Designing Technology for People with Dementia

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Dementia and the ageing population

In recent years in the western world improvements in the quality of life have lead to much greater life expectancies amongst the general population (Arbeev, Butov et al. 2004). With this increase in life expectancy, a shift has occurred in the demographic of Britain, leading to a phenomenon referred to as the aging population. With this shift comes a dramatic increase in the diseases and syndromes associated with old age such as dementia (Ferri, Prince et al. 2005).

Dementia is a severe debilitating condition and, people with dementia experience a global decline in cognitive function leading to problems with memory, perception, reasoning and temporal and spatial awareness (Whitehouse 1993). In addition to these cognitive impairments, those who suffer from dementia can come to suffer from distressing and potentially dangerous behaviours such as wandering, a behaviour where the sufferer performs movements for no apparent reason ranging from restless walking around the home to becoming lost in the community, and aggressive behaviour towards others ranging from verbal to physical aggression (James and Swann 2001).

Over the course of the cognitive-decline that dementia causes, people with dementia come to rely on others to provide care for them, typically a spouse or adult child. This caregiver suffers great deals of stress and anxiety arising from the burden of care placed upon them. The caregivers can also suffer from heavy requirements placed upon their time and consequentially, their personal finances (O'Shea 2003).

It is estimated that in Britain, the annual cost of caring for people with dementia is four point six billion pounds, it is anticipated that with the increasing number of sufferers, the cost is anticipated to rise to nearly ten billion in the next forty-five years (Comas-Herrera, Wittenberg et al. 2005). One final driver for research and development of new methods to assist in the care of people with dementia is the relative decline in the numbers of people available to care for the older population. As the balance shifts towards the older population, there will be less and less people under the age of sixty available to care for the older person.

It is within this context that we are examining the potential for assistive technologies to be used in order to promote the independence of individuals with dementia. In particular, our goal is and to enable them to re-claim some their of the sense of self which dementia can rob a person of. Within this work, the use of communication technologies plays a key role, allowing for compensation for the fact that now many caregivers have competing commitments for can not spend all their time and often
either with their charge and may live in a separate home or spend significant amounts of time in some other form of employment, be at work during the day.

The use of communication technologies for people with dementia

Two examples of the ways in which communication technologies can and are used to enrich the lives of people with dementia and to relieve the burden that is placed on the caregiver are telecare and mobile communications technology. Both technologies illustrate how improvements in communication technologies can have profound impact on the lives of people with dementia and those that care for them.

**Telecare:** Currently within the care sector, extensive use is made of Tele-care systems. Tele-care involves the use of communication technologies to alert manned call centres to emergency needs of elders. Systems range from those which can be activated by pulling cords installed in the home in areas where problems might arise such as the bathroom, to sensor systems located on the body which are capable of detecting when the user falls and sending alerts to get help to them.

Tele-health is a relatively new term that refers to the advent of distributed health care using electronic monitoring tools, this technology allows a doctor to monitor a patients health remotely whilst still communicating personably with the patient via the medium of their television set. The ability to remain in the home, whilst receiving personal medical care via communication technologies, provides an example of the promotion of independence for elders with any condition which might limit mobility.

**Mobile communication technologies:** Several major trials have demonstrated the efficacy of tracking for people with dementia, even people who do not typically suffer from the specific behaviour of wandering are still at risk of becoming lost due to forgetfulness and disorientation. The main challenge that faces this technology is not in fact the challenge of tracking but one of developing systems which are ethically and legally sound and secure.

Trials which prototyped GPS concluded that, from a technological standpoint, the systems where feasible for use when tracking a person with dementia (Shimizu, Kawamura et al. 2000; Miskelly 2005). The sensors used in both projects did appear to be somewhat cumbersome, strapping a mobile phone on the chest or having the participant carry a bag with them, but both systems provided results that where deemed as being sufficiently accurate and reliable even under adverse conditions.

