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Abstract

In-home technologies can support older adults' activities of daily living, provide physical safety and security, and connect elders to family and friends. They facilitate aging in place while reducing caregiver burden. One of older adults' primary concerns about in-home technologies is their potential to reduce human contact, particularly from cherished caregivers. In this exploratory in-situ study, we provided an ecosystem of networked monitoring technologies to six older adults and their caregivers. We analyzed the amount and content of communication between them. The amount of non-computer-mediated communication stayed the same or increased through the six week study. The content of communication coalesced into four themes: communication about the technologies, communication facilitated by technologies, intrusiveness of technologies, and fun and playfulness with the technologies. Our results suggest that in-home technologies, designed with sensitivity to older adults' primary motivations, have the potential to strengthen important relationships in later life.

How In-Home Technologies Mediate Caregiving Relationships in Later Life

Key terms: Older adults, caregivers, in-home technologies, relationships, communication, privacy

Introduction

There is significant evidence to suggest that integrating information technologies into the homes and daily lives of older adults can significantly enhance their quality of life. In-home technologies can support activities of daily living, provide physical safety and security, connect older adults to family and friends, and have the potential to help older adults age in place while reducing caregiver burden. Older adults are generally considered to be less enthusiastic about adopting new technologies, less familiar with their uses, and more concerned about the impact of new technologies on their relationships than younger users. Thus, overcoming the digital divide among elders requires more than appropriate design and implementation. It demands deep consideration of the ways in which technology mediates, influences, and is shaped by *human* relationships (Kvasny, 2005; Loe, 2010).

One of those essential relationships is that between an older adult and their informal caregiver. Informal caregivers are usually family members or very close friends who provide practical care and/or emotional support. These relationships are highly salient to older adults' mental and physical well-being. A critical component of well-being in late life is adaptation to changing capacities and circumstances (Baltes, Lindenberger, & Staudinger, 1998). Successful adaptation strategies include prioritizing the activities and relationships that are perceived to be most important (Scheibe & Carstensen, 2010; Carstensen, Gross, & Fung, 2003; Blieszner, 2006).

As illness or functional limitations challenge the number of activities and relationships that can be maintained, older adults choose to focus on those that they find the most emotionally rewarding. These relationships are most often with cherished family and friends that provide informal caregiving. One way older adults can facilitate these important relationships is to use technologies that reduce caregiver burden while supporting aging in place (Lorenzen-Huber et al., 2010; Caine et al., 2010; Carstensen, 2011; Essen, 2008).

Research on the use of technology in caregiver-older adult relationships suggests that sharing information reduces caregiver burden, strengthens relationships, and enhances the quality of life of both parties (Mynatt et al., 2001; Consolvo et al., 2004). Networked pervasive technologies provide information to family caregivers about health status, activities of daily living, safety, scheduling, and social activities. Such technologies can be empowering to older adults and their families alike; however, designing technologies that are useful to all and sensitive to the concerns and needs of all parties remains an ongoing challenge. Many individuals, not just older adults, are concerned about the potential for communication technologies to replace (or reduce) human contact, intrude into their own lives and the lives of their loved ones, or break down at key moments.

In this work we were interested in exploring these questions of communication between older adult and caregiver and gaining an understanding of how that relationship would be affected by the introduction of in-home technologies. Rather than beginning with an assumption of need or deficit, we began with a group of older adults where all of the participants were satisfied with the level and content of communication with their caregivers and in the overall quality of their caregiving relationships. In addition, all of the older adults in the study lived in a retirement community with sufficient safety and amenity services. We reasoned that if we started

with a relatively healthy, non-isolated group, we could explore how technology can add or detract from relationships. Specifically, we were interested in the following questions: Does technology facilitate social connectedness in the caregiving relationship or does it reduce face-to-face human connection? Where can technology add to relationships? How do older people and their caregivers accommodate and adapt to technology in the homes? What privacy perspectives and challenges arise?

We take a value-centered design approach to the development and evaluation of such tehnologies (Friedman, 1996; Johri & Nair, 2011) that emphasizes the concerns and needs of the individuals who will be using the technologies. In addition, we emphasize an interrelated ecosystem of devices rather than the development and deployment of one or two technologies to address specific domains such as health or safety. No previous work that we are aware of has implemented a suite of technologies, addressing a range of functional domains, over a period of time, and included data from older adults and their caregivers. As we look ahead to increased use of monitoring technologies to facilitate aging in place, this formative work provides insights into the ways technology can be used to not only reduce caregiver burden, but to facilitate the relationship between older adults and their caregivers.

In the following sections we survey the existing literature and present preliminary findings from an initial series of focus groups and surveys in which individuals expressed their own wants, needs, and concerns for in-home technologies to support aging in place. Building upon these findings, we propose an elder-sensitive privacy framework. We then describe a qualitative, in-situ study where we introduced a custom built ecosystem of prototypes and commercial technologies to assess the proposed elder-sensitive privacy framework. We gathered feedback from both older adults and their caregivers about their experiences with the system. In

this article we address one of elders' primary concerns: what is the effect of in-home technologies on the quantity and quality of communication in the caregiving relationship.

Review of Literature

Adoption and Use of In-Home Monitoring Technologies

Numerous projects have investigated the use of and acceptability of technologies to support aging in place. A confluence of factors suggest an imperative for the field: population aging, a shrinking pool of family caregivers, the advent of inexpensive monitoring technologies, and increasingly burdened health care systems. While many older adults may prefer human contact over technologically facilitated contact, adult children may live at a distance and/or have competing demands at work and with their own families. In these situations, technology can facilitate, augment, or if necessary replace face to face contact. Particularly for caregivers who live at a distance, technology can provide "peace of mind" about the safety and daily activities of loved ones who are aging in place.

Technologies in the home can be designed to meet a number of needs: supporting health, physical safety and security, monitoring of activities of daily living, and enhancing social communications. Some of the technologies are a form of ubiquitous computing, meaning that detailed data is collected continuously in an environment that is aware, active and responsive. In-home technologies can transmit data ranging from highly granular, such as video feed of the front door, to virtually anonymized, such as a motion sensor in the same location. When the technologies are networked, the data have the potential to be observed from any connected locale

on the planet. In-home monitoring systems present obvious challenges to the personal privacy of both the older adult and their caregiver (Ross, 2004).

Older adults' adoption and use of in-home technologies is most often predicated on perceived usefulness (Rogers & Fisk, 2010). Older adults and their caregivers will use in-home monitoring systems if they see a need for it at the present time. A technology that might be useful in a year or two is often not adopted, possibly because of the stigma of appearing to need help or lack of perceived vulnerability (Myall et al., 2009). Other factors that affect adoption and use of new technologies include income, attitudes, and beliefs as well as perceived difficulty of use of the technology (Charness & Boot, 2009).

