Visual Sensing Devices in Home-Care Systems
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ABSTRACT

Research on monitoring in the home environment often assumes that the use of cameras is unacceptable because of privacy concerns. In this paper, I examine this assumption in light of research on designing for older adults, privacy in assisted living, and theories of privacy. Given the results of this examination, I propose well-being as an additional variable to be considered when designing home-care systems. I conclude by suggesting avenues for future research on visual sensing devices in home-care settings.

Categories and Subject Descriptors
J.4 [Social and Behavioral Sciences]: Psychology; K.4 [Public Policy Issues]: Computer-related health issues and Privacy

General Terms
Human Factors

Keywords
Privacy, Home-care Systems, Aging, Older Adult, Smart Home

1. PROBLEM SPACE

Older adults stand to benefit substantially from in home healthcare systems [1]. Home-care systems may allow older adults to stay healthier and independent longer and thus age in place. Aging in place is preferable for a number of reasons. From a financial perspective, it is often much less expensive for a person to continue residing in their home rather than receive care at an assisted living facility. In addition, older adults overwhelmingly prefer to stay in their own home rather than move to such facilities.

Many home-care systems propose the use of visual sensing devices to monitor residents as a means of ensuring safety [2]. Often these visual sensing devices provide high-fidelity images to the people who are responsible for monitoring the older adult. However, designers of home-care systems commonly assume that monitoring a home using visual sensing system is unacceptable because of privacy concerns.

Although privacy may be a significant concern when evaluating the appropriateness of devices for use in the home of older adults, it should not be the only consideration. Older adults are disproportionately affected by medical conditions, are at greater risk for falls [1], and may have different privacy concerns from the population as a whole [3]. Thus, other factors such as the well-being of an individual and an individual’s personal risk factors should be taken into account when determining the appropriateness of technology for use in the home.

2. ASSUMPTIONS ABOUT CAMERAS

The prevailing assumption about cameras is that they do not belong in the home. Much time and effort in academia and industry has gone into designing alternative devices that approximate the function of cameras, yet distort the captured images in an attempt to “preserve privacy.” However, there is currently no theory or model that allows reliable prediction about the perceived privacy implications of a particular system [4]. When examined in light of existing privacy theory and research on privacy in assisted living it becomes clear that this design intuition about cameras in the home requires reconsideration as well as further investigation.

3. PRIVACY IN ASSISTED LIVING

Privacy is one of many issues to be considered in designing dwellings for aging adults. Other issues include social interaction, control/choice/autonomy, aesthetics, personalization, orientation, safety/security, accessibility and functioning, stimulation, adaptability, and familiarity [5]. For an older adult, moving to an assisted living facility involves not only a physical move, but also may include psychological trauma such as being forced to leave behind possessions, pets, and social support.

In addition to these changes, residents often find that there is very little privacy in assisted living facilities. In assisted care environments bathrooms and bedrooms are often shared rather than private [7]. Even in non-shared environments, nursing home residents are often assisted by staff in the traditionally solitary activities of bathing, toileting, and dressing [6]. These challenges are often exacerbated because the duties of protecting the privacy of nursing home residents are often left primarily to caregivers [8]. Thus, the private life that an older adult experiences at home may be very different from life in an assisted living environment.

4. THE INFLUENCE OF WELL BEING

For an older adult who is high functioning (i.e., can take care of him- or herself without any problem) a visual sensing system in the home may seem unnecessary or invasive. However, consider

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the following scenario: Henry, an 87 year old man who lives at home is becoming less and less able to take care of himself. Some days it is hard for Henry to get out of bed by himself and he worries he may not be able to get out of bed himself at all some day soon. However, Henry wants to live in his own home. He is comfortable in his home and has, up to this point, been able to take care of himself. For Henry, the idea of installing a visual sensing system in his home so that someone can check up on him and provide help when needed may seem comforting rather than invasive. In this way, Henry’s privacy concerns are not only affected by the technology, but are also influenced by well being.

One way to assess an individual’s well-being is by using scales such as the Activities of Daily Living (ADLs) and Instrumental Activities of Daily Living (IADLs) [9]. These scales are used by health professionals to determine an individual’s ability to live independently. The level of perceived benefit of device and the level of privacy concern a person has for a specific device are influenced by the level of functioning as measured on the ADL and IADL scales [10]. Stated another way, it seems that a person’s well-being influences the perceived benefits of any home-care system. If the benefits of a visual sensing device include comfort and the ability to live at home rather than in an assisted living facility, this shifts the calculus of privacy. However, well-being is one of many things that are not addressed in current theories of privacy [11].

5. CRITIQUE OF THEORIES OF PRIVACY
The most commonly cited theories of privacy are Alan Westin’s theory of privacy and freedom [12] and Irwin Altman’s theory of interpersonal interaction [13]. While both theories are based on extensive fieldwork and represent a major contribution to privacy theory, neither is sufficient for understanding the complexities of the present-day privacy debate.

One issue, as described above, is the lack of consideration for the benefits of sharing information. Another significant issue with these theories is definitional; no common definition among theories exists, and privacy defined as “being physically alone” is insufficient given the current state of information technology. Today we often find ourselves in a room physically alone, yet connected to many others via the Internet. Given that these theories were published before 1980, it is not surprising that neither successfully accounts for technology-mediated situations. However, it means that these theories of privacy are ill-equipped to provide guidance about how technology fits in to the privacy equation [11].

6. IMPLICATIONS
There are a number of implications for privacy research dealing with home-care systems for older adults based on this critique. First, designers should revisit the claim that visual sensing devices should not be considered in their toolboxes. Especially in the case of older adults, visual sensing devices may provide benefits above and beyond other alternatives. Second, as a result of the increased information captured using visual sensing systems, especially video systems, the secure transfer of data from visual sensing devices to the approved viewers (e.g., family members, neighbors, caregivers, health care providers, emergency personnel depending on the preferences of the individual being monitored) becomes paramount. Finally, there needs to be an increased focus on areas such as usable sharing/privacy interfaces for older adults to ensure that users are aware and in control of when and to whom information about them is transmitted.

7. CONCLUSION
Privacy concerns are and should continue to be an important consideration in the design of visual sensing devices for home-care systems. However, neither current psychological theories of privacy nor designers’ intuition about privacy are adequate for fully understanding the privacy implications of introducing visual sensing devices into the home environment. Therefore, visual sensing devices should not be rejected outright, but rather should be subjected to additional acceptance and privacy research.

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9. REFERENCES