ECHOES: Encouraging Companionship, Home Organization, and Entertainment in Seniors

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ABSTRACT
The ECHOES project (Encouraging Companionship, Home Organization, and Entertainment in Seniors), is focused on understanding and improving aspects of companionship in senior populations aged sixty-five years and older. Individuals in this age range commonly experience the loss of close friends and life partners. Furthermore, they are at risk of suffering from feelings of loneliness and depression. The project team consulted with several experts on aging in order to better understand the target population. The team followed an iterative design process which included focus groups and field studies. Potential design possibilities were identified and a final design prototype was chosen after several rounds of usability testing. The proposed system includes "TeleTable," an interactive table-based device that offers intuitive means of arranging and organizing digital media. The TeleTable also functions in a communicative capacity, encouraging individuals to interact with each other by playing simple games, conversing verbally, and exchanging digital photos with each other. This system also includes the "Pitara," a portable device enabling the association of physical mementos and keepsakes to digital media which adds a mobility, lifetime sharing and storytelling aspect to the TeleTable.

Author Keywords
Companionship, TeleTable, Pitara, Assistive Technology, Eldercare, Design Ethnography, Interaction Design, Seniors.

ACM Classification Keywords
H.5.m Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION TO PROBLEM DOMAIN
The elderly play many roles in different cultures including acting as leaders, nurturers, teachers, and mentors for younger generations. However, in modern westernized cultures, they generally play a limited role in the makeup of societal identity and function [9]. Furthermore, seniors can often find themselves separated from their families who may have relocated to other parts of the country or world. Such problems can isolate and disconnect seniors from their loved ones and their livelihoods. However, the elderly in the US and elsewhere may soon find themselves in the spotlight once more as we move into what has been called "The Aging Revolution," where nearly one in five Americans will be over the age of sixty-five by 2030 [3].

CHI2005, April 2-7, 2005, Portland, Oregon, USA,
ACM 1-59593-002-7/05/0004.

The Issues of Companionship
Of all the issues related to senior populations, the problems associated with the loss of a companion are especially important. Many seniors' lives have been defined by connections with their wives or husbands. However, as nature runs its course, death and loss become unavoidable parts of elderly existence. There are a wide variety of responses to the loss of a companion. Some individuals cope with their loss by strengthening bonds with other friends. Others devote their time to helping the community through volunteer work, or purchase household pets. However, many seniors are unable to deal with their loss, and become deeply depressed. Complicating factors such as socioemotional selectivity [12] can also limit the willingness of individuals to seek out new forms of companionship due to their perceptions of the limited time they have remaining.

In order to understand the effects of loss of a close companion, it is necessary to understand the role companionship plays in the lives of seniors. Companions have an extended relationship to the individual that goes above and beyond simple friendship. These companions experience life together, provide support and safety for one another, and serve as a counterpart in discussions. Dealing with the loss of such an important and versatile individual impacts their lives negatively on several levels. For these reasons, assuaging this contingency has been an area of growing research and investigation.

Related Research in Senior Companionship

Several attempts have been made to monitor and improve the quality of life for senior populations in regard to companionship. These range from novel forms of communication and interaction such as the "ELDEr Care Project" [11], "TeleWindows" [10], or "The Hug" [8] to artificial forms of companionship involving robotics and artificial intelligence such as the AIBO [1] or "Snuggling Ifbot" [15].

All of these approaches suffer from obstacles in their acceptance and effectiveness in senior populations. First, while most seniors would want strong connections to their children and grandchildren, this does not completely satisfy their needs for companionship. Seniors also have stated the need to maintain connections and interact with individuals of their own age [7]. While telephones and chat rooms allow for instant communication with almost anyone in the world, current communication technologies do not facilitate group oriented, casual, or non-focused conversation which is an important part of companion interaction.

Also, seniors in some cultures, such as those in South East Asia, have begun to experiment with limited forms of artificial companionship [15]. However, it is highly unlikely that all populations will accept artificial agents in their current incarnations. This is in part due to seniors' self reported desire for "real" human interaction [7], and their need for a depth and breadth of conversational context that current artificial agents cannot currently provide. Furthermore, elders exhibit trends toward increased religiosity and conservative mindsets, which can dissuade them from seeking out implementations of artificial companionship [7]. This is not to say that all generational cohorts will exhibit similar preferences. Over the course of several decades it is possible that the moods and tendencies of the average senior will change drastically. However it is unlikely that the influential population of "Baby Boomers[1]" will be ready to embrace artificial companionship in the form of an artificial intellect.