Reciprocal versus One-Way Monitoring

There is still relatively little research on preferred types and features of in-home monitoring systems. Most current off the shelf systems, such as Quiet Care (http://www.careinnovations.com/Products/QuietCare/Default.aspx) are one-way technologies, providing a summary of an older adult's daily activity information to a caregiver. Most systems are designed to provide only critical incident notifications. How critical incidents are identified and consequent action steps are still in a nascent stage, although many commercial systems are already in use (Brownsell, Bradley, Blackburn, Cardinaux, & Hawley, 2011). Potential problems with current systems have not been thoroughly studied and are thus the implications of their use are not well understood. Systems may lack design sensitivity to changes in an older person's activities that portend incipient critical changes in health status. Systems break down and have the potential to misinterpret monitored data which may lead to unanticipated and unpredictable consequences (Stephanidis, 2009). There is also the likelihood that systems could provide

evidence of decline, instigating suggestions of the need for long term care (Rowan & Mynett, 2005). Finally, such systems may have the unintended consequence of reducing the number of phone calls or visits from caregivers, since the caregiver now knows that the older adult being monitored in their home is safe and secure for the present moment

Despite legitimate concerns about these systems, one-way monitoring systems like the Digital Family Portrait (Mynett, Rowan, Jacobs, & Craighill, 2001) can provide peace of mind. For caregivers, knowing that mom likes to garden outdoors around 10 am and receiving confirmation from a monitoring technology that indeed mom is in the garden, can provide a sense of familiarity and reduced anxiety about an unreturned phone call. For some older adults, monitoring can help them feel privileged, cared for, and safe while other older adults find it intrusive and constraining (Essen, 2008).

Recent prototype projects have explored reciprocal monitoring systems; systems with paired technologies and a two-way flow of data. These systems empower older adults as equal participants in the exchange of information, rather than passive subjects. Some early research has suggested that such technologies can also facilitate increased emotional closeness in the caregiving relationship through awareness of activities and a sense of connectedness. For example, during the development of a "presence lamp," a table lamp enabled with a motion sensor that was placed in the homes of an older adult and a family member, Intel's Eric Dishman explains that elders were much more accepting of the technology because the device involved a "two-way street." That is, the lamp allowed both the older adult and their younger family members to have increased awareness of each others' activities rather than just giving family members information about their older relatives (Hutlock, 2003). A study exploring the effects of the "shared family calendar" revealed that older adults often enjoyed the increased connection

with their loved ones even more than did their younger family members (Plaisant, et al., 2006). In a study with "family planters," another presence-oriented device, older adults responded even more positively than their grown children. When asked what they liked about the device older adults reported feeling comforted by an awareness of their loved ones' presence (Lindley, Harper, & Sellen, 2008).

The finding that older adults enjoy the increased awareness of family activities and feelings of connection and closeness that reciprocal technologies can provide is not surprising considering that older adults generally tend to value reciprocity in their personal relationships. That is, they seek to maintain an equal exchange of resources as a way to build and maintain social capital in late adulthood (Keyes, 2002). In fact, it has been shown that elders who believe they receive more support than they give feel less positively than those who feel as if they are contributing equally to a relationship (Lindley, Harper, & Sellen, 2008). Reciprocity within relationships is closely tied to self-esteem and self-efficacy, enabling perceptions of competence and value.

Older Adults and Caregiving Relationships

Many of the technologies designed to help older adults age in place begin with the incorrect assumption that all older adults want to be taken care of and are frail, lonely, and dependent. On the contrary, most older adults consider themselves to be in good to excellent health, happy with their social life, independent, and autonomous (Lindley, Harper, & Sellen, 2008; Federal Interagency Forum on Aging-Related Statistics, 2010; Scheibe & Carstensen, 2010). Additionally, particularly in Western cultures, older adults do not want to be a burden to their offspring (Essen, 2008; Loe, 2010). In fact most instrumental, emotional, and financial

support flows down through generations rather than upward (Lindley, Harper, & Sellen, 2008). While advancing age may be accompanied by the need for some assistance, older adults want to remain as autonomous and independent as possible and not burden their caregivers (Sixsmith, 1986). While the need for autonomy and independence may be culturally influenced (Cicirelli, 1992), most older adults have a strong preference for maintaining control over decision-making relative to their own life. In-home technologies can facilitate independence and autonomy and enable older adults to age in place.

In turn, family members may desire reassurance that "everything is fine with mom and/or dad" and that it is safe for their older relatives to live independently. Developing in-home technologies that not only include important safety-monitoring features, but also are able to foster meaningful connections between independently-living older adults and their loved ones, can be beneficial for both sides of the relationship (Hutlock, 2003; Rowan & Mynatt, 2005; Plaisant et al., 2006; Essen, 2008). While in-home technologies can provide a means for helping elders remain independent and autonomous at home and decreasing the burden of care for family members, technologies designed with an understanding of relationships in later life can be most sensitive to meeting the changing needs of older adults and their family caregivers.

There is significant research on the importance and complexity of social relationships in later life (e.g. Antonnuci, Birditt, & Akiyama, 2009; Fisk, Rogers, Charness, Czaja, & Sharit, 2009; Rogers & Fisk, 2003). Social relationships contribute positively to well-being in later life, helping older adults draw deeper emotional significance from their lives and maintain a positive sense of self (Lindley, Harper, & Sellen, 2008). Carstensen's theory of Socioemotional Selectivity suggests that people in late life are aware of limited time left to live. This sense of a shortened time horizon is very different from healthy young people, who may feel like they have

an infinite amount of time ahead of them. Because older adults have a limited sense of time, they are likely to prioritize the relationships which are most rewarding and emotionally meaningful and invest less energy in relationships and activities that are less immediately rewarding (Scheiebe & Carstensen, 2010; Carstensen, Gross, & Fung, 2003; Carstensen, 2011).

Because relationships with personal caregivers are among the most vitally important to older adults, they employ strategies to increase the number and frequency of positive and meaningful interactions (Baltes, Lindenberger, & Staudinger, 1998). One such strategy might be the willingness to use technologies that reduce caregiver burden. Technologies that facilitate emotional connectedness and relieve caregivers of less-rewarding tasks are likely to be viewed by older adults as contributing to the overall quality of the caregiving relationships. Older adults are most likely to be driven to use social networking technologies that facilitate communication with their family members (Hochheiser & Lazar, 2010; Ji, Choi, Lee, Han, Kim, & Lee, 2010). Maintaining meaningful personal contact with cherished family members, especially with those living far away, is critical to a sense of connectedness (Lindley, Harper, & Sellen, 2009).

