Design

Phase one of the studies was crucial to the success of the project. The findings of this phase were used to inform the design scope and criteria of the communication technology—sympathetic devices. More importantly, it was a phase intended to link research to design and design to research. Survey, interview and focus group studies were carried out to incorporate the user in the design process.

During the survey studies, students were given the opportunity to be involved in the project. They carried on a design project for two months linked to the framework and population of this study. A total of sixteen students were involved in the class. The class was divided into eight teams, where each team conceptualized, designed and modeled a sympathetic device for the subsequent phase.

The major relevance of conducting this project in the class, was that students were able to work closely with older adults to advance their design solutions. The most interesting aspect was how the students and the aging community were unified in the process. The face-to-face interviews were of extreme importance in the project. Older adults stayed in touch with the students after completing their research protocol. There was a natural and mutual interest in aiding the design process, what can be referred as to communication by design. It was truly integrative evidence on how to design for inclusion and communication technologies.

3.1   Formative Conversations

Based on the interviews, participants were able to inform the design process in an insightful manner. Different open-ended questions were developed to assess the participant's technology use, attitude to trying new things and communication frequency and needs. Their answers, even though varied, informed the outlook of how communication technologies are relevant for everyday activities. Below, there are a few short excerpts from the conversations established with older adults and the designers. Even though they are a few in number, they served as examples of how rich their interaction communications can be formative for design.

One of the major comments from participants was the fact that older adults are willing to try new things and are not afraid of technology. For example, one of the participants stated: "I haven't been exposed to new things for awhile. I had to get a new printer, so I learned about that, and I am still learning about my computer. I'm

not illiterate, but I'm not a real expert user either. A lot of my friends here, throw up their hands and say that don't want to look at a computer. Right now, if you're not a little computer literate, then you're out of it. And I don't want to be out of it."

However, as stated, if technologies are used, they should be designed in a manner to support current lifestyles. One participant interestingly stated: "I write them (letters), but then I send them on the computer."

Older adults are active users. But being active does not necessarily mean that the process of doing activities should be fast. They should be enhanced with the opportunity to accommodate to an individual pace and to celebrate the joy, even the rituals of accomplishing tasks: "I like to play games on the computer… I am task oriented, but I don't like to sit down, and I don t like to be idle, I need to be doing something, I don't, could be just nervous energy"; and: "A cell phone means fast, be brief, get it over with and I like conversations…and that is not rigid.. I was 51 years old before I learnt to use a pressure cooker and I was in my mid thirties before I learnt to drive. So gadgets and I...we are not like that".

More important is to realize that connections among people regardless of age should be enhanced. The problem relies on better indentifying the different communication styles: "Contemporaries have all time to talk. Younger people are involved in study and their careers and their jobs etc…and they do not have as much time or are able to call as often as the contemporaries."

Even though older adults may feel technologically challenged, attention should be placed on the accessibility and inclusive aspect of designs for them. It is not so much a question of what but how they should be designed for older adults.

3.2   Design Criteria

Based on the data collected from the survey and interviews, design criteria emerged when conceptualizing the communication technology devices for older adults. This criteria is nevertheless an approach to design of sympathetic devices, by understanding and responding to the real needs of older adults.

It became apparent that students were able to inform the design process following a set of open guidelines in their creative process. One the first guidelines included making use of current and available technologies in a creative manner. There are many approaches in bringing about solutions that are detached from the reality of users, becoming products that are only available at the laboratory level or to just a few people. As such, the goal was to arrive to the design of cost-effective solutions that make use of simple off the shelf technologies in order to potentially advance those concepts for fast deployment in the market.

Second, inclusive design approaches become central for concept ideation. Designing devices for older adults should be addressed in a universal manner. Older adults may experience limited vision, dexterity problems, hearing loss, mobility problems, etc. As such, communication technology devices should be designed in a multisensory manner to address the different needs from the population.

Third, simplicity in the interface also became fundamental, where tangible embedded technologies were a preferred viable technology. They offer the possibility of envisioning concepts that can move beyond the typical desktop interface into new physical contexts. As such, concepts could have the potential to be outlined by using

graspable interfaces, sensor-based interactivity, and ambient technologies to mention a few, where the products and environments older adults may interact with on a daily basis, can potentially be computationally facilitated in a less intrusive manner.

Lastly, flexibility of use was a major design criterion. Older adults have diverse needs not only across the population and their housing options but mainly within their healthy lifestyles. A well designed device should be able to accommodate sudden and temporal changes without compromising the functional, accessible and simple use. That is, allowing different use of the product(s), across users and spaces.

3.3 Sympathetic Conceptualizations

A series of concepts and rough prototypes were developed using creative technologies and interfaces aimed at promoting more intra and inter personal communication and socialization. At a high level, devices were conceptualized around everyday simple activities and using communication at the interpersonal and intrapersonal level to reduce isolation in creative ways. Concepts were articulated around remembering (cognitive aids), eating (addressing the issue of eating alone), learning (life-long e-learning tools), and moving (incentivizing activity). A total of eight communication technology devices were conceptualized.

The first concept, "*Thinking of You*" is a communication device consisting of five square (5x5 inch) stained wooden blocks with a translucent white overlay and a stainless steel hook. Each block can be placed to a magnetic bar that can be mounted to the wall. Each block is associated with a person in their social network by attaching something memorable about that person to the hook. The user may touch a block to send a simple gesture to the person associated with the block. When receiving a gesture, the translucent overlay glows.

