

**AN EXPLORATION OF THE NEEDS AND CONCERNS OF
POTENTIAL AMBIENT ASSISTED LIVING USERS WITHIN
THE CONTEXT OF THE MEANING OF HOME**

by

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ABSTRACT

The purpose of this study was to explore the potential affect that Ambient Assisted Living technologies may have upon users within the context of the meaning of home. A qualitative approach was employed and semi-structured interviews were held with potential users. Findings revealed that an Ambient Assisted Living system would have little affect upon six of the seven meaning of home categories identified in this study. It was found however, that an Ambient Assisted Living system had the potential to affect behavioural freedom within the home space. Additional themes that emerged from this study were concerned with the importance of family, who benefited most from the system and the nature of trade-off in older adults' decision-making processes. It was concluded that future research should be directed towards developing Ambient Assisted Living systems as part of a broader holistic paradigm designed to assist older adults with aging-in-place.

Keywords: Ambient Assisted Living; meaning of home; gerontechnology; telehealth; aging-in-place

DEDICATION

To My Daughter Zoe,

Always an Inspiration ~ Thank you!

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CHAPTER 1: INTRODUCTION

Canada is a country that is aging, and it is projected that the number of individuals over the age of 65 will grow from its current 13 percent of the population to an estimated 21.4 percent by 2026 (Turcotte & Schellenberg, 2007; Wister, 2005). A goal held by many older people concerns itself with remaining independent in one's home and aging-in-place (Sixsmith, 1986, 1990; Sixsmith & Sixsmith, 2008). Information and communication technologies (ICTs) have considerable potential for enhancing the lives of older Canadians and may assist in achieving this desired goal. One such technology under development is an Ambient Assisted Living (AAL) monitoring system that provides individualized support services and health care to older people in their homes. Successful development of emerging AAL monitoring systems could promote the ability for older people to adapt to their environment (Lawton & Nahemow, 1973; Lawton, 1989; Wister, 1989), and remain in their homes, thereby aging-in-place. Lawton's ecological model of adaptation and aging included both a macro and micro environmental perspectives. The core premise of the model is that adaptation stems from the interaction between individual competence (e.g. health, perception and cognitive skills) and environmental press (e.g. demands from the personal, group, social, and objective physical environment). It may be envisioned therefore, that AAL could potentially function as a tool to assist in the management of environmental press faced by older adults as they age. These

in-home monitoring systems are currently under development by consortiums in Europe (SOPRANO, 2008) and the United States (CAST, 2008). Little research however has been conducted in the Canadian setting regarding these emerging technologies. Further, in spite of innovative methods employed by SOPRANO to involve the user in all phases of the development process (Sixsmith et al., 2010), research has not been conducted to envision the impact such a system may have upon the users intimate space of the home environment. This is vital because it has been reported that both objective and perceived aspects of housing are related to well-being in older adults (Oswald et al., 2006). The purpose of this study was to consult with potential AAL users and to explore the needs and concerns of these individuals within the context of the meaning of home.

1.1 An Ambient Assisted Living (AAL) System

An AAL system is a combination of stand-alone assistive devices, smart home innovations, and telehealth technology. Specifically, the system is to involve passive monitoring of older individuals in their homes using multi-sensor data acquisition technologies (SOPRANO, 2008). The realm of smart home technologies includes sensors, actuators, smart interfaces and artificial intelligence that facilitates the monitoring of individuals, and promotes safety and comfort within the home (Demiris & Hensel, 2008). Telehealth is broadly defined as the diverse development and use of ICTs to deliver health and health care services over long and short distances, employing a range of activities which

includes image transmission, teleradiology, and telehomecare (Canadian Society of Telehealth, 2008; Marchildon, 2005). A complete system incorporating pervasive technologies in this manner has yet to be successfully developed. This research draws upon work carried out within SOPRANO (Service-oriented Programmable Smart Environments for Older Europeans), and CAST (Centre for Aging Services Technologies), both representing consortiums developing these forms of home monitoring systems.

1.2 Purpose of Study

One understudied component of these emerging technologies is concerned with the perspective of the individuals for whom this technology is being developed (Sixsmith & Sixsmith, 2000; Wild, Boise, Lundell, & Foucek, 2008). At present an AAL home monitoring system has yet to be developed beyond the prototype phase. Thus, gathering input from potential users prior to any widespread implementation will make a valuable contribution to the scant literature available in this field. Wister (2005) suggests that beyond the obvious association that technologies may have in regards to personal assistance, little is known about the beneficial impact that these devices and systems may have upon an aging population. The purpose of this project was to probe the needs and concerns of potential AAL users and particularly to explore both the positive and negative impact of this technology upon the meaning and experience of home. The data generated builds upon existing research by employing a lens that focuses on the meaning of home versus the technology itself. Much of the

research to date has emerged from what Sixsmith and colleagues (2009) have coined “technology-push” and fails to examine the impact these technologies may have upon the intimate space of the home. Such research is essential if we are to optimize performance and minimize the negative unforeseen side effects (Dizard, 1985) these new technologies may possess.

CHAPTER 2: LITERATURE REVIEW

A review of literature was conducted to develop an understanding of the proposed effectiveness of AAL technologies, and to identify the needs and concerns of potential users. To identify studies for review keyword searches were conducted in the following databases: Academic Search Elite; AgeLine; Alt HealthWatch; Communication and Mass Media Complete; Medline; SocINDEX; Academic Search Premier; and Canadian Reference Centre. The keywords used in the searches were: “technology and older people”; “technology” and “aging”; “gerontechnology”; “smart homes”; “telehealth”; “ambient assisted living”; “home modification”; and “meaning of home”. Additional studies were found in the websites of two key players in the development of technology based assisted living systems namely SOPRANO and CAST.