The desire for close relationships sometimes contrasts with older adults' desire for autonomy, making the caregiving relationship one of constant, careful negotiation (Clarke, Presoton, Raksin, & Bengtson, 1999). Both older adults and their caregivers continually renegotiate roles and responsibilities as physical and cognitive abilities decline in very late life. While most older adults prefer care in their own homes by family members, often outside resources such as in-home technologies are needed to reduce caregiver burden. Quite naturally, older adults who did not grow up with technology are concerned about the role and function of unfamiliar blinking boxes in their homes. In our work and in other studies (Beach et al., 2008; Wild, Boise, Lundell, & Foucek, 2008) older adults generally report concerns about the effects of

the technologies on caregiving relationships in addition to concerns about the technologies themselves.

Older Adults' Concerns about Monitoring Technologies

A small number of studies, including our early work with focus groups and surveys, have investigated older adults' concerns about in-home monitoring technologies (Beach et al, 2008; Kwasny, Caine, Rogers, & Fisk, 2008; Wild, Boise, Lundell, & Foucek, 2008; Lorenzen-Huber et al., 2010; Caine et al., 2011; Shankar, Camp, Connelly, & Huber, in press). While older adults are concerned about perceived usefulness and privacy (Kwasny, Caine, Rogers, & Fisk, 2008), these findings suggest that many of older adults' concerns about monitoring technologies are focused on the effect of these technologies on key social relationships.

Replacing human contact. A primary concern that older adults express about these types of in-home technologies is that they will replace human contact with formal and informal caregivers (Rogers & Fisk, 2010; Lorenzen-Huber et al., 2010) While many older adults may prefer a phone call or visit over interacting with technology, adult children may live at a distance and/or have competing demands at work and their own families. Technology has the potential to replace face-to-face or phone contact. Particularly for caregivers who live at a distance, technology can provide "peace of mind" about the daily activities of loved ones who are aging in place, and eliminate the need to call or visit.

Burdening informal caregivers. While monitoring technologies may be designed to reduce caregiver burden, older adults worry that the flow of data may be overwhelming or unnecessary for already-busy adult children. Depending upon the type of device, in-home technologies can

produce vast quantities of undigested data in the form of patterns of movement, video, text, and audio. Even filtered data could be overwhelming. Older adults do not want or expect informal caregivers to spend hours on the receiving end of data from monitoring devices, particularly when most of it is non-critical.

Privacy and Intrusiveness. In addition to the concerns older adults currently have, ubiquitous and pervasive technologies (particularly networked ones) in the home bring up new challenges to personal privacy. Many people underestimate their privacy risks in an increasingly networked society. Older people in particular are likely to be unaware of when they are interacting with the network, what type of data is being created, and who is receiving the data. Detailed data, collected continuously through sensors, cameras, and similar devices, raise the possibility of security breaches and other intrusions.

Description of Previous Work

Development of an Elder-Sensitive Privacy Framework

The overarching goal of our research program is to develop an elder-sensitive privacy framework for home-based ubiquitous and pervasive computing. Frameworks help designers and users understand the questions that need to be asked and the incentives facing users (Ostrom, 1990). The purpose of our framework is to help designers and users understand the questions that need to be asked about in-home technologies and the incentives facing older adults and their caregivers in adoption and use. In our earlier focus group work, we listened to the concerns of older adults about in-home monitoring technologies. We concluded that if older adults and their families are to embrace home-based technologies, usefulness and safety must be balanced with

data privacy, social communication needs to be enhanced rather than minimized, and designs need to be easy to use, robust, and clear. In this paper, we focus on the specific question of how design choices affect the relationship with the most common recipient of data, the family caregiver. In the next section, we provide background about the development of the elder-sensitive privacy framework and the technologies and prototypes used to evaluate the framework

We began with a privacy framework based on the literature, which suggests that privacy is composed of the right to seclusion, autonomy, control over personal information, physical and virtual space, and the ability to view and correct personal data (Warren & Brandeis, 1890; Introna, 2003: Bloustein, 1968; Odlyzko, 2004). We then engaged in a series of five studies to test and modify this framework to reflect the needs and wants of older adults in regard to home-based monitoring technologies. In the first three studies, we used a series of two focus groups (n=64 and n=48) (Lorenzen-Huber et al., 2010; Shankar, Camp, Connelly, & Huber, in press) and a survey (n=48;Caine et al., 2011). Through repeated analyses of the data, four overarching constructs emerged as a privacy framework relevant to older adults and home-based ubiquitous technologies: usefulness of the device, data granularity, sensitivity of activity being recorded, and data recipient (Lorenzen-Huber et al., 2010; Shankar, Camp, Connelly, & Huber, in press).

In the fourth phase, we assessed the strength of the proposed framework in an in-depth in situ study (n=6). We operationalized this framework in two ways: as explicit design considerations in prototypes and as scenario development for interview questions with study participants. The goal was to illustrate these framings of privacy both through artifact development (for elder-caregiver interactions and comments) and discussion (through extended open-ended daily and weekly interviews). The sample size was necessarily small, as building and maintaining prototypes for use out of the lab and collecting data in person from each participant

on very regular intervals were both cost- and labor-intensive (Hazlewood, Connelly, Caine, Zimmerman, & Blanton, in press.), and resulted in rich, qualitative data. These prototype technologies and daily and weekly interviews were time intensive but necessary to capture participant perceptions in close to real time. Qualitative analysis was chosen because it is useful for studying close interpersonal interactions, such as those between older adults and their personal caregivers (Daly, 1992). In this work, we wanted a focus on perceptions, interactions, and constructed understandings of participants' experiences with the technologies and communications within the caregiving relationship.

The fifth and final stage of the study was a survey with older adults (n=101) in which we further validated the elder sensitive privacy framework with respect to in-home technologies, The results of the large-scale survey are under analysis. In the next section, we describe the design of prototypes and selection of commercial technologies that would illustrate this framework

Prototypes and Technologies Used to Test Privacy Framework

We developed a suite of technologies to assess each aspect of the framework. We chose technologies that were independently and/or collectively sensitive to usefulness, data granularity, sensitivity of activity, and data recipient. The technologies were also selected to provide information across domains of functioning including personal safety, daily activities, and social communication. Each prototype captured different types and granularity of data. Data types included video, motion sensor, and sleep patterns. We built in a feedback system so that users could see what data was being collected and transmitted. Finally, we tested a prototype that gave

older adult users control over the flow of data to their caregivers. The technologies are explained detail below.