After consulting with focus groups and with experts on aging, the team reached a conclusion: a companion cannot be replaced. Instead, bonds with the individual's other friends should be strengthened and new companionships should be created. The individuals who have lost a spouse or friend must redefine their place in social contexts without their prior companions. This will be a difficult period of time in their lives, but through the use of aptly designed communication and life sharing technologies, the grieving individual can connect with a new network of companions, as well as share the memories of their lost companions.

[1] The large generation of individuals in the US born soon after the end of World War II (1946-1964) whom the project focuses on.

Day-to-day Objects

Since artificial companionship was not initially accepted by the senior focus group, the design process centered on other concepts or items that they will feel comfortable with. Of the vast array of items a person interacts with over the course of a lifetime, furniture is particularly important [5]. Due to their inherent functional and aesthetic nature, pieces of furniture can play a prominent role in social setting arrangements, as well as in organization. Furthermore, furniture creates a domestic aesthetic that communicates aspects of personality. For the purposes of this project, we have chosen to focus our design on the role of the kitchen table. Every individual in our focus group discussions mentioned having a kitchen table, and most individuals stated that the tables serve a wide variety of organizational, conversational, and recreational needs in the household.

DESIGN PROCESS

The ECHOES project was persistently guided by an iterative design process. Throughout the project, key issues relevant to aging and loss of companionship were explored and verified through interviews with experts and potential users of the system, as well as through focus group studies with seniors. After sketching rough concepts, early prototypes were tested using the 'Diamond Touch' Surface [6]. The results of this initial user testing were used to further refine the concepts and enhance their utility, while confirming the feasibility of the solution. At every stage of the process, user needs and requirements were recapitulated and evaluated using a set of personas [7]. These personas were developed using data garnered by thorough explorations in the field of gerontology as well as results from questionnaires [7].

Identification of Key Issues

Challenged by the task to create an artificial companion which caters to the social, emotional, physical and psychological needs of the senior population, the team decided to focus on two core issues related to loss of companions:

- Ameliorating one's grief due to major loss.
- Redefining a senior's role in society after such loss.

There were also a number of corollary issues related to the theme that were investigated. Among these was the question of how to keep seniors connected to more technologically advanced relatives and friends. Another related issue involves providing means for seniors to connect to like-minded groups in order to foster supportive social networking. Furthermore, enabling organization and sharing of digital photographs was a concern. Finally, the question of how to encourage seniors to engage in frequent casual conversation with friends and family was explored.

Many methods were used in order to identify the key issues relevant to this project. These methods will be described in the subsections below.

Research: A number of published materials, articles, and videos relating to aging and gerontology were studied. The team visited several experts on the subject, including the Indiana University Bloomington Center for Aging Research, the Retired and Senior Volunteer Program (RSVP), and the Indiana University Bloomington Continuing Studies Lifelong Learning Programs. An interesting finding from these visits showed that the most pressing attractor to technology for seniors was the use of eBay, which allows seniors to sell unused objects. Preliminary research also included meetings with residents at a local senior housing complex, and a visit to a senior volunteer session as an ethnographic observation. These sessions showed that seniors enjoy having child companions, but they also require friends of their own age.

Concept Exploration: Ten potential prototype designs were implemented as exploratory prototypes to investigate the feasibility and relevance of forms and functions related to companionship [7].

Focus Group Study: Six residents (two couples and two widowed seniors) from a local community housing center were invited for several focus group discussions. The volunteers were asked several questions regarding lifestyle and personal issues. Meetings involved discussions about day to day activities, use of and comfort with technology, and interactions with families, friends, and grandchildren. These sessions guided the team in choosing the strongest ideas from the initial group of exploratory concepts.

Refining Requirements through Iterative Design: Once the optimal shape and functionality of the devices were selected, the exact implementation and form of the objects were refined through a series of high-fidelity mock ups and prototypes. This allowed the team and test participants to envision, understand, and test the system.

Prototypes and Concept Refinements

The TeleTable and Pitara concepts were discussed in focus groups and were then refined based on the comments made by participants. Using current technologies, various prototypes of the design concepts were created and then tested by target users. An initial prototype of the TeleTable was implemented using Mitsubishi Electric Research Lab's (MERL) "Diamond Touch Surface." [6] The Pitara concept was implemented using RFID technology and a USB based digital media reader in a box resembling an Indian Pitara.