2.1 An overview of Ambient Assisted Living (AAL) Systems

It has been proposed that an AAL system would be comprised of a blend of smart home technologies, with stand-alone assistive devices, and telehealth. Due to the fact that such a system has yet to be developed, there are problems to be addressed in regards to terminology as it is currently employed in this field. Telehealth for example has been defined in the Canadian setting as the use of ICTs to deliver health and health care across both long and short distances

(Canadian Society of Telehealth, 2008). Sixsmith and colleagues (2007) using the UK as a model, have identified three generations of “telecare”. In this model the first generation of telecare is characterized by an alarm system that is worn by the older adult user in the home providing him/her with the ability to send out an alert should a problem requiring assistance arise. One problem identified with such an alarm is the fact that an incapacitated individual would be unable to summon for help in the event of an emergency. This led to the development of a second generation of home monitoring whereby a potential emergency situation such as a fall could be detected by the system and help could be summoned without action on the user’s part. The third generation of telecare currently under development takes components from the earlier generations and attempts to expand the monitoring scope into the realm of health and social care with the goal of enhancing ones’ capacity to live independently. It is these third generation AAL research initiatives that will be the focus of this review.

2.2 Current Research and Roadmaps

2.2.1 Consortiums

ALLIANCE

The European Ambient Assisted Living Innovation Alliance (AALIANCE) has developed a series of roadmaps to guide the way in the development of innovative ICT’s that are to enhance the process of aging well at home and in the community (AALIANCE, 2009). The roadmap defines short-term (until 2013), medium-term (until 2018), and long-term (until 2025 and beyond) goals for technological developments across a wide variety of domains in the European

Union. This roadmap includes the domain of medically and acute care oriented solutions such as tele-monitoring and self-management of chronic disease conditions that are currently being adopted in the Canadian setting. The AALIANCE roadmap possesses a far broader vision regarding how technologies may help older adults remain in their homes compared to medical domain oriented vision here in Canada. For example, person-centered services that revolve around shopping, feeding, personal care, socialization, safety and communication are all part of the AALIANCE AAL roadmap. It is these person-centered services that are to become part of a comprehensive AAL in-home monitoring system. Unfortunately, these personal care oriented technologies would fall under the umbrella of home care within the Canadian setting. Thus it is understandable that little attention has been paid to the development of these technologies within Canada. The Canadian Home Care Association (2008) for example, has noted that while governments in Canada espouse the ideal of aging-in-place, strategic thinking and funding decisions have not shifted in a manner necessary to support the implementation of services that could make this ideal a reality. While the AAL roadmap is an excellent visionary tool, it is the within the SOPRANO project where many of these technologies are being developed.

CAST

CAST refers to the Center for Aging Services Technologies based out of Washington D.C. CAST was established in 2003 and represents a coalition of more than 400 technology companies, aging services providers, research institutes, and government partners (CAST, 2008). The organization functions as

a facilitator for collaboration between partners, and possesses the overarching goal to ensure that technological solutions are fully realized and are developed to meet the needs of our aging society. Due to this broader scope CAST's function includes a wide range of health and social care technologies and the organization also functions as a clearinghouse. CAST has produced a film *Imagine – The Future of Aging*, which depicts an integration of the work of its many partners, and displays an AAL system in action. Permission to use this film was obtained from CAST and the study incorporates this film into its design. Details regarding this strategy are discussed further in the methods section.

2.2.2 Randomized Controlled Trials and Pilot Studies

SOPRANO

SOPRANO stands for service-oriented programmable smart environments for older Europeans and it represents an international consortium of corporations, service providers, and academic institutions with over 20 partners from countries including Greece, Germany, UK, Netherlands, Spain, Slovenia, Ireland, and Canada. The SOPRANO system, a project currently underway, is being designed as part of a socio-technical system that models human and machine domains within a single conceptual framework (Sixsmith et al., 2010). To achieve this goal, potential users were consulted in order to gather their feedback on the key challenges to independence and quality of life without specific reference regarding as to how technology may be used to address these challenges (Meuller & Sixsmith, 2008). According to Sixsmith, opportunities for introducing technological support were envisioned without being driven by a predefined

technical agenda. Themes that emerged from these initial discussions included social isolation, safety, forgetfulness, physical activity, accessing information, mobility in and out of the home, and management of care in the home.

The SOPRANO project employed these themes to drive the technological development of an Ambient Assisted Living (AAL) system that could assist older adults with maintaining independence in the home. The following describes use-cases (descriptive models) that have been developed within the SOPRANO project.

SOPRANO USE-CASES:

Medication reminding: Developed to help older adults who forget to take their medications

Safety & Security: Developed to control access in and out of the home, and to monitor activity for signs of problems such as falls within the home

Exercise: Developed to help older adults follow rehabilitation programs prescribed after being discharged from a hospital

Active: Focused on monitoring and supporting healthy behaviour and routines

Remembering: Providing support to people who suffer from cognitive impairments such as forgetfulness

In Touch: Technologies designed to help prevent social isolation in older adults

Entertained: This use-case is focused on leisure and combating boredom in older adults

Adapted from Sixsmith et al., 2010.

The future direction is the demonstration phase of the project where the SOPRANO system is expected to be deployed in 2010 and 2011. Sixsmith notes that information from the demonstration phase will provide crucial insight

regarding future issues concerning practical and commercial deployment of the system.

PILOT STUDIES

One of the most recent pilot studies (Reder, Ambler, Philipose, and Hedrick, 2010) involved 12 older adults in a 3-month trial of technologies for long term care or TLC as it was coined. The trial was focused on sensor monitoring of meal preparation, physical activity, vitamin use, and personal care. The information gathered was conveyed to the participant and his/her informal or paid caregiver. The older adults reported the system would be able to help them maintain their independence and that it would make them feel safer in their homes. The family caregivers felt safer having the older adult live alone with the system in their homes, and this afforded them increased peace of mind. The feelings were similar among the paid caregivers with the exception of two caregivers who felt they were being watched and judged by way of the increased surveillance that was taking place. In this study, privacy was not a great concern, however, this finding is in part due to the perception that the information collected was not particularly personal. Overall, the findings of this study were positive. Given, however, that the participants in this study were all paid to participate (\$575.00 in gift certificates for elders/ \$250.00 for family caregivers), there appears to be a bias towards a positive evaluation that is focused on the functioning of the system versus how it felt intrinsically for users to interface with the system. Additionally, the sample size is small and results cannot be

generalized. Thus, in spite of the qualitative design, the study did not probe deeply enough into how the TLC system may affect one's meaning of home.