Presence clock. The Presence Clock is a reciprocal device in that it is designed to work in pairs; the older adult received one and the caregiver received the other. The clock looks like an old-fashioned table top clock and has integrated motion sensors and LED lights. It only provides information about a persons presence (very low data granularity), is integrated into the environment, and does not require interaction from the user. The clocks were networked and shared the times that each device detected anyone when they sat near or walked by their clock. The corresponding clock stayed lit up for the duration of the detected presence until the clock hands came to that position again. Thus, a 12 hour history of presence was recorded (see Figure 1).

Figure 1. Presence Clock

Beacon Strip. The beacon strip (Figure 2) was in the form of a long carpet mat with pressure and light sensors. The sensors turned on a series of lights when the participant stepped on it when getting up from bed during the night. The prototype also featured pressure sensors under the participants' mattress which monitored movement patterns. Movement patterns were displayed as a simple line graph (Figure 3). As a result, older adults and their caregivers could view number of nightime trips as well as movement in the bed and changes in their sleep patterns -- data that was potentially sensitive to older adult participants.

Figure 2. Beacon Strip

Figure 3. Line graph

Video Cameras. Off the shelf video cameras, providing live (but not archived) streaming video, were placed in the homes of the older adult participants. The older adults chose the location of the video cameras in their homes. Caregivers received the video stream on a touch screen in their home. Video cameras provide very high data granularity (image, sound, and motion with timestamping) and depending on their location, data about activities potentially sensitive to being monitored (see Figure 4).

Figure 4. Video camera

Touch Screen Prototype Control System. The control system was implemented as a touch screen computer that was embedded into a frame so that it looked like a digital picture frame. When not in use, it displayed a slide show of photographs. When touched, it allowed older adult participants to turn each of the prototypes on or off. Each caregiver also had a touch screen, which was networked to their older loved one. The caregivers' touch screens provided a review of data being collected by the prototypes (Figure 5).

Figure 5. A screenshot of the feedback system

Digiswitch. The Digiswitch (Digital Switchboard) was an additional function built in to the Touch Screen Prototype Control System (see Figure 6) . In addition to being able to turn all the

devices on and off, the Digiswitch included a "Friend's View" screen that showed the older adult exactly what their caregiver was seeing, thus increasing data awareness (Caine et al., 2011). The Digiswitch also allowed increased user control over personal data by allowing the older adult participant to temporarily cease transmission, "Me Time," for privacy reasons.

Figure 6. Screen shot of Digiswitch

Android 3-G Smart Phones. Two of the six participants were assigned to a condition where they received mobile 3G android smart phones (Figure 7) rather than the suite of technologies. The phones were equipped with Internet access, email access, unlimited calling minutes, unlimited SMS and MMS, games, and other standard smart phone features.

Figure 7. Android 3-G Smart Phones

Methods

The technologies described above were designed to support aging in place, and also to serve as a means of studying a variety of questions related to technologies for older adults and their caregivers. The technologies offered varying degrees of granularity, could be turned on and off independently, transmitted potentially sensitive data , and gave participants an opportunity to reflect and report on how useful they perceived the prototypes. From our earlier focus group research, we expected that our participants would underestimate the privacy risks in having monitoring technologies in their homes.

We conducted a six week in situ study investigating the effects of various technology systems on older adult caregiver communication. We provided technologies to six older adults and their caregivers and provided training to all participants on how to use the technologies. During the six week study, we kept the prototypes working (despite the challenges of intermittent but regular electrical storms, Internet down time, and other technical difficulties), and completey removed them at the end of the six weeks.

Design

There were three conditions to which older adult participants were assigned: 1) Control Panel (CP), 2) Non-Control Panel (NCP) , and 3) Phone (P). In the Control Panel condition, two participants were given all 4 protoypes and the touch screen with the Digiswitch which provided access to feedback about the devices and control over whether each device was on or off. In the Non-Control Panel condition, two participants were given all 4 prototypes and the touch screen, but no Digiswitch access. In the Phone condition, two participants received only the mobile smart phone, but no installed technologies.

Participants

Participants were recruited from a retirement community in the United States. Staff at the facility assisted with recruiting older adult participants from residents living in independent-living apartments and cottages. Interested participants were screened by researchers. Inclusion criteria included age between 65 and 90, living alone, having an informal caregiver within a 50 mile radius who would be likely to participate with them in the study, having an Internet connection, and a minimum score of 21 on the Telephone Interview of Cognitive Status (TICS-M) scale (de Jager, Burke, & Clarke, 2003). No one selected for the study refused to participate.

All of the six participants were women, had been married and were now widowed, and had adult children. The participants ranged in age from 73 to 86 (M = 82.17; SD = 4.71) and had between 3 and 4 children each. All but one was a college graduate (but even this one had attended some college) and four had completed graduate school. All participants reported that they had used a computer for at least 10 years. All participants reported experience using email and reported that they enjoyed using the computer. All rated their own health as good, very good or excellent. One participant reported a fall in the last 3 months that had resulted in an injury.

Four caregivers also participated in the study. Caregivers were identified by participants and contacted by research assistants to determine interest in participating in the study. The only inclusion criteria for the caregivers were that they were willing to participate in the study, had an Internet connection, and lived within a 50 mile radius of the study site. Because participants in the mobile phone condition could call their caregiver using existing standard household technology in the caregiver's home (i.e., home telephone) participants in the phone condition were not required to identify a specific caregiver to participate in the study. Caregivers werean adult daughter, a daughter-in-law, a brother, and a pair of friends. Once caregivers were identified, we installed the caregiver portion of the monitoring system at their homes.
The study was approved by the Indiana University Institutional Review Board and all participants signed informed consent forms.

Procedure

There were three main phases of the study: pretest, six weeks, posttest. Pretest assessments consisted of a demographic questionnaire and the first weekly interview to assess the quality of key relationships in participants' lives, self-report of social connectedness, and familiarity with information technologies such as computers and cell phones. After the pre-test,

participants were trained on how to use the prototype technologies and were asked to answer questions about their satisfaction and understanding of the devices.

During the six week study, three types of data were collected. First, electronic prototype logs were kept 24/7, tracking participants' use of technologies. For example, the logs would record whether and when the video cameras were turned on or off manually or whether the Digiswitch was used to control the cameras. These logs were reviewed weekly during research meetings and the data compared to data from interviews. Second, daily five minute semi-structured phone interviews were conducted with the older adult participants. Participants were asked to rate their satisfaction about each of the devices, whether or not they had any problems with the technologies, if they found the technologies to be useful that day, and whether or not they had had any contact with their caregiver that day. If they had contacted their caregiver that day, we asked about the nature of the conversation (i.e, "What kinds of things did you talk about?"). Finally, we conducted weekly face-to-face semi-structured interviews with all six older adult participants (in their homes) and all four caregivers (over the phone). During the weekly structured interview we asked participants, "What is the frequency of contact with your caregiver?" and for phone group only, "What is the frequency of contact with your friends and family." How these questions were asked in practice varied slightly from the scripted question to maintain conversational flow. For example, the question may have been rephrased, "How often have you been in contact with your caregiver over the past week?"

