

# **AUTOMATION AS CAREGIVER; THE ROLE OF ADVANCED TECHNOLOGIES IN ELDER CARE**

**Organizer & Moderator:** Christopher A. Miller, Chief Scientist, SMARt Information Flow Technologies

## **Panelists:**

Wende Dewing, Senior Scientist, Honeywell Laboratories  
Kathleen Krichbaum, University of Minnesota, College of Nursing  
Stacy Kuiack, President and CEO, Vigil Health Management, Inc.  
Wendy Rogers, Associate Professor, Georgia Institute of Technology  
Steven Shafer, Senior Researcher, Microsoft Research

An unprecedented boom in the elderly population will hit all industrialized and most other countries over the next 30 years. In many cases, governments, social service organizations and even individuals and families are turning to technological solutions to aid in care giving for this elderly population. While much of this technology continues to occupy traditional assistive roles such as aiding in walking, door opening, and communication, increasingly advanced technological solutions are being proposed to aid in monitoring, diagnosis, situation awareness, decision aiding and the direct automation of tasks for either the elderly themselves or for their caregivers. That is, technology is increasingly either occupying or sharing the role traditionally occupied by human caregivers. This role is understudied from a Human Factors perspective and, as with all human interactions with novel technology, failure to consider the humans' needs, desires, capabilities and limitations will lead to unsatisfactory technological solutions at best, and disasters at worst. This panel will explore the role of automation as caregiver for the elderly. The central question will be *how* automation can be most appropriately integrated into a caregiving infrastructure so that it provides the best, most acceptable and most effective care from both the elders' and the human caregivers' (both professional and informal) perspectives.

## **PROBLEM STATEMENT**

The population distribution of the United States (as well as most industrialized countries) is shifting to a higher proportion of aged people. The number of people in the U.S. over the age of 65 will double from 34.7 million now, to 69.4 million by 2030. This number represents an increase from about 8% currently to over 22% of the projected U.S. population (AOA, 1998). The Baby-Boomers are coming, and they're going to live longer: the average life expectancy for persons reaching age 65 is an additional 17.6 years, an increase of 3.3 years just since 1960 (Census, 1999).

This situation is posing, and will increasingly pose, a serious problem for most industrialized societies—especially, the United States. As the cognitive and physical health of elders begins to deteriorate, they increasingly require assistance from caregivers. Specifically, elders have increasing problems with Activities of Daily Living (ADLs) and Instrumental Activities of Daily Living (IADLs).

In current practice, as an elder becomes increasingly less capable of caring for him/herself, either the family or the government (or both) step in. This first takes the form of informal care—increased visits, chores, errands, reminders, etc. Estimates are that this informal caregiving activity accounts for more than 85% of all elder support

(GAO, 1997), involves more than 23% of US households (AARP, 1997) for an average of 12 hours per week and has been conservatively quantified at a cost of \$11.2B per year in 1997 (MetLife, 1997).

As the elderly's capabilities decline, the ability of an informal caregiver becomes inadequate. This is a period of intense stress for both the family and the elder. At this point, in-home professional care and/or assisted living and/or nursing home care becomes necessary. In-home health care is projected to cost Americans \$56.7B and nursing home care to cost \$130.9B by 2005 (each almost doubling corresponding 1996 figures (HCFA, 1998)). Historically, 43% of people over the age of 65 will enter a nursing home at an average cost of \$47,000 per person per year (HCFA, 1998).

Even if the U.S. economy could handle these increases in terms of both costs and the available (and shrinking) labor pool, the strain on families and individuals is enormous—informal caregivers use prescription drugs for depression, anxiety, and insomnia at a rate of two to three times that of the average population (Gallagher, et. Al., 1989), and surveys have shown that 30% of the elderly would rather die in their legacy homes than move to nursing care (HCFA, 1998). If nursing home admission could be deferred for one year for less than 1 in 5 of these elders, the U.S. would save an estimated \$22 billion in 2005 alone—not to mention untold familial suffering.

Technologists are rushing to provide solutions to these problems. Everything from ergonomically designed can openers and countertops, to chemical analysis toilets and smart refrigerators, to telemedicine, to integrated home monitoring and aiding systems may serve to let the elderly maintain their independence and remain in their legacy homes longer—or reduce the need for professional assistance, extending the capabilities of those engaged in it and, hopefully, reducing the costs. But such goals are, increasingly, placing technology in the role of caretaker—a role previously occupied almost exclusively by humans. This role is understudied from a Human Factors perspective and, as with all human interactions with novel technology, failure to consider the human's needs, desires, capabilities and limitations will lead to

unsatisfactory technological solutions at best, and disasters at worst.

## PANEL DESCRIPTION

This panel will explore the role of automation as caregiver for the elderly. The central question will not be so much *whether* automation should be cast in the role of caregiver—the world seems to be rushing toward that solution—but rather *how* automation can be most appropriately integrated into a caregiving infrastructure so that it provides the best, most acceptable and most effective care from both the elderly and the human caregivers' (both professional and informal) perspectives.

We do not intend that panelists should so much provide a detailed account of research results in this field as that they should present a variety of perspectives, concerns and lessons learned from both research and practical experience on the topic of how technology can and should be brought to bear to aid in caregiving for the elderly. As such, we have assembled a group of panelists with unique insights on and knowledge of this question.

Dr. Kathleen Krichbaum is a professor specializing in gerontology and long term elder care at the University of Minnesota's School of Nursing. Dr. Wendy Rogers is a Psychology professor at the Georgia Institute of Technology specializing in human factors research on the elderly's use of technology. Mr. Stacy Kuiak is the CEO and President of Vigil Health Management, Inc. a company which has fielded an advanced monitoring and alerting system used to extend the available human caregiver resources in assisted living care facilities for dementia patients. Both Dr. Wende Dewing of the Honeywell Laboratories, and Dr. Steven Shafer of Microsoft Research are currently engaged in projects to develop advanced ubiquitous computing architectures to be used to monitor and assist elders in their homes.