Prior research methods employed to study AAL-type systems in the home included questionnaires, in-depth interviews, and focus groups. These have been used in a number of pilot studies. For example, in a 2-year randomized controlled trial of currently available smart home technology (Tomita, Mann, Stanton, Tomita, & Vidyalakshmi, 2007) 91% of the participants (N=46) said they would recommend a smart home system and the reasons included security, safety, easy access to lights, and comfort. Those who did not recommend the system reported problems with reliability, erratic functioning, and system problems. Interestingly the most impressive finding from this trial emerged from the descriptive statistics where it was reported that 80.4% of the treatment group participants were still living in their homes after the 2-year study period in comparison to 65.7% of the control group participants. While this finding is encouraging, the study focused on the technology rather than its affect on the user.

Sixsmith's (2000) 3-month field trial of an intelligent monitoring system included a questionnaire administered to 22 older adult participants, and semi-structured interviews with 14 of these. In general, the participants were satisfied with the system and felt enhanced feelings of safety and security. These participants felt comfortable with the system and did not perceive privacy and intrusiveness to be a problem. Demeris et al., (2004) used focus groups to explore the perceptions and expectations of 15 older adult participants in a smart

home pilot study. Using this design, numerous benefits of smart home technologies were identified such as access to emergency help, vital signs monitoring, safety, and security. However, in contrast to Sixsmith's field trial, these participants identified several concerns including potential privacy violations if cameras are used, replacement of human interaction with technology, user-friendly devices, and lack of training specifically geared towards older adult learners.

Brownsell, Blackburn and Hawley (2007) conducted a 1-year field trial (N=24) to evaluate telecare services in older people's housing. These researchers used the SF-36, an established tool to evaluate a person's health and ability to do everyday activities across nine domains. No differences were found in the scores between the control and experimental group in 8 of 9 domains. The exception was the social functioning domain in which a statistically significant difference between the two groups was found suggesting a beneficial effect of the telecare intervention in this domain. The research of Alwan and colleagues (2006) also used established instruments to evaluate the psychosocial impact of monitoring technologies in a pilot study involving 25 residents living independently and their 26 informal caregivers. In a pretest-posttest design, the resident outcomes were measured using the Satisfaction With Life Scales (SWLS) instrument while informal caregivers were assessed by way of a Modified Caregiver Strain (CSI), and Caregiver Burden Interview (CBI). In this trial while there were no statistically significant changes in scale scores, however, there were statistically significant increases in the number of informal

hours provided to residents by their informal carers. This is an interesting finding because one may expect as a negative side effect of monitoring, that personal contact may decline as caregivers are able to establish that their loved ones are in satisfactory condition from a distant location.

2.2.3 Depiction and Visualization Studies

While RCT's may be considered to be the gold standard when it comes to understanding the potential influence of an AAL system upon the user, additional methods have been employed to gather data. A number of studies have attempted to understand the impact by way of "depicting" an AAL system to potential users and asking them to visualize the impact such a system may have if they were to use it themselves. The SOPRANO project, prior to the development of any technological solutions asked participants to envision the key challenges to their independence (Sixsmith et al., 2010), and had participants come up with potential solutions. This produced a series of use-cases or descriptive models that were further refined using multimedia demonstrators and live dramatizations. The latter or "theatre method", as it is also referred to, is a novel approach to use-case refinement. In this method, the use-cases titled "in-touch", and "exercise" were transformed by a professional scriptwriter into a depiction that was acted out for participants by professional actors. The participants were able to engage interactively with the actors and visualize how these solutions to the challenges of aging compared with solutions they themselves had envisioned. The process was one of modification and refinement

which continued until the groups were able to agree upon a single design solution for each use-case.

The findings from this literature review suggest the idea of refinement and evaluation by way of depicting a system, is where the bulk of the research in the AAL field lies. Percival and Hanson (2006) for example developed three case scenarios to depict how telecare may function in the home, and presented it to 22 focus groups made up of older individuals (N=92), carers (N=55), and professionals (N=39). In this study, the positive scenarios focused upon the components of the system that could provide peace of mind, such as fall detection, flood detections, and automatic sensors. The bulk of the paper reports on the potential negative externalities of such a system, including data protection concerns, creeping surveillance, privacy issues, and a decrease in the likelihood of face-to-face contact. These results are in contrast many studies where the element of trade-off between privacy and maintaining independence was not highlighted.

In an effort to understand the acceptance of health monitoring devices among older adults, Mann, Marchant, Tomita, Fraas, & Stanton (2002) depicted monitoring technology by way of a 13-page booklet that contained large print and graphics describing devices that could monitor one's health at home. The book was presented and explained over the course of face-to-face interviews with the study's 71 participants. The key findings suggest that such a system would be met with strong acceptance. The main concern of the participants was with the unattractiveness of such devices in their homes, yet there were no comments

regarding how such monitoring may negatively affect their daily living. Additionally, Coughlin, Ambrosia, Reimer and Pratt's (2007) research has identified four very distinct themes. These researchers conducted a workshop and focus groups with 30 leaders (aged 40-75 years) in aging advocacy and aging services in the United States. Under the technology theme, functionality and system reliability were identified. A second theme, titled ethical considerations identified issues dealing with privacy, trust, loss of dignity, and access to the personal data collected. A third theme, concerned with user perceptions overlapped with the ethical theme and issues of dignity, stigma, and ageism were raised. Finally, a fourth theme that emerged was the role of policy and markets. Concerns over access to technology, equity, affordability, and the absence of Federal and State policy were identified. It is interesting to note that concerns for privacy appear to emerge in a stronger fashion when non-users of the system discuss benefits and drawbacks of such a system on behalf of potential users.