Answers to the question were given conversationally by participants. In two cases, the participants' answers were not clear and these answers were recorded as "missing data." Interviewers recorded responses on a structured interview worksheet into one of the following 6 categories:

- Twice or more a day (6)
- Once a day (5)
- Twice or more a week (4)
- Once a week (3)
- Twice or more a month (2)
- Once a month (1)

At the conclusion of the study, participants again completed self-assessments of the quality of key relationships in their lives and self-reports of social connectedness. Approximately two months after the study, older adult participants attended a member check meeting in which we presented our preliminary findings and gathered informal feedback from the participants about the study. Caregivers also participated in a member check meeting on a separate day. All interviews except the phone interviews were conducted by at least two members of the research team. The research team was composed of six faculty and six graduate students, from a variety of backgrounds including gerontology, occupational therapy, social informatics, computer science, psychology, human computer interaction, and privacy and security. The entire team met weekly during the pretest, in situ study, and postttest to reflect on methods, findings, and data analysis. A field journal was kept to record ideas and hypotheses generated during participant interviews (Lincoln & Guba, 1985).

Data Analysis

To analyze the quantitative data about frequency of communication between older adults and their caregivers, each category was assigned a numerical value (shown above in parentheses

beside each category label). We computed a mean score for each category of participant: Control Panel (CP), Non-Control Panel (NCP), and Phone (P). The results from that analysis are presented in Table 1. Because of the small sample size we did not conduct statistical analyses on these data. However, numerically both the Control Panel group and Non-Control Panel groups reported that the frequency of communication stayed the same (for control panel twice or more a week, up to once a day, then down to twice or more a week; for non-control panel, between once a week and twice or more a week up to between twice or more a week and once a day, then back down to twice or more a week). The Phone group reported increased communication (between twice or more a week and once a day up to once a day).

Qualitative data were analyzed using a grounded-theory approach (Glaser & Strauss, 1967). Audio tapes were transcribed and researchers independently developed major and minor coding themes. The research team then met to discuss areas of congruence and contention. After a series of weekly meetings to discuss coding themes, a code book with eight high level codes was identified, refined, and agreed upon by the research team. Daily transcripts with no relevant information and containing only "everything is okay" comments were not coded. The remaining transcripts were then coded, using the code book, by two coders. In most cases, there was agreement between the coders. Differences were discussed and adjudicated. Two of the themes relating to caregiver relationships, "caregiver relationship," and "communication," were then studied again by the research team. First, we analyzed frequency of communication, as measured by questions given during the weekly interview. Next, we looked for themes expressed by the participants about the content of communication. Four themes emerged: 1) communication about the technologies, 2) communication facilitated by the technologies, 3) perceptions of perceived

intrusiveness by either older adult or caregiver, and 4) perceptions of fun or playfulness related to the technologies.

Results

Of the six participants originally enrolled in the study, all completed pretests and posttests. Five of the six completed all six weeks of the technology installation. One caregiver asked to leave the study three weeks after the technology was installed, but completed posttests. This is a remarkably low drop-out rate, likely supported by devoted attention from the team of researchers and the free technical support for not only the technologies but for participants' personal computers and other personal technologies.

In this study we were interested in the following questions: Does technology facilitate social connectedness in the caregiving relationship or does it reduce face-to-face human connection? Where can technology add to relationships? How do older people and their caregivers accommodate and adapt to technology in the homes? What privacy perspectives and challenges arise?

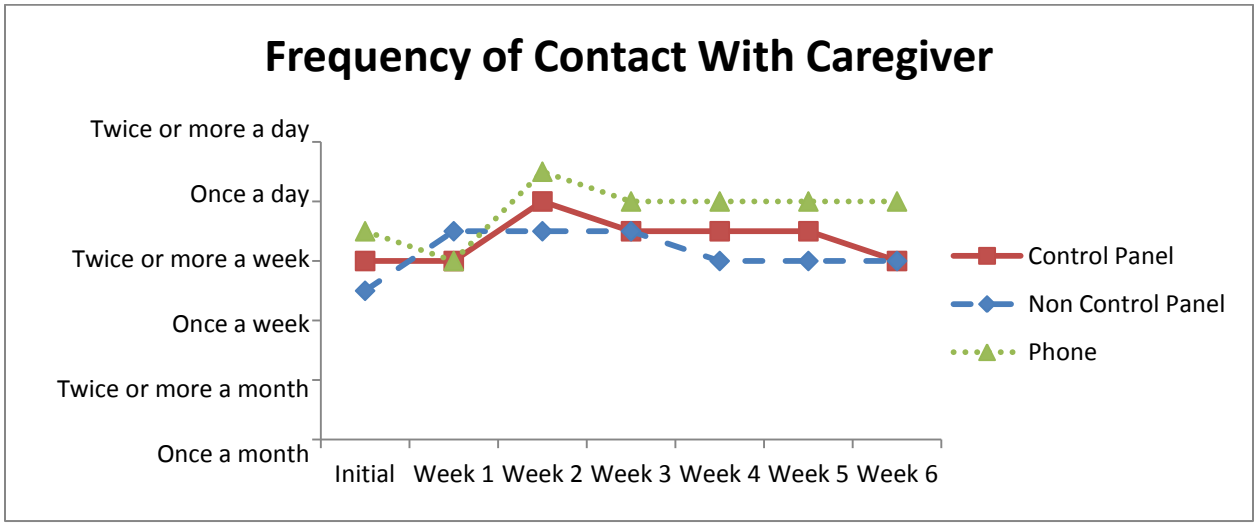
Does technology facilitate social connectedness in the caregiving relationship or does it reduce face-to-face human connection?

Technologies Facilitated Communication. One of our primary research questions was whether technology facilitated or reduced social connectedness in the caregiving relationship. From our focus group and survey research, one of the primary anxieties that older adults expressed about monitoring technologies is that they might replace human contact, particularly contact from

informal caregivers. In the current study, we asked both the older adults and their caregivers weekly how often they contacted each other.

Participant	Group	Age	Initial	W1	W2	W3	W4	W5	W6
1	CP	82	4	4	4	4	4	4	4
2	CP	85	4	4	6	5	5	5	4
3	NCP	86	4	5	5	5	4	4	*
4	NCP	84	3	4	4	4	4	4	4
5	P	83	5	*	5	5	5	5	5
6	P	73	4	4	6	5	5	5	5

Table 1. Frequency of Older Adults' Contact with Caregivers. (* = missing data).



