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Smart Houses and Uncomfortable Homes

Norman ALM[1] and John ARNOTT
School of Computing, University of Dundee, Dundee DD1 4HN, UK

Abstract. In order for smart houses to achieve acceptance from potential beneficiaries they will need to match the users' expectation that their house is also their home, with the sense of privacy and control that this implies. Designers of this technology will need to be aware of findings in this regard from fields such as architecture and design ethnography.

Keywords. smart homes, ambient assisted living, home care, privacy, control

1. Introduction

Technology is being applied more and more within the home. From the early days of washing machines and televisions we have progressed to wireless environments that allow parts of the house to be in constant communication with their owners, and remote access by homeowners from miles away to monitor and control security, heating, cooking and entertainment systems.

At the same time the technology to support ambient and assisted living has continued to improve, and become more and more powerful and less and less obtrusive. Why then have we not seen a wider application and uptake of this technology to help frail older people remain in their own homes for longer rather than going into residential care? A number of commentators have noted this disappointing level of uptake and proposed some suggested reasons [9,16,17], such as barriers to adoption (e.g. threats to identity, independence and self-care; expected disruption to existing services) and difficulties with pilot projects not necessarily producing good evidence, policy or practice decisions. Interestingly although the development of 'smart home' technology has moved into the mainstream, and is much discussed in the media, take-up among the general population has also been surprisingly slow [1].

We discuss here another possible explanation for the slow adoption of such smart technology in the home, and make some suggestions for improving its acceptability. This discussion follows on from a body of work in architecture and design ethnography that underlines the importance of mapping any technological systems onto the routines, priorities, lifestyles, and attitude of the people who transform a 'house' into a 'home' [4,5,6,9,15].

Designers of ambient assistive technology for the home need to recognize that Le Corbusier's famous dictum that "A house is a machine for living in" [12] is not accepted by many (and in any case it is not at all clear that his meaning here was subject to a simple explanation).

[1] Corresponding Author.

One's home of course does meet a number of practical needs: shelter, comfort, a place to interact with family, and a base for entertaining others. There are also deeper emotional meanings for most of us in the word 'home', including privacy and control.

> *A 'house' is generally taken to be synonymous with a dwelling or a physical structure, whereas a 'home' is not. A 'home' implies a set of social relations, or a set of activities within a physical structure, whereas a 'house' does not.* [21]

Homeless women who took part in a research study defined homelessness as meaning a number of things apart from just being without a roof over their head: poor material conditions, lack of emotional and physical well-being, lack of social relations, and no sense of control and privacy. Interestingly, the researchers found that about one-third of the women who did not consider their present accommodation to be their home did not define themselves as homeless, while about the same number of the women who considered their present accommodation to be their home thought of themselves as homeless [21]. These contradictions indicate the complexity of the meaning of home and homelessness.

Drawing on this work, and other explorations into what it means to the individual to be 'homeless' led Somerville to set out a number of dimensions of the concept of 'home'. An extract from his chart is given below. It should be noted that what he means by 'Paradise' here was an idealised vision of what a perfect home could be [18].

Key signifier	***General connotation***	***Sense of security***
Shelter	Materiality	Physical Protection
Abode	Place	Spatial Rest
Hearth	Warmth	Physiological Relaxation
Privacy	Control	Territorial Possession
Heart	Love	Emotional Happiness
Roots	Source of identity	Ontological Sense
Paradise	Ideality	Spiritual Bliss

Table 1: Some meanings of 'home' (Adapted from table in [18], p.533)

2. Care at home through technology

In order to provide safety and security for an older person at home, a degree of oversight by other members of the family, and possibly neighbours, is necessary. In earlier societies, when much of one's life was lived out in public spaces, and where large extended families occupied a single dwelling, such oversight could be provided unobtrusively as a side-effect of all living together in close proximity. As societies have become more prosperous, to some extent we have used our increased wealth to buy increased privacy. This has benefits, but it may also have introduced the unwelcome results of loneliness and vulnerability.

One technical approach to addressing the isolation of those living alone has been to develop smart housing and telecare to help in their care and connect them remotely to others. Ubiquitous computing, with networked computing devices and sensors

incorporated into the items and structures around us, has been an area of research for some time, with implications for smart domestic environments [22]. Sensors can be used to monitor environments, and identification (e.g. RFID) tags can be attached to objects to enable them to transmit information about themselves. The presence of people and their movement and interaction with their environment can be monitored using sensor networks and pervasive technology [7]. Standard household appliances can be made 'smart' using embedded computing [13]. Such technology is enabling the development of what has been called 'the internet of things' [5], potentially a global network of physical objects which can communicate and interact and also record the behaviour and activity of humans in their daily lives.