**Research Hypothesis and Area’s of Development**

The driving principle behind all the work that we will be doing during the project is that of including people with dementia and their caregivers in the design work. The project aims to include them via the mediums of interviews and focus groups initially, with testing done at a later date in the home. We believe that the inclusion of people with dementia at the design stage, something rarely attempted prior to now, will lead to technologies which do not suffer from any of the problems which other studies have discussed arising from usability problems and a lack of familiarity with what younger generations might consider to be basic paradigms of human computer interaction (Gregor, Newell et al. 2002).
Tracking for Wandering and People with Dementia at Risk of Becoming Lost:

Our goal in the field of tracking people with dementia is to develop socially sensitive tools which enable the user to experience independence from their caregiver again. We believe that by allowing this, the elder life will be enriched by the experience of reclaiming a freedom previously lost to them and the caregivers quality of life will likewise be increased as a result of the reduction of the burden of care put on them. In order to achieve a tracking system that genuinely meets users needs, we will work closely with people with dementia, to this end, we will run focus groups to elicit the feelings of people with dementia towards this tracking and will take account of these feelings in the design of the system. We foresee that their will be a demand for flexible tracking systems which can associate themselves with meaningful area’s based upon the person with dementia and their caregivers perception of the environment that they live in.

We intend to develop tools that aim to allow the user of a system to express these areas’s as they perceive them and will focus on this area in preference to the more technological area’s looking at how to realise the tracking and communication. This will raise challenges when it comes to eliciting information from the person with dementia around the area’s of ensuring that they can associate the area’s as presented to them by the system with the area’s as they move through them in real life.

Supporting The Ambient Kitchen: We are currently developing an ambient kitchen in Culture Lab. This is a mock-up of an actual kitchen in which we embed a number of working demonstrations of the potential for ambient assisted living. The kitchen will provide a platform for explaining and exploring the application of pervasive technology in a domestic setting. Elements of the physical environment they attempt activities of daily living and appliances will be highly instrumented, both with sensors (e.g. accelerometers) and different wireless communication technologies (motes and RFID tags) which will allow both wireless collection of the data and location sensing through the use extensive instrumentation of the artefacts in a kitchen.

An ongoing topic of research in pervasive computing is the unobtrusive recognition of user actions using sensor networks, that is, the identification of activities, manner of performance, and intermediate states in the performance of an action. By building on past approaches, the project will explore the use of both layered probabilistic representations and decision tree classifiers in developing an activity recognition framework that is appropriate to the nature of situated cognitive assistance required. This work will be augmented by a detailed exploration of typical errors which people with dementia make as they attempt activities of daily living and through the use extensive instrumentation of the artefacts in a kitchen.

Upon the identification of possible errors, the ambient kitchens various output devices will be used to provide prompting for the user thus avoiding the need for direct user input and achieving a “vanishing” interface” (Orpwood, C.Gibbs et al. 2005). The manner in which the prompt is delivered will be flexible to account for the wide variations in the cognitive capabilities of the user. Here crossmodal and multimodal prompts have an additional value as they have the potential to allow for possible deficits in one or more of the senses (Gregor, Newell et al. 2002).

Previous studies have shown that recorded voice prompting, embedded characters and subtle location cues can all be of use in such systems, the situated nature of the prompts leading to a simulation of implicit prompts (Kautz, Fox et al. 2002 ) but with the option of detecting failure to act upon the prompt so moving on to a more detailed
level of cuing (Mihailidis, Barbenel et al. 2004). The ambient kitchens prompting systems will be able to avoid the distress that other less well provisioned systems have caused as a result of false alerts (Adlam, Faulkner et al. 2004; Adlam and Orpwood 2004) due to the more complete and complex nature of the sensors embedded in the environment.

We believe that the two research area’s detailed above, along with an examination into the nature of prompting, provide an excellent inroad for the development of enabling technologies for people and will also afford insights into the nature of working with people with dementia for design purposes. We hope to develop guides to good practice that will provide a basis for future work with people with dementia whilst at the same time demonstrating the value of their inclusion via the development of novel, sensitive technologies.

References