Levy, Jack, Bradley, Morison, & Swanston (2003) explored the attitudes of older adults towards telecare technologies using a questionnaire. These researchers sought to determine attitudes of respondents towards technology on a more general level. Interestingly, in the analysis of the 199 respondent questionnaires (42% response rate), it was determined that individuals most receptive to telecare were younger (under 80 years of age) and satisfied with the health care services they receive. One interesting result that may inform future telecare markets was that those who owned their homes were twice as likely to

be excited about learning how to use new technology, in comparison to those who did not own their own homes.

Wild and colleagues (2008) set out to understand the reactions and perceptions of older adults regarding an unobtrusive in-home monitoring system. To illustrate the system, a slide show depicting in-home monitoring was developed and presented to 39 focus group participants. The focus group discussions were transcribed and content analysis of these transcripts identified a number of themes. First, maintaining independence was the dominant theme. Second, the system was considered to be especially relevant to an individual who was living alone. Third, issues of privacy were found to be salient in the participant's responses. The older adults who were potential users of the system did not have a problem sharing the health information that would result from monitoring with their physician, however, the feelings were greatly mixed when asked if this information should be shared with family members.

Mahmood, Yamamoto, Lee, & Steggell (2008), used a novel depiction of technology in their focus group pilot (N=9) where video clips from *Star Trek* were used to depict personal communication devices, and scenes from *Harry Potter* were used to introduce the idea of monitoring technologies. Questions for discussion were asked to encourage dialogue regarding the use of such technologies to support aging-in-place. Four themes that emerged in this study were safety, social interaction, use of technology, and support. Three additional themes that were not directly linked to the technology were health, finance, and privacy. The content analysis displayed the privacy theme was mentioned 3

times compared to a frequency of 54 times for the safety and independence theme. While these researchers acknowledge, that due to their small sample size it is not possible to generalize the findings, the overall attitudes of these participants towards the use of such in-home devices were positive.

2.2.4 The Meaning of Home

The idea of what home means to people is a question that has been explored by anthropologists, architects, designers, sociologists, gerontologists, geographers, and philosophers (Leith, 2006). While home on a material level is composed of bricks and mortar and other constructive elements, it is noted that a home may become a symbolic representation of self, a place in which one can be him/herself more than any other setting. Looking specifically at older adults, Sixsmith (1990) has identified three themes that are particularly relevant to this population. First, home as a refuge and a place of privacy, appears to be more significant for older adults than for younger cohorts. Second, there is a greater concern with the instrumental aspects of home in older adults. It is speculated this is conceptually related to the highly symbolic meaning of independence (Sixsmith, 1986) and the role that the home may play in the maintenance of one's independence. Third, older adults possess a deeper concern for their homes and its role as a place in which memories are bound.

The rationale for proposing to study AAL systems and the meaning of home is derived in part from Leith's (2006) assertion that homes must be understood as being dynamic and context bound. Simply, "as peoples' circumstances change, the ways in which they experience and conceptualize

home change(s) as well” (p.318). Instinctively we would imagine such conceptualizations of home to be semantically positive, however, as Sixsmith and Sixsmith (2008) note, it is important particularly in the case of older adults to be aware that home has the potential to become viewed as “a virtual prison or a tremendous burden” (p.221). In such cases, instead of facilitating the older adults the home has the potential to become a source of problems (Pynoos, Nishita, & Perelman, 2003). Further, the meaning of home has been conceptualized into three modes of experience, namely the physical home, the social home, and the personal home (Sixsmith, J. 1986). The physical home refers to the bricks and mortar of the home and the physical space it creates. The social home consists of the relationship with significant others in the home and this includes others who share the physical home space as well as those who may enter the home from time to time such as friends, extended family, and those in one’s community networks. Finally, the personal home encompasses the creative aspect of the home space, meaning that one has control over this space as a potential venue through which to express oneself, and it includes feelings of security, belonging, and familiarity. An AAL system has the potential to impact virtually all components of the home space and the present study represents and initial exploration into this framework.

In Leith’s (2006) study regarding the meaning of home for women who had recently moved into a congregate living facility the key to maintaining a feeling of “at-homeness” was independence in, and environmental control over their new surroundings. While the present study concerns itself with individuals

living in the community, understanding the importance of control over one's environment is a component not to be ignored. In Tanner, Tilse, and deJonge (2008) for example, home modification (adaptation to the physical home) was considered to be the primary manner in which participants made their house into a "home". In this study, the independence afforded by home modifications was reported to be associated with increased feelings of control and self-efficacy. These results suggest that an AAL system may be viewed positively by older adults in that the system represents a modification to one's environment that may enhance control and the ability to age-in-place. It is important to note that an assumption is made whereby we assume the older adults have had control and choice in placing such a system into his/her home. Perhaps the placing of this type of technology into one's home would result in different feelings regarding its potential to affect the meaning of home if originating from a caregiver versus the system user.

Imrie's (2004) study into the meaning of home in disabled individuals has also informed the present research. While older adults who choose to install technological systems, such as AAL, into their homes may not necessarily be disabled, it is assumed to have occurred in response to some kind of stimulus likely characterized as decline. Testimonials from Imrie's research suggest that there is a tension between the ideal conception of home and the domestic realities of those who are experiencing disability or decline. Further, it is suggested " a person's feelings about, and experience of, the home, cannot be dissociated from their corporeality or the organic matter and material of the body"

(p.760). Given these varying results, it is not possible to predict how individuals may respond to the placement of AAL systems into their home environments. The present study may therefore be viewed as a step towards filling this gap that exists in the present literature.