The second concept, "*TagIt*" is functions similarly to the previous concept, but designed as a stained wood tri-fold frame with metal décor on the two outer panels and a touch screen LCD display embedded in the center. These panels provided a surface on which to attach small magnetic photos surrounded by clear frames. The photo frames glow when a message arrives and touching the photo brings up the associated person's message or media on the LCD screen. The user may touch a control on the LCD to send an audio/video response recorded by the device. The remote recipient may receive messages through email, instant message, or other means that fits their preference and communication style.

The "*Altruist*" concept focuses on informing the user of the presence of their connected friends at one of the common areas in a community. The model consists of two glass objects that could be used as a keychain or carried in a pocket. At home, the objects would be placed in a glass dish. Each friend would have one of these objects and be able to join the other's circle of friends by fitting their two glass pieces together for a short time. After joining, the glass dish base station will play music, specific to location, when one of the circle of friends enters a common area, like the gym or spa. The hope being that they will be more likely to get out and socialize if they know their friends might be at a particular location.

The "*Forgetfulness*" concept utilizes a bracelet with color-coded plastic tags embedded and is intended to replace the string on the finger reminder. The tags may be removed to place on some object, then a voice message is recorded on the bracelet.

Colored lights on the bracelet indicate the tag is missing. Pressing a button plays back the messages and returning the tag clears the associated message.

The "*ShareLab*" concept is designed to provide a simplified method for older adults to share their crafts with others, either for sale or pride. The device is designed to look like a scrapbook, but with an LCD screen and physical slider to move from capturing a photo to editing that photo, then sharing the photo. The share application included a method of pushing images to monitors around a community or emailing to a friend. The concept also allows receipt of messages in response to shared images.

"*C-Connect*" is a concept to link older adults to cultural institutions, events and databases. Influenced by the design of audio guides from museums, the device looks like an extended PDA with a small LCD screen and physical controls to select options and playback media. The device can learn preferences and search for information on lectures and similar cultural events, suggesting the most relevant to the user. It can also download and playback PODcasts or other media.

The "*Mockingbird*" concept is aimed at allowing older adults to easily capture music, build playlists, and share the music with others. The system consists of a small clip (similar to a refrigerator clip) that when pinched close, would record a short clip of music played nearby. Returning the clip to one of two types of stations, it will upload the clips and online software will match them up with the song ID online and add it to their playlist. In the docked position, the docking station will play the playlist from an online personalized radio site. The clip can also be clipped to a common area music system to share the individual's playlist.

The "*DinnerCloth*" is a concept providing a means for indicating presence of another individual sitting down to dinner, thus providing a sense of connection to friends and family during meal time. The design is in the form of a placemat with interleaved loops. Two small fiber optic strands with wooden beads at either end are split and one given to the older adult and one to the other family member or friend. Each may then weave their strand in a pattern that associates them with the other individual. When someone sits down with a shared strand, the matching one glows on the placemat and vice versa, thus given a sense of presence at meal time, when a sense of loneliness might otherwise set in.

3.4   Older Adults in Design

The aforementioned concepts were prototyped and used in a focus group with older adults in a usability lab setting. The group was comprised of older adults representing the NORC communities and AP. The participants varied in ability (including vision and hearing impairment, dexterity, and mobility), age, and number of home residents (from alone, to companion care to living with family).

The focus group was articulated with different activities. First, older adults were presented with the prototypes. Older adults provided feedback for each from a first impression aspect, guessing what each model might do. Each concept was then presented by students to the group to help them understand the benefit of the concepts. The group was asked to talk through their thoughts on the concept and after all were presented, grade each on most to least likeable considering individually perceived value and easy of use, aesthetic preferences, and likeliness to adopt the communication technology—sympathetic devices. It became apparent that aesthetics of each concept were weighed more heavily than the function by most of the group. When

asked about whether each would benefit from the concept, at least 50% focused on the appearance and had to be asked several times to get a valid answer.

The well-received concept was the "*Forgetfulness*" bracelet concept. One possible explanation is due to the simple aspect and usability of the product addressing a common shared need of the group. Also, it was the only concept that was presented through a video scenario, which likely had some impact on the recall of function by the participants. It is apparent from the focus group that aesthetics and inclusive design indeed play a significant role when designing a good technological system for older adults. The subsequent well-received concepts were "*TagIt*" and *"Thinking of You"* due to the perceived usefulness and realistic approach. It is expected to redesign the last two concepts into a unified approach to develop functioning prototypes, evaluate and implement them in the homes and lifestyles of older adults.

4   Conclusion

Communication technologies have the potential to enrich many aspects of our lives, especially for older adults. But if not well designed, it is not likely they will be successfully adopted. This project and the documentation related to the design of communication technology—sympathetic devices for inclusion serves as an example of designing for older adults. The major aspect of this effort is the evidence that research has started to extend from investigator-initiated and technology-centered to a needs-driven, user-centered approach. Research is crossing its practice boundaries by including the users, industry and the classroom in a unified process. In terms of the design, this project serve as evidence that aesthetic and experience design, along with ease-of-use and understanding of the usefulness of technology devices have an impact on older adults accepting technologies. There are a number of criteria that affect the success of designing such technologies for older adults ranging from its functionality, value, design and cost. We have described four criteria toward designing sympathetic devices: realistic design, inclusive design, simple design and flexible design. As such, to design for older adults it is to design in an inclusive manner, where the physicality of the interface, therefore traditional approaches towards product design, remains a valid approach in bringing about successful, implementable and adoptable solutions.

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