Usability Testing

A number of topics were considered with regard to the use of the TeleTable by seniors in natural settings. The initial prototype was used to test the system's ease-of-use, and to analyze the acceptance of the touch and gesture-based interaction model. The team also conducted user testing sessions to discover if the conversion of physical affordances to digital media was accomplished in an intuitive way. These tests showed that physical implements should not be used in conjunction with the DiamondTouch surface, but otherwise the interface proved extremely intuitive for the manipulation of media in organization tasks. The studies were approved by the Human Subjects Committee and informed consent was obtained from all participants.

PROPOSED SOLUTION

This section describes the various elements of the TeleTable system. These elements can assist seniors individually and can be combined together to form a system capable of enhancing companionship. The principle task of this system is to keep the elderly connected and to provide a device to help organize their digital media through the use of the TeleTable. Furthermore, the Pitara enables mobile display of seniors' digital media for friends and family.

Overview of the system

The system has two major components, an interactive digital table surface called "TeleTable" and a physical-digital information container box called "Pitara". While the TeleTable is located in the home, the Pitara is designed to be mobile, enabling the individual to take it on vacation or to friends' homes.

TeleTable

The TeleTable is an extension of a kitchen or center table. It uses currently available technology, and would not be out of the price range affordable by most seniors. The TeleTable is comprised of several different parts including:

Touch Screen Digital Surface: The top surface of the TeleTable contains an arrangement of multiple touch sensitive computer monitor screens which function as display and interface surfaces (Figure 1). The functions of the table related to sorting and organizing are accomplished through touching the screen either through one's hand or by means of a stylus.

Placeholder for Pitara: The center of the TeleTable contains a special slot for the Pitara. Placing it in the center activates a function which associates digital images on the TeleTable with the physical objects contained within the Pitara. Adding new artifacts to the Pitara queues up associated digital objects on the screen.

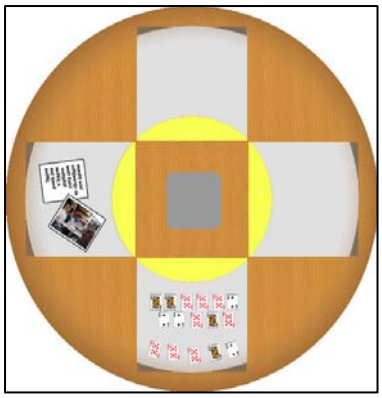

Figure 1. TeleTable Surface

Specialized Operating system and Hardware: The system runs on a limited operating system that runs the GUI display on the touch-screen, RFID sensors, and USB connectivity. The system also allows input from digital

cameras and flash memory media. Current standard desktop computing hardware is more than adequate for these tasks, and can be easily contained within the table base. The technology inside the TeleTable allows it to perform a variety of organization, entertainment, and communication related tasks.

Among the tasks that the TeleTable can potentially perform, the following are especially important to the theme of our problem domain:

Playing Games: Engaging in leisurely activities is a vital part of a healthy lifestyle, especially for seniors. Recent findings have shown that elderly who have increased cognitive activity due to participation in recreational game play are less likely to develop dementia as they grow older [4]. Also, many seniors are now engaging in online gaming. The communication context of various board and card games affords relaxed, non-focused conversation. Social interactions in the form of games keeps individuals engaged and interacting far longer than traditional methods of remote communication such as phone calls or instant messaging. Recent surveys show that online gamers are predominantly middle-aged (35-49 year old) women [13], and this generational cohort will most likely continue this practice well into their senior years.

Writing Digital Letters: Using a stylus and the touch sensitive screen, seniors can compose a letter without having to use a keyboard. Individuals without typing training and those suffering from repetitive stress injuries to the wrist will both be able to create letters comfortably (Figure 2). The interface allows for a visual address book, so that seniors will not have to learn e-mail address protocols.

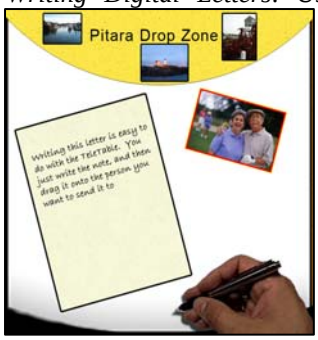

Figure 2. TeleTable Screen Interface

Organizing Personal Photographs: Elderly people love to share their life experiences with others. Digital media technologies can be a very effective platform to record and create digital memories providing a method for storytelling. However, organizing and managing all of these media is a daunting task for anyone. The TeleTable allows seniors to organize the photos in a more intuitive and natural fashion than what is provided in standard desktop environments.