Communication levels, as reported during daily phone interviews ("did you talk with X today?") and weekly interviews (frequency and satisfaction with communication during the past week) either stayed the same or increased from pretest through the study to posttest for all six older adult participants and the four caregivers. Comments made during the pretest gave an indication that communication levels were likely to have at least stayed the same because of the stable quality of the caregiving relationships of the study participants. "We always see each other on Sunday morning. We always go to church the same place, same time, and we sit in the same

spot....We talk usually once or twice a week. He's busy, I'm busy, and so unless we have something we don't just call up to gab." Midway through the study, at week four, another participant also indicated the shared satisfaction with existing levels of communication: "In my family, we don't bug each other, we just keep up to date." Comments made during the posttest, showing the neutral effect that the technology had on the frequency of communication, included "Although the technologies gave them (caregivers) information about me, I think our relationship would stay the same. It wouldn't change anything." Another said, "Oh, I don't think it has changed anything, other than they would just comment, 'Oh, look, Grandma's reading. That's all Grandma does, is read, or play on the computer, or watch TV.' "

In all of the weekly interviews with older adults and caregivers, there was only one comment made once by a caregiver about the technology obviating the need for a phone call or visit. The caregiver said, "Well, interestingly, with the technologies, I actually have talked to her less. Since I know she is there, I know she's functioning and I don't have to call her to know, or email her to know." However, in subsequent interviews, this caregiver did not report a decrease in communication and the older adult in this pair did not perceive a decrease in communication. This is also the caregiver who asked to withdraw early from the study.

In many of the weekly interviews, older adults and caregivers indicated that they talked more during the study. To explore how the technologies might have increased communication, we analyzed the content of communications from the weekly interviews. Those participants who were given the suite of technologies used the technologies in a variety of ways to eliminate potential intrusiveness and time communications for optimal mutual enjoyment. Those participants who were given the phone did not have this advantage, although the phone did increase the amount of communication older adults had with their entire family. While the suite

of technologies focused the caregiving relationship with one caregiver, the phone distributed the caregiving load among the broad network of friends and family.

We next describe the four themes that emerged in the analysis of the qualitative data: communication about the technologies, communication facilitated by technologies, potential or perceived intrusiveness of technologies, and fun and playfulness with the technologies.

Communication about the Technologies. It is not surprising that the technologies themselves created a topic of conversation. Communication about the technologies was a major theme, and all of the four older adults with the suite of technologies and their four caregivers reported content of communication that was specifically about the usefulness and functionality of the technologies. A caregiver said, "I got two emails this morning. I talked with her twice yesterday, and it was about the technology." Another caregiver said, "Well, it's created another topic for sure (laughter)... something to talk about."

Some of the conversations were diagnostic in nature, assessing if the technologies were working as expected. A series of electrical storms during the study took all the prototypes down and after each storm a researcher had to visit each home to reset all the devices. After one such storm, an older adult and her caregiver were assessing whether or not the Presence Clock was working. The caregiver reported on the conversation, "She said, 'No, I didn't do anything to the clock.' It's still possible she might have accidentally hit something, you know, without knowing, but there's this puzzling element there."

Communication facilitated by the technologies. While conversations about the technologies might decrease over time, communication facilitated by the technologies might be expected to be stable over time. The suite of technologies provided older adults and their caregivers a variety of windows into each others' daily lives, and all four of the older adults and their caregivers

reported communications that were facilitated by the technologies. The other two older adults who were given phones and not matched with caregivers also reported communication facilitated by the technology. The phones provided an easy and novel new channel of communication, and both older adults that were given phones reported increased calling, texting, and sharing of media through the smart phones. Communication facilitated by the technologies was the second major theme of content of communication.

The reciprocal nature of the Presence Clock in particular facilitated many conversations that could prove to be stable over time. The Presence Clock provided an equal and reciprocal view; both older adults and their caregivers had access to information about the presence of the other. Often just glancing at the clock gave each party a quick update on the other's whereabouts. A caregiver said, "Yes, I think it has made me think of her more. It made me more aware of what she does all day and that kind of thing...Yeah, it has made me more aware."

One of the key reciprocal uses of the Presence Clock was an unintended use--to schedule a phone call. Three out of four of the older adults who had a Presence Clock used the clock to know when was a good time to call their caregiver. One said, "He goes to his computer, where his Presence Clock is set up, and I could tell he was there for several hours. So one time I wanted to call him about something else, and I knew he was there, so that was handy." Another older adult reported that she relied on the clock to verify whether her friends/caregivers were home, and therefore whether it would be okay to call them. She also said that she did not mind them using the clock to determine whether they could call her. When asked if she would ever want to turn the clock off, she said that she would not turn the clock off if she had the choice, even if she wanted no interruptions; she wants them to feel welcome to call her whenever they like. She said, "Turning off a device would be like slamming the door in someone's face."

The clocks helped older adults and their caregivers schedule phone conversations for mutual enjoyment, an example of how older adult accommodate and adapt to in-home technologies. This use of technology allows older adults and their caregivers to tailor and shape communications in a way that benefits both parties. In contrast, the phone did not provide this window of information. One of the older adults who was given a mobile phone said, "I tend to worry about interrupting someone else, calling at the wrong time, and that makes me tend to not call as much." While the phones did not provide new windows of information, they were obviously designed to facilitate communication. The two phone participants both indicated in their interviews that they used the phone to increase both frequency and types of communication. "I call my family a lot more now," said one. They both indicated that they made more calls, used texting, and sent photos, music, and videos. One had indicated in early interviews with her that she wished to "make a change" by increasing the quantity and quality of her communications with her family, so even a plain cell phone might have yielded this result. However, both phone participants reported that having the ability to text easily improved the quantity of communication they exchanged with grandchildren. One said, "I talked to my granddaughter quite a bit. She thought it was hilarious, I was calling her so much."

We also found that research participants used information from the prototypes in ways that the researchers/designers had not expected. The reciprocal nature of the Presence Clock allowed the older adult to see into her caregiver's life in ways we had not anticipated. One older adult had thought her caregiver, her brother, was out of town. She was surprised to see lights on her clock that evening, indicating someone was in his house. Suspecting a break in, she phoned her brother. When he answered, he told her that the Presence Clock must have not been working properly. In a follow-up interview with the brother, he indicated that he actually had been at

home but had changed his plans and did not want to explain all of this to his sister. The older adult later told the interviewers that she thought the Presence Clock would make a useful and unobtrusive home alarm system.