2.2.5 Summary and Research Questions

Current themes from the research into AAL systems include maintaining independence, issues of privacy, sense of safety, social interaction, stigma, affordability, and accessibility. These themes are more salient in research performed on non-users of AAL systems, in comparison to those who will actually interface with such technologies. One theme that is currently lacking in the literature concerns the affect these technologies may have upon the users' meaning of home. Thus, the following research questions are addressed in the present study:

- 1) How will an AAL system affect meaning of home?
 - a) How do research participants currently describe their home environments?
 - b) Can older adults envision positive affect in using AAL technology related to one's meaning of home?
 - c) Can older adults envision negative affect in using AAL technology related to one's meaning of home?

CHAPTER 3: METHODS

3.1 Purpose

The objective of this study was to explore the potential affect that AAL may have upon the meaning of home in older adults. The research is based on qualitative data gathered from older British Columbians between April 2010 and September 2010.

3.2 Approach

A qualitative approach was employed in this study, and was deemed appropriate due to the exploratory nature of this research (Creswell, 2003). The process was iterative meaning data was gathered and analysis took place concurrently over the course of the study (Bryman & Teevan, 2005). The data was collected by way of semi-structured interviews with research participants. A semi-structured interview may be described as one in which the researcher has a list of specific questions to be covered, while maintaining a flexible outlook in regards to how the interviews are to proceed. The rationale behind this approach is derived from the idea that excessive structure may hinder “genuine access to the worldviews” (p.186) of research participants. Further, this open ended method of data collection is considered to generate rich and varied information (Sixsmith, J.,1986). Critiques of the qualitative approach are often concerned with the inability to generalize results to the broader population (Bryman &

Teevan, 2005). It is often forgotten that individuals interviewed in qualitative research are not meant to be representative of a population, but rather the findings of qualitative research are meant to develop theory. In the present research, such an approach is justified because the results were intended to inform and develop the theoretical lens of home meaning.

3.3 The Study Sample

The sample consisted of community dwelling British Columbians over the age of 60 years, with at least one self-reported chronic condition and/or mobility restriction. A self reported chronic condition was operationalized in accordance with the Canadian Community Health Survey (Gilmour & Park, 2003) where participants must have been suffering from one of the following conditions:

- Arthritis/Rheumatism
- Cataracts/Glaucoma
- Back problems
- Heart Disease
- Diabetes
- Thyroid condition
- Urinary incontinence
- Asthma
- Bronchitis/Emphysema
- Mental illness
- Cancer
- Migraine
- Effects of stroke
- Stomach/intestinal ulcers
- Bowel disorder/Crohn's disease/Colitis
- Chemical sensitivities

- Alzheimer's dementia
- Fibromyalgia
- Chronic fatigue syndrome
- Epilepsy

A mobility restriction was operationalized as an individual who uses a cane, wheelchair, walker, scooter, or some other device to assist in mobility. A combination of convenience and snowball sampling was used to recruit research participants. Convenience sampling refers to using a sample to which the researcher has access, in this case, neighbourhood networks and the Council of Senior Citizens' of British Columbia (COSCO). Additional participants were recruited using snowball sampling where participants who had completed the study provided suggestions for where to find new recruits (Bryman & Teevan, 2005). Alternative sampling techniques may have been employed, but the fact remains that it is difficult to convince older adults to participate in research studies, and a selection bias towards overly healthy samples is common (Spriduso, Francis, & MacRae, 2005). In the present study, the use of convenience and snowball sampling resulted in access to participants who were more likely to be users of AAL in the future.

The final sample consisted of nine female and three male participants (M= 75.6 yrs; age range 61-95 yrs), with a mean of 3.75 chronic conditions, and 5 of 12 used an assistive device for mobility. To compile a more complete health profile, participants were asked to rate their overall health using one of five descriptors. Three participants rated their health as excellent, three rated their health as very good, two rated their health as good, and four rated their health as

fair. No participants chose the poor category. Additionally, participants were asked whether or not they had been hospitalized in the past year. To this question six participants answered yes, and six participants answered no. Interestingly, of those who answered yes, five of the six had been to the hospital two times in the past year. For all participants the mean length of hospital stay was 11 days, with a range of 1-60 days. Finally, participants were asked to report the amount of bodily pain they had experienced in the month preceding the interview using six pain descriptors. Three reported no pain, four reported very mild pain, one mild, two moderate, and two reported severe pain. No participants chose to categorize their pain as very severe. Lastly, it is worth noting that 4 of 12 participants had experienced falls in their home. One of these falls was serious enough to result in broken bones, and two participants had the unfortunate experience of falling in the evening and had to remain on the floor overnight until help arrived.

3.4 The semi structured interview and the depiction/visualization of AAL

The semi structured interviews were approximately 45-75 minutes in length. The sessions began with open-ended questions asked to elicit participants' perceptions regarding the meaning of home, in terms of the physical space, the social space, and the personal space. The core question was simply to ask participants what home meant to them. Further questions were asked to ensure that the interviews were covering Sixsmith's (1986) categories and structures of the home-independence relationship. This period was followed with

participants viewing the short film *Imagine the Future of Aging* furnished for inclusion in this research with the permission of CAST (2008) as a means to depict an AAL environment to research participants. [Website URL: http://www.agingtech.org/imagine_video.aspx]. CAST has produced this film to depict an integration of the work of its many partners, and displays an AAL-type system in action. This film was incorporated because it provides an excellent depiction of an AAL environment and is a novel method in comparison to previous depiction and visualization studies. CAST's film runs 10 minutes and 33 seconds, and the research participants were shown a 9 minute and 46 second segment of this film that depicts the following features of an AAL system:

- Medication reminding
- Vital signs monitoring
- In-home monitoring of the activities of daily living via sensor technologies
- Displays that both professional and informal caregivers (e.g. family) have access to data collected
- Displays a well functioning electronic health record
- Cognitive function monitoring by way of an assessment tool embedded in a solitaire game
- Social interaction with an online community of friends
- Video conferencing