Pitara

The Pitara takes its name from a Hindi word meaning a "small box of interesting objects that grandparents share with their children." It aids seniors in sharing photos and mementos with friends and family. In its original sense and our digital appropriation of the Pitara, mementos serve as tangible items to engage listener curiosity, and serve as props to enhance the storytelling aspect of a senior's experiences. The physical nature of the objects also affords easy association with pictures, leading to more meaningful photo organization.

Figure 3. Pitara and Assorted Mementos

Organization of photos is a task that senior focus group participants claim to struggle with when using current technologies. When RFID tagged items are placed inside the Pitara, associated photos and video are displayed in the form of a slide show on a small screen attached to the lid of the box (Figure 3). This mobile system serves as a way to share the memory of a loved one or the events of a trip in an extremely useful fashion.

Technology

The Pitara uses radio frequency identification (RFID) technology which allows individual objects to retain a unique identifier. The identifier can be a sticker or discrete tag which when placed on the personal object can be sensed by a small antenna located in the box. The identifier brings up the images onto the screen which can be navigated in a sequential fashion via controls on the box. The pictures can be sorted and organized from the TeleTable, or loaded directly into the box through a USB connection.

Scenarios of Use

Susan is a sixty-eight year old widow who lives in Carmel, an Indianapolis suburb. Susan has become lonely since her husband Joseph's passing, but decided to keep their Indy home full of shared memories. Joe served in the Navy, so Susan would like to associate all of his military memorabilia with photos of him taken during his service. She transfers photos from her digital camera and scanner to the TeleTable through the USB cable or the memory card slot, and each photo is displayed on-screen. Next, she places her Pitara in the center of the TeleTable and applies a small RFID sticker tag to the back of Joseph's service medal and places it into the Pitara box. This causes the table display to change, showing a section of the screen marked "Pitara Drop Zone". Susan then selects photos with her hand and drags them onto the Pitara section of the screen. This downloads the images from the TeleTable to the Pitara and associates them with the tag on Joe's service medal. Later that month, Susan brings the Pitara along on a trip to her daughter's home. Her grandchildren are immediately intrigued by the medal from their grandfather's military service. Susan gathers the children around the Pitara and places the medal inside, which brings up a digital image on the Pitara screen. Susan is able to scroll through the photos of Joe one by one, describing their experiences as a military family. Susan is happy that she can so easily pass on the memory of Joseph to his progeny, and talking about her late husband helps Susan cope with her loss.

Later that afternoon, Susan uses the TeleTable to connect with her friends. In the evening she sees a number of her friends' photos on the TeleTable screen, indicating that they are playing an online card game. She presses a button on the screen indicating that she is present and wants to chat with them, and is instantly able to hear the conversation going on in the room. She joins her friends in a game of Canasta and engages in casual conversation. Susan interacts with her cards by selecting them with her finger and placing them in the proper areas of the TeleTable. The game goes on for several hours, and after a while Susan realizes that it is time for dinner. She thanks everyone for the game, says goodbye, and exits the game by shutting down the TeleTable so she can use it as a setting for her dinner plate.

CONCLUSION

The high level of variance in physical and mental capabilities makes seniors one of the most difficult groups to design for. However, the potential for substantial improvement in the creation and maintenance of meaningful companionships in this age group is very real. Our proposal shows that the activities afforded by the TeleTable and Pitara can improve this quality of life for seniors living alone or with partners.

By encouraging deeper casual social interactions through games and sharing of personal memories and their tangible artifacts the TeleTable and Pitara can bring about emotional engagement, thereby encouraging and strengthening human-human companionship. Furthermore, by supporting intuitive and accessible methods for organizing and composing digital media, the TeleTable can help seniors to utilize the potential of new communication technologies in their interactions with family and friends.

ACKNOWLEDGMENTS

The Echoes team would like to thank Martin Siegel, Yvonne Rogers, William Hazlewood, and others in the School of Informatics who offered their guidance and support. We also wish to thank the residents of the Meadowwood Community, the Indiana University Center for Aging, the Retired and Senior Volunteer Program, and all of the participants in our research studies.

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