While all of the participants reported content that was facilitated by the technologies, there was one example, reported above, in which one caregiver said in one interview that she didn't need to call, because she could see that her older loved one was alive and well via the highly granular video feed. This comment indicates that older adults' primary concern about in-home technology's capacity for replacing human contact is not unfounded. However, even this caregiver also used the video feed to increase positive social communication (i.e. "I can see that you have a friend over, say hi for me"). This particular older adult/caregiver pair provided a negative case sample (Milinki, 1999), facilitating extended discussions among the researchers in interpreting the data.

Potential or perceived intrusiveness of technologies. To explore whether increased data transparency and control improved participants' acceptance, we integrated touch screens and the Digiswitch into the suite of technologies. These prototypes were designed to facilitate and measure privacy behaviors. When we installed the prototypes, we demonstrated the on/off features to both older adults and their caregivers. Only the older adults were provided with and shown the pause ("Me Time") feature of the Digiswitch. During this initial technology training, all four of the older adults who received the suite of technologies indicated that "privacy" was not of significant interest to them (this theme was also a significant part of the focus groups, even though concerns about financial security and data breach were indicated by study participants in all parts of the project). However, introducing our research prototypes into the participants' homes for six weeks raised new concerns about privacy for two of the four older adults, making

potential or perceived intrusiveness of the technologies one of the minor themes of content of communication.

For example, at the outset of the study, one older adult stated that she "did not care" about having the camera on in her home. She had not thought about the implications even when her caregiver, her son, mentioned that he had seen her on the cameras. However, after several weeks, she said she started feeling intruded upon when she realized she liked walking to the kitchen in her "skivvies," but no longer felt comfortable about it. During a later interview, she asked us to show her exactly how to turn the camera off and let us know during subsequent interviews that she was doing so. Her experience demonstrates that increased experience with a technology may lead users to gain a better understanding about the capabilities of the device, and thus gain a more nuanced understanding of the privacy implications.

Each of the older adult/caregiver pair was a different type of family or friend relationship. What was shared and how it was shared differed dramatically depending upon that relationship. One older adult had two middle-aged male friends as her caregivers. She understandably felt less than comfortable with having them view personal details of her life. She chose to have the video camera installed in her formal living room, focused in such a way that it recorded very little of her daily activities. She was the most relieved at the end of the study to have all the prototypes removed. When asked if she would feel differently if her caregiver for this study had been her older adult daughter, she said she thought that she might have been more comfortable with that. Her daughter lived in another state, so we could not set up or maintain the technologies with the daughter for this study. In contrast, one of the older adults had her younger brother as her caregiver. While this was also a cross-sex relationship, she was not bothered by providing him with a window into her life. "He's my baby brother after all." Her brother also did not mind, "It's

nice to be able to see her and know that she's okay."

Fun and playfulness with the technologies. One unexpected theme that recurred during the course of the in situ study was a sense of playfulness and "fun" that the technologies afforded both caregivers and older adults. Although the prototypes were not designed for play, all four of the older adults with the suite of technologies found ways to have fun with the technologies. These comments were interesting but infrequent and thus playfulness is a minor theme of content of communication. The cameras in particular, perhaps because of the immediate nature of the data transmitted, were often used in this playful manner. For example, one older adult had a neighbor over visiting. Her caregiver called and said, "I see you have Mrs. X over! Say hello for me!" Another said, "My son calls sometimes because he sees me sitting at the desk and he thinks it's funny."

While some of these interactions could be perceived as intrusive, they were reported during the interviews with laughter and joking. The perception of playfulness, as opposed to intrusiveness, was only possible because of the close existing bond between the older adults and their informal caregivers. In a classic example of the potential for technologies to be intrusive, a daughter joking accused her mother of having an affair. One of the male graduate assistants on the research team was re-setting the beacon strip in one of the older adult participant's bedroom after a storm. Her caregiver daughter saw the student on the camera and called to say teasingly, "Mom, what is a man doing in your bedroom?" The older adult retorted, laughingly, that her daughter could be "as nosy as she wanted to." This same older adult, during daily brief interviews and the longer weekly interview, often mentioned "having fun" with the devices and enjoyed "waving at her family" through the camera. She said, "sometimes the grandkids get a hoot out of it." She once noted that she was at her desk writing checks and her daughter called

her to say, “I see from the camera you have your checkbook out; do you want to write me one too?”

As discussed above, several participants mentioned that the Presence Clock gave them information on the whereabouts of their caregiver and whether they could call them. One older adult joked, she called her brother when the clock indicated his presence at home, because “even though he’s on a cell phone, I know he’s home.” Another older adult liked to “prank” the Beacon Strip. Since the Beacon Strip senses pressure, she said it amused her to walk around the strip or step over it, to provide confusing and contradictory information to the researchers and her caregivers. She liked to think of it as a “runway, you know, like when a fashion model goes out.” She did use the word “play” to describe her behavior, but the quality of this play had a more mischievous quality to it than the curious playfulness of other participants. While this behavior may be more reflective of the playful personality of this particular participant, it does suggest that older adults can play with what is transmitted and to whom, much the way teenagers can play with what they report to their parents via their cell phones (“Of course I am at the library!”)

Lastly, the sense of play or fun also extended to sharing their impressions of their devices with other individuals in the retirement community (although we had asked them not to discuss the study with others in the community, we did not expect with certitude that the research participants would do so). One of the phone users said she enjoyed discussing the features of the smart phone with other retirement community residents. She speculated that learning to use the advanced features of the phone could potentially be a status symbol. Others in the study also indicated the potential of the prototypes to be something to “show off” to others. Some researchers have considered whether making these practical devices explicitly integrate play or status would change their potential for adoption (Siek, Connelly, & Rogers, 2006; Siek, Connelly,

Rogers, Rohwer, Lambert, & Welch, 2006).

Discussion

As part of a larger study to explore the privacy perceptions of older adults related to in-home monitoring technologies, we asked, "What are the effects of home monitoring technologies on the caregiving relationship?" We started with a group of older adults that was safe and secure, cared for in a retirement community setting, and satisfied with their closest relationships. We asked this group of volunteers and their informal caregivers to engage deeply with a suite of prototypes and commercial devices designed for "aging in place". We installed a suite of technologies in their homes, and over the course of six weeks, asked how these technologies affected the close caregiving relationship, focusing in the anxieties and concerns that have been previously expressed by older adults and their caregivers about in-home technologies. No previous work that we know of has collected such rich, contextual data on multiple technologies installed in the home, over a period of time, from both older adults and their informal caregivers.