Each participant will have approximately 10 minutes to present his or her research and experience. Panelists will be asked specifically to offer a position, derived from their experience and data, on filling in the blank in the following statement: *In order to provide acceptable benefit*

*to both caregivers and elderly clients, automation systems occupying a role as caregiver must*

Since the panel participants have a variety of backgrounds, some with extensive experience in human factors and others with none, we hope to encourage the audience to raise and pursue topics of interest in the application of technology to caregiving for the elderly. Following presentations by the panelists, the symposium will be opened for questions. Potential questions might include, but will certainly not be limited to:

- How can we accurately convey the capabilities and, especially, the limitations of a technological system to a decision maker (who may or may not be the elder) who must decide whether or not to use this particular system in the care of this particular elderly person?
- How should we approach the tradeoff between comfort and dignity in the elder's interaction with the technological system? This is particularly pressing with regards to security and privacy issues surrounding monitoring systems.
- How can/should we cope with the legal issues surrounding caregiving systems? Will (should?) the liability issues associated with such systems prohibit the fielding of capabilities which could, technologically, be provided?
- Unlike many other forms of automation, caregiving automation inherently provides a service for the recipient that s/he cannot provide themselves. What impact will this factor have on the types of automation that can or should be fielded?

### **PANELISTS STATEMENTS**

Below are brief descriptions of the background and position statements for each of the panelists.

**Wende Dewing**  
**Honeywell Laboratories**

Our Independent LifeStyle Assistant (ILSA) program is designed to enable elders to defer, if not avoid, a move to institutional care through the use of advanced user interface, reasoning, and home automation technologies. The success of these technologies depends on the extent to which they can accommodate individual differences. In order to provide meaningful benefit to both caregivers and elders, automation systems must be tailored to the individual needs, activities, patterns of behavior, capabilities, and preferences of those they serve. Our recent research has explored the daily routines of elders in an attempt to understand the range and frequency of activities that must be addressed, as well as the capabilities and preferences that will determine the ways in which ILSA interacts with elders and caregivers. I will describe a day in the life of an elder and her caregiver, and how this information might impact the design of systems such as ILSA.

**Kathleen Krichbaum, RN, PhD**  
**University of Minnesota**

The potential benefits of automation systems acting as caregivers for elderly clients are vast. In order for this change to occur, designers of these systems must be aware of the unique needs of elders living independently. Research on these elders has demonstrated that this population is heterogeneous; it becomes difficult, then, to aggregate needs broadly. However, there is a growing body of literature that has identified factors that contribute to institutionalization of elders. This literature is based on the important distinction between normal changes associated with aging and changes that signal functional or cognitive decline that necessitate more intensive caregiving. As such it has informed care providers about what it takes to maintain elders independently at home. Understanding the "Top Ten Reasons" that predispose one to move from home to Assisted Living Facilities and/or Nursing Homes will help in the design of automation systems as caregivers.

**Stacy Kuiack**  
**Vigil Health Management, Inc.**

There are an estimated 6.25-million dementia sufferers in the United States, and that figure is expected to rise to 14-million by 2050. The one pervasive complaint within the medical profession is that dementia patients have great difficulty operating a traditional nurse call system. These people are often physically unable or confused about how and when to summon help. In effect, dementia sufferers do not equate the pushing of a small red button with summoning help. In those cases where they do know when to call for help, physical impairment often prevents them from doing so. This has historically been a key point of failure for care delivery and IT performance in seniors' care.

To deliver effective care in these situations it is necessary to understand when a dementia sufferer needs help. Each patient has a unique set of needs and by understanding their rest and activity behaviors, bathroom and/or incontinence patterns, and mobility patterns caregivers are better able to design and deliver individualized care based upon unique, pro-active behavioral profiles.

VigilÆ is focused on delivering technology-based solutions to these challenges and the Vigil Integrated Care Management System provides long-term care residents with a state-of-the-art behavioral monitoring system. Through an array of passive sensors and proprietary hardware VigilÆ provides residents with a means of summoning help without being cognitively alert or physically mobile. VigilÆ returns dignity, independence and peace of mind to residents, their families and the medical community while increasing the quality of care received.

**Wendy A. Rogers**  
**Georgia Institute of Technology**

Technology certainly has the potential to improve the lives of older adults. Technological advances may increase functional independence, may enhance social interactions, and may be used to improve home health care. However, technology is only as good as it is usable by the intended user population. In our work, we have found that older adults are very open to new forms of technology provided they are taught how to use the new

systems and that they can conceive of a potential benefit (i.e., not technology for the sake of technology). Unfortunately we have also found that many systems are not designed with the needs and capabilities of older adults in mind. I would make the following points in my discussion: a) age-related motor, sensory, and cognitive declines must be considered in the design process; b) designers should capitalize on age-stable abilities; c) older adults should be included in the formative and summative usability evaluations.

**Steven Shafer**  
**Microsoft Research**

In the future "intelligent" home or office environment, lots of devices and programs have to work together. Today's systems require custom construction and configuration. In the EasyLiving project, we are developing a prototype system that creates a model of the environment using cameras and other sensors. Using this model, home and office automation can become more of a commodity market, and we may see the emergence of a "marketplace" of the necessary devices and application programs. There are many applications possible for people with disabilities or age-related infirmities, such as monitoring, medication dispensation, and communications assistance.

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