One approach to the care of people in the home is to gather information about their domestic lives by recording and modelling their activity, with the aim of detecting changes which might relate to changes in well-being. Activity and interaction with spaces and objects might change over time in ways which imply that some intervention or investigation is advisable to address health or well-being problems [3,8,10]. Sensor networks and pervasive technology enable the acquisition of data in the home and recording of information about domestic life. The motivation is to provide domestic residents and their carers with information to help the provision of care and help older people to 'self-care' and thus continue to live at home. The security of such data is immensely important however, as it relates to domestic life and possibly quite detailed and intimate aspects of the lives of individual people. Perceptions of how such data might be appropriately shared have been explored and it is clear that challenges to our current conceptions of privacy arise [4,5].

3. Privacy

Thus we can introduce a degree of helpful oversight using technology, but this always risks creating a resistance to having privacy violated. One dramatic indicator of the role that privacy plays in our feelings about our home is the emotional reaction that most people experience if they have been the victim of a burglary. Often the damage done to the home in a burglary can have a greater impact on the victim than the loss of possessions [20].

> *Anger is a common reaction, reported by 41 per cent of property crime victims. "There is a terrible sense of violation coming home to find your home broken into that people really don't get over," says University of Alberta criminologist Bill Pitt. "I think what law enforcement really misunderstands here is the sense of violation, the sense of loss, the sense that someone has been in your home."* [19]

The 'trespassing' involved in a burglary can leave the home-owner feeling 'violated and insecure' [2]. It is possible to deal with the sensitive issue of privacy when developing ambient assistive technology, but this needs careful thought, and attention paid to the wishes and priorities of the potential users.

An interesting exemplar of this is the research work reported by McKenna et al. [14], in which a focus group of older people, when presented with the technical possibilities in an innovative way (by using actors portraying a proposed system in use), could distinguish between being filmed and being monitored in such a way that

no other person could watch them, and where no permanent visual record was kept. The members of the group were happy to be monitored this way, but definitely did not want to be 'on camera' in the usual sense. The report on this work concludes:

> *Several researchers have previously expressed the opinion that image-based monitoring would be unacceptable to older people. The findings in this study contradict this received truth. In fact, all the groups were happy to accept that although the system was based on video input, it was not necessary for it to store or transmit any visual images.* [14]

Another example of carefully adapting surveillance technology to the sensitivities of those being monitored is the Just Checking system, which is commercially available in the UK [11]. Here the doors in the person's home are fitted with motion detectors, which are small and unobtrusive. The distant family member, over a password-protected webpage, is shown a continuously updated chart with a vertical line drawn for each time one of the sensors was activated. From this minimal information, the family member can use their human abilities at pattern recognition to get a quick and informative picture of the overall activity in the home, and spot potential problems (such as the person never visiting the kitchen that day). This minimal presentation of information seems to be effective. According to one user :

> *We could see that all arrangements were working well, that the home carer had been in each morning, that Mum was picked up and dropped back from a Friday lunch club, and when she popped out and returned from the local shops, where she was well known. My brother, who lives in New Zealand, also logged on each day. It meant we had more to say about Mum when we talked each week on the phone. And we were both able to see when she needed a higher level of care, so it wasn't me having to make that difficult decision on my own.* [11]

It is interesting to note an added benefit here. A simple problem like having difficulty making conversation can actually lead to a lack of regular contact. Being prompted with something to talk about, based on the person's actual daily activities, is a very useful and welcome addition to the security aspects of the system.

4. Control

The home should supply refuge from the world outside [15]. This implies a degree of control over your domestic environment that may be less possible in the wider world. The introduction of 'labor-saving devices' into the home has no doubt been of great benefit. As devices take on more and more decision making, however, they can come to a point where their intervention, however helpful, may not be welcomed. If a fridge can detect when foodstuffs are running low, and automatically put in an order to the supermarket, this may reduce the householder's opportunities to enjoy the social aspects of a regular trip out to do the shopping. Characterising the inhabitants of the home as 'users' may miss important aspects of their lives and activities. Davidoff et al. point out that:

Unlike users, families both individually and collectively resist clearly defined goals. [In addition] advanced context-aware systems ... challenge or even invert ... [their] sense of who is actually in control. [6]

Smart house technology needs to develop control and interaction mechanisms which reflect the complex and emotional relationship between the person and the dwelling in which they live.

5. Conclusion

Technology to support ambient and assisted living is becoming more powerful and less obtrusive, but complex and varied factors combine to hinder its uptake. Concerns about privacy and loss of control are important for residents. Developers of home care technology need to strive for balanced solutions where privacy is valued and intrusion is limited to a minimum while residents perceive that they hold an appropriate level of control over their home and their domestic lives.

Home care technology has much to offer, but the words of Rybczynski apply here:

... the evolution of comfort will continue. For the moment, this evolution is dominated by technology ... This need not dehumanize the home, any more than effective fireplaces or electricity did in the past. Can we really have coziness and robots? That will depend on how successful we are in turning away from modernism's shallow enthusiasms, and developing a deeper and more genuine understanding of domestic comfort. [15, p.224]

Comfort in one's home can be compromised by technology; the challenge is to design so as to actually realize the potential benefits.

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