While our earlier studies cautioned us to expect that technology might cause disconnection, we found something unexpectedly, richly, promising in the kinds of communication facilitated by the devices. As Carstensen's Socioemotional Selectivity Theory would suggest, the participants, all in late life, prioritized meaningful relationships and used the technologies to strengthen those relationships. Whether it was using the Presence Clock to call her younger brother about a suspected break-in (a use completely unanticipated by the researchers) or waving at the grandkids through the video camera, some of our respondents found ways to use the devices to show care and affection toward their caregivers. All of our respondents expressed the desire to use the technology to improve communication patterns, to build social support, and reduce the perceived burden of their caregiver. Our respondents and

their caregivers often approached the technologies and indeed, the study itself, with humor and play, both ways to enhance and enrich relationships.

In addition to assessing whether the number of communications between older adult and caregiver were affected by the installation of technologies, we examined qualitative data to explore the following questions: Where can technology add to relationships? How do older people and their caregivers accommodate and adapt to technology in the homes? What privacy perspectives and challenges arise? We asked older adults and their caregivers about the general content of their communications during the study.

Based on our earlier work (two focus groups and a survey) and the literature, we had already identified some of the anxieties older adults have about home-based monitoring technologies. Most of these revolve around the fear that the use of technologies for caregiving will reduce the quality of or even replace human contact with family caregivers. While older adults acknowledge technology's potential for reducing caregiver burden and offer the possibility of home-based aging(c.f., Caine, Fisk & Rogers, 2006), they have also expressed concern for technology's potential for increasing intrusion into the lives of their adult children as well as into their own lives, were some of the strongest concerns older adults had with respect to the use of devices for aging in place.

We focused first on elders' primary concern: would the in-home technologies reduce human contact? We found that communication levels, as reported during phone interviews ("did you talk with X today?") and weekly interviews ("how often did you talk with X today?"; "how satisfied are you with your communications with X?") either stayed the same or increased from pretest through the study to posttest for all participants. Stable levels of communication are good.

Increased levels of communication are even better, suggesting unforeseen benefits to in-home monitoring technologies.

We examined the content of the communications to explore the second question: what, if anything, was technology adding to the elder-caregiver relationship. The first way in which we explored this question was to investigate the durability of the increases in communication over time. We asked participants about the general content of their communication. Four major subthemes of communication content were identified: communication about the technologies, communication facilitated by technologies, and fun and playfulness with the technologies, and potential or perceived intrusiveness of technologies. Talking about the devices as a topic of conversation is unlikely to last over time. Once the novelty wears off, the technologies are more stable in their operation, and the devices become part of normal daily activities, it is very likely that the technologies would cease to be a topic of conversation. This is particularly true for devices that provide ambient or routine data, such as the number of nighttime trips reported by the beacon strip. Conversely, it is possible that some technologies, like the smart phones, have enough variable uses that they might provide an ongoing topic of conversations. New apps, new features, and grandparents asking grandchildren for help are likely to be enduring topics of technology-related conversation.

Our third question focused on how older adults and their caregivers specifically adopt and adapt the technologies to fit with their needs and their lives. During the interviews, we learned about "alternative" uses for the devices, such as the older adult who suggested the Presence Clock might make an unobtrusive motion sensor to detect home invasion or resistance practices for "avoiding" detection (such as stepping over the beacon strip so it wouldn't trigger the sensor). While we designed our prototypes to give older adult participants a significant

amount of control over the devices, each participant wielded that control differently. Concurrent with our proposed framework, granularity, sensitivity of activity, and data recipient were the factors that influenced decisions about control of data. For example, the older adult who had two male friends as her caregivers allowed only anonymized data of routine activities to be transmitted. She allowed the Presence Clock to record presence in her study, but turned off the video camera or pointed it at a corner.

Not surprisingly, the technologies facilitated discussion about privacy and intrusiveness, which led into our fourth large research question about privacy preferences. While much of our earlier work and the work of others (Beach et al., 2008; Wild, Boise, Lundell, & Foucek, 2008) suggests that older adults are unconcerned about privacy, findings are limited by one-time, short-term interaction with the technologies. Surveys and focus groups ask participants for their impressions about in-home technologies after a brief laboratory exposure to a Wizard-of-Oz scenario or, at best, a brief interaction with an actual device. In our 6 week in situ study, participants had much more time to fully appreciate the privacy implications of in-home technologies. Over the course of the study, two participants who were originally unconcerned about highly granular video feed became more uncomfortable with being always "on." This underlying concern may only exacerbate the natural role strain between a parent – even one that needs care – and having adult children intervening in one's most personal affairs.

Our findings suggest that the protection of privacy remains a significant challenge to the adoption of new home-based technologies, both by older adults and their adult offspring (Coughlin et al., 2009; Kwasny, Caine, Rogers, Fisk, 2008; Shankar, Camp, Connelly, and Huber, in press). Understanding the privacy preferences of older adults toward home based monitoring technologies as a function of their close, professional, and other relationships will extend the

work we began here, considering a range of technologies, types of data, domains of need, and key relationships, all studied over a period of time.

The small number of participants limits broad generalizations of any kind. But this lengthy, in-depth exploration suggests that older adults' primary anxiety about monitoring technology, the replacement of human contact, may be minimized (if not entirely eliminated) if technologies are designed with sensitivity to the primary motivations in late life. Besides helping older adults maintain independence, in-home technologies should be designed with the key motivation of older adults in mind: the ability to maintain and strengthen key relationships while empowering them to manage the technologies they use.

Our study and others suggest there are multiple mechanisms by which this can be done, both for older adults and their informal caregivers. Previous research suggests that older adults prefer to maintain reciprocal exchanges over dependence as a way to build social capital (Keyes 2002); two-way or multi-way communication technologies have the potential to increase connection in ways that one-way monitoring devices do not (Hutlock, 2003). Other studies have suggested that increased awareness and communication would facilitate a sense of emotional "connectedness" for both the older adults and their caregivers (Rowan & Mynatt, 2005). Our own pilot research, with one of the authors and her parents, used a paired set of plants with motion sensors. Field notes and interviews suggested that awareness of daily activities facilitated increased sense of closeness and familiarity. Older parents can be "out of sight, out of mind." Ambient devices indicating that older loved ones are at home and near the phone is often just enough to prompt a phone call. Even if communication is not instigated, information that all is well can provide comfort and reassurance to older adults and their caregivers, facilitating and supporting a positive caregiving relationship.

As with all information and communication technologies, our designs shaped the kinds of interactions individuals had with them and with each other. Unlike many devices designed for home monitoring, we found that our attention to privacy, empowerment, and the importance of deepening and strengthening personal relationships to older adults during the design process gave the users (both older adults and their informal caregivers) a "window" that could facilitate the relationship, a window that has the potential to enrich and enhance relationships over time.

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