- Social connectivity via video conferencing with distant family members

Upon completion of the film, participants were asked to describe their thoughts and feelings about the film they had viewed, and the potential effect that AAL may have upon the meaning of their home environment. Where necessary, probing questions informed by Sixsmith's (1986) study were asked. For example, participants were asked if they felt such a system would enhance their ability to remain independent in the home, and whether or not they felt such a system may impinge upon their sense of privacy. Prior to commencing the study, one critique of this method was that participants would not be able to truly visualize AAL in their own homes and be able to comment authentically on such a system after merely viewing a film. Additionally, it was found that if participants did not "identify" with Ernesto, the man in the film living with an AAL system, they encountered difficulty responding. To deal with these issues, participants were (if they could not see themselves using AAL) asked to put themselves into the place of Ernesto. Using this strategy, the participants not only envisioned the system through Ernesto's eyes, but often responded using a first person narrative. For example when Meg was asked to comment on how it would feel for Ernesto in terms of social interaction to use videoconferencing, the first person transposition was apparent when she responded " I think I could see that being beneficial, say for instance in my case both of my family members are not living in the same town as me, so in that respect I think it would put their minds at ease and mine

too". The combination of guiding questions, a less structured interview format, and encouraging visualization resulted in the capture of vibrant and meaningful commentary from the research participants. The interviews were voice recorded using a digital recording device and memos providing reminders for reflection (Bryman & Teevan, 2005) were written during the interview session. Upon completion of the twelfth interview and its transcription, five follow-up interviews were conducted to confirm and validate the participant's responses and to probe deeper into the early themes that were emerging from the data.

3.5 Data analysis

Using a qualitative approach, the data were reviewed throughout the entire research collection period. The goal of this analysis was to identify themes and key concepts that were emerging from the data (Creswell, 2003). To this end, interviews were transcribed verbatim and analyzed using NVivo 8, a software package designed to classify, sort, and arrange qualitative research data (QSR International, 2009). Using NVivo 8 the coding of data was completed through a line by line analysis of the data and the development of nodes. These nodes mapped the coding for the project and items were created to represent salient behaviours and concepts of interest or themes (Bryman & Teevan , 2005). This process continued until a point of theoretical saturation, in this case 12 participants, where new interviews were found to add very little to the themes that had emerged from the analysis.

3.6 Ethical Concerns

Prior to running the study it was necessary to obtain approval of the Simon Fraser University Ethics Review Board (Simon Fraser University, 2006). The recruitment process upheld the tenent of voluntary participation. The location of the interviews were at the discretion of the participants and took place in either the participant's home or at another location deemed suitable by both parties. The interviews began with an explanation of the nature of the study. They were asked to sign an informed consent form that was generated as part of the Simon Fraser University ethics approval process. It was clearly explained that participation in the research was voluntary and that they were free to withdraw from the study at any time (Bryman & Teevan, 2005). One of the benchmarks of ethics in social research concerns itself with not harming your participants (Babbie, 1990). While a semi-structured interview appears to be a relatively harmless instrument, caution was nevertheless exercised due to the fact that participants were discussing technology that was most likely unfamiliar to them. It was possible that participants could feel stressed if the interview had in some manner exacerbated feelings of inadequacy due to unfamiliarity with the subject matter. A number of strategies were employed to minimize the potential threat of interview questions. For example it was emphasized that my interest was in learning about the participants' feelings and opinions regarding technology and the meaning of home, versus the interview being any kind of test of their knowledge about the subject matter. Additionally, participants were encouraged

to ask for clarity in regards to the technologies they viewed during the film portion of the interview.

The participants' confidentiality was protected by removing all names from transcribed interviews and replacing them with identification numbers that have been kept separately in a safe and secure environment (Babbie, 1990). Finally, pseudonyms are used in the presentation of all data derived from this study.

CHAPTER 4: RESULTS

This chapter presents the results of the coding and thematic analysis and has been organized according to themes that emerged from the data collected from participant interviews. The core analysis pertains to the theme titled the meaning of home, and reflection upon the research question: Can AAL change the meaning of home? This theme is organized into the following sub-themes: independence; security; privacy; comfort/warmth; belongings/memories; having visitors in; and freedom to do what I want. Additional themes that emerged from the data will be reported, and they include: safety; the idea of trade-off; I'm already being monitored; who benefits most from the system; non-technological commentary and the importance of family; and the theme of burden.

4.1 The Meaning of Home

The starting point for this research was to develop an account of what home meant to the participants in this study. A limitation to this research is that in a single interview, the goal was to ascertain a baseline meaning of home for participants, have them view a film depicting AAL technologies, and then have them visualize and comment on how such technology may affect what home means to them. This is in contrast to the research of Sixsmith (1990) who was able to devote entire interviews to develop an understanding of what home meant to his research participants. This limitation was apparent in the fact that

Sixsmith’s participants identified 25 home meaning categories compared to the participants in this study who identified just seven home meaning categories. The following table displays how participants in the present study categorized what home meant to them.

Table 1: MEANINGS OF HOME: Frequency of mention of categories of home (number)

Category	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	Totals
Independence	1	1		1	2		1			1		1	8
Security	2			2	2			1	1	1	1		10
Privacy	4	2		1	1	1	1			2			12
Comfort/ warmth	1	2	1			1		2	1		1	2	11
Belongings/ memories	1	1	1	1	2	1	2			1	1	3	14
Having visitors in	1		1		1		2			1	2		8
Freedom to do what I want		3	1	2	1	2		1				3	13

The above table was derived by examining transcripts using NVivo 8 and coding for meaning of home themes line-by-line, taking into context the statement made by the research participant. It would have been possible to use the NVivo 8 program to do a simple word count for each of the home meaning

categories, but this type of analysis has the potential to skew the results. To illustrate this point consider the following quote from Sarah who states: “Oh I think it’s great, I know I said privacy before but you lose it as you get older, I mean I never dreamt that I’d have to sit in a bathroom with someone else while I’m having a shower and stuff, but that’s privacy out the door.” Using the NVivo word count function, the above quote would have simply counted the word “privacy” twice whereas in the NVivo 8 thematic analysis that was performed, this utterance was counted as a single contextual expression of privacy as a meaning of home. The previous table therefore represents a contextual analysis of the home meaning categories.

The meanings of home in this study coincide with findings from other studies such as Sixsmith (1990) regarding the conceptualization of home, however, some categories of home such as “family” and “happiness” are noticeably absent. One possible explanation for this could be due to the dramatically shorter period in which participants were asked to describe what home meant to them. In the present study for example, participants “belongings and memories” as a home meaning category are mentioned 14 times. In the study by Sixsmith, where entire interviews are devoted to the meaning of home, it is clear that with more time to probe participants for clarification, Sixsmith was able to gather data to support a separate category for both possessions (belongings) and memories. In spite of this limitation, the seven categories of home in this study have been identified as salient for participants, and each

category will now be presented separately, focusing on the potential for AAL technology to affect the meaning of each of these “home meaning” categories.

4.1.1 Independence

Secker, Hill, Villeneuve, and Parkman (2003) reporting in the British context have noted that while independence is a central theme in social care and health policy the concept is rarely defined. In a broad sense Stephenson and Koehn (1999) have reported that maintaining independence is important to older people and that successful aging is defined greatly by one’s capacity to maintain independence. While this finding displays the importance of independence it does not impart exactly what independence means to older adults. Sixsmith’s (1986) study of independence and home in later life found independence to be a multifaceted phenomenon. In his study of sixty older adults (aged 65+) Sixsmith found that independence meant being able to look after oneself; possessing self-direction; and it was also linked to feelings of obligation. This last category, feelings of obligation, has to do with the idea of not wanting to be beholding to others, and it is interesting to note the cross-cutting nature of these themes in the present research. This feeling of obligation for example, will be discussed further under the theme of burden that emerged from the current study. While Sixsmith’s study provides us with a good definition of what independence means to older adults, the research of Smith, Braunack-Mayer, Wittert, and Warin (2007) challenges the assumption that ‘independence’ is an entirely positive component of successful aging. In this study of 36 older men (aged 55+) it was found that at least in the masculine context, independence was also associated with

participation in risky health behaviours such as health service avoidance and ignorance about health issues. Thus in contrast to the central dogma that independence is health-enhancing, these researcher's argue that independence may also be viewed as a health damaging concept. These previous findings will be reflected upon as the theme of independence in the present research is discussed below.

To begin, it is interesting to note that in the present study independence is one of the least populated categories in terms of meaning of home for the research participants, where only 7 of 12 participants mention this category of home a total of 8 times. This appears to be in contrast to the literature reviewed, however, part of the reason for this finding has to do with the overlapping nature of the conceptualization of independence. Sixsmith's (1986) study for example reports that "participants also saw independence as the capacity for self-direction, that is the freedom to choose what they do" (p.341). In the present study, "freedom to do what I want" emerged as a separate category with 7 of 12 participants mentioning 13 times the importance of this dimension of home meaning. Keeping this overlapping nature of independence in mind the findings of the current study are presented.

Seven of 12 participants commented directly on independence as a meaning of home theme. Sarah's commentary attests to the overlapping nature of independence with other dimensions of home:

"You have these people... watch(ing) you and that might make you feel less independent, but then you get to stay in your home and

not have to go... and I can go out whenever I like even if they know about it... and it would still be my home”.

The quote from Sarah not only provides us with a clear assertion that AAL has the potential to affect one’s meaning of home in regards to independence as a dimension of the meaning of home, it also provides clues as to how AAL is perceived by potential users. On an experiential level Sarah has envisioned that people outside of the home would be “watching” her, where in fact she is commenting on the potential for people to monitor her activities by way of sensors, not cameras that are placed throughout the home. The nature of the monitoring, e.g., that sensors would simply record that you have entered and exited rooms, turned stoves on and off and such, was explained clearly to Sarah and all participants, yet it was perceived that AAL is a form of watching her in her home space. It is interesting to note here a connection to Sixsmith (2000) where one of the issues identified was a “divergence between client perceptions of the system and its actual function” (p.71). In the case of Sarah it is possible that with her recent fall, she may have been idealizing the technologies that were presented to her during the session. Further, returning to the overlapping nature of these themes, note that when Sarah asserts “I can go out whenever I like even if they know about it” is clearly an expression that home is a space in which she has the freedom to do what she wants.

Examining both the original and follow-up interviews for commentary to answer the research question can AAL affect the meaning of home in terms of independence, the overall conclusion is that AAL has the potential to enhance

independence and function as a tool to empower older adults to remain independent in their home. The bulk of this commentary leans towards a positive effect upon this meaning of home. This commentary is stated as a matter of fact by Alex who when asked if AAL technology could interfere with one's sense of independence in the home stated:

“No because it makes them independent, the alternative is to go to a nursing home or live with a relative which would be much less independent.”

This quote is very representative of the positive commentary heard from most of the participants and it is interesting to note this cross-cutting idea of trade-off whereby it is viewed that giving up some independence is favourable especially if it means being able to remain in one's home. The value of remaining in the home is exemplified in Gina's reflection on a recent stay in the hospital where she states “ditto” agreeing with a woman in the bed next to her who exclaimed:

“You know I'm missing my home so much, I'll do anything to get out of here.”

These comments reflect how important home is for the participants in the present study. Additionally, the result very much corresponds to earlier findings by Levy and colleagues (2003) where their results indicated that a persons' home is one's most desirable dwelling space, even if a considerable amount of care were required for them to remain in that space. While this commentary is positive, weight must be applied to Bob's answer to the same question where he responds:

“I wouldn’t want anything that made me feel inadequate, or that people had to spend their life devoted to checking on me all the time”.

In this statement Bob has clearly stated that not only would AAL cause him to feel less independent in his home, it would exacerbate a feeling of inadequacy, and the seriousness of this claim is apparent in another comment by Bob who states that:

“If you are made to feel inadequate, that destroys you as a person.”

Bob’s commentary very much displays the importance of understanding independence from a multifaceted perspective as Sixsmith suggests (2000). For example, independence is more than just being free from dependence (Secker et al., 2003), it means being free to run one’s own life (Percival & Hanson, 2006). In the case of Bob it appears that the AAL system may present as a constant reminder of a decline in his ability to run his own life. Thus while we may wish to conclude that the AAL has the potential to affect the meaning of home dimension of independence in a positive matter, the commentary of Bob must be seen as important due to the fact that he is suggesting the technology has the potential to cause psychological harm to himself.

4.1.2 Security

In Sixsmith (1990) it was reported that a great majority of older adults (80%) felt that home becomes more important in later life. One of the reasons for this was that home “affords a sense of permanence and security in later life”

(p.177). This sense of security is more than simply a good feeling among those who feel secure, it is a factor that may affect one's decision whether or not to enter a retirement home. A recent study by Fonad, Wahlin, Heikkila, and Emami (2006), reported that many of their participants lacked a sense of security in their homes after falling, and this was a motivating factor for them to find a safer place (a retirement home) to live. In the technological realm, De San Miguel and Lewin (2008) have concluded that the use of personal emergency alarms provides older adults with an increased sense of security in their homes. This literature provides a framework in which to understand the findings regarding security in the present study.

Seven of 12 participants made a total of ten comments regarding security as a dimension of the meaning of home. This count is what one would expect given the previous research in the field. Bob epitomizes this dimension when in his very initial response to what home means to him states:

“Home is security, a place where you have control over your own life”

Regarding the potential of AAL technology to affect this dimension of home a total of eight positive responses were recorded versus only two negative responses. A characteristic response was made by Debra who when asked if AAL would change the way Ernesto felt about his home answered:

“Oh I think he'd feel a lot more secure than without it, because when you are experiencing various physical symptoms and live by yourself, it's easy to get a little bit frightened of incidents happening and not being able to summon assistance”

This very much coincides with the findings of De San Miguel and Lewin (2008) who found that social alarms could enhance the feeling of security in older adult users. Interesting, it is Debra who is perhaps reflecting on her previous answer when asked if she felt there was anything missing in the system responds:

“There might be a false sense of security in that one would think that the monitoring was being monitored when really it was being used as a kind of way of reassuring the older person, so you need to have a kind of contract in place I guess that what is promised is going to actually occur.”

In many ways this comment represents a lack of trust in the service providers, whoever they be, rather than an issue with the technology itself. Nevertheless, it is important to take note of these concerns when it comes to the ethical distribution of these technologies to a consumer market. Interestingly, this idea of lack of trust is echoed in Teresa’s comment on the data collected using AAL technology where she comments on security in the traditional sense stating:

“But the problem with it all (referring to AAL) is security, I noticed that the doctor in the film had to use his thumbprint and that’s the way to keep it secure”

Here Teresa is talking about security in regards to how the data collected and kept separate from oneself in a site outside of the home is to be kept secure.

This finding very much coincides with the concerns of the participants in Percival and Hanson (2006) who expressed concern over the potential for commercial companies to acquire lifestyle data and use it to direct marketing strategies.

Overall, while it may be concluded that AAL has the potential to affect the meaning of home dimension of security in a positive matter, future service providers should make note that potential users of AAL technology are placing a

great deal of trust in the system and that security of data is of utmost importance.

4.1.3 Privacy

Sixsmith's (1990) study pertaining to the meaning of home in older adults found that home was described as a place of refuge and privacy. According to Cantor (2006) privacy is difficult to define and remains a fluid concept that evolves and changes alongside societal beliefs. Regarding this fluidity there has been a dramatic increase in the sheer quantity of surveillance technologies since Sixsmith's study over 20 years ago. Depending on your locale, being monitored on public transit, via webcams in small businesses, in traffic on the freeway, and by way of home security networks have all become the norm (Farmer & Mann, 2003). Debra's previous commentary questioning the trust of those who may act as service providers for AAL system suggests, we should expect to see some rather vibrant commentary from participants in the present study given that AAL in many ways amounts to bringing surveillance into one's home.

Seven of 12 participants made a total of 12 comments regarding issues of privacy and AAL. Interestingly, four of the comments were made by Sarah, the individual who may be classified as the older adult in the study who most wanted AAL in her home immediately. Sarah struggled with the concept of privacy starting out with the thought that:

“As long as privacy is maintained, I can't see anything (wrong with the system).”

A thought that she held in the balance with the idea that:

“As you get older... you lose a great deal of your privacy.”

The reasons for these apparently contradictory thoughts on privacy became apparent as the conversation continued and Sarah stated clearly her willingness to accept a trade-off:

“If it meant being able to stay in the home longer, then privacy would go out the door.”

In this series of comments, it is clear that it was not difficult for Sarah’s ambivalence towards AAL to tip in favor of accepting the system into her home. It is not surprising then, the many studies that conclude high acceptance of these technologies on the part of older adults. In the present study, while it may be concluded there is a high degree of acceptance of these emerging technologies, it is important to note that it is possible this is connected to a fear of having to leave the home, and any “reasonable” solution may therefore be seen as “acceptable”? The trade-off appears to possess a somewhat coercive nature, where in light of the “threat” of going to a nursing home, an older adult would be willing to cede one’s privacy in order to stay in the home.

One advantage of conducting a qualitative study that is iterative, is that concepts that evolve (such as this idea of coercion) were able to be explored as the study continued. To this end the idea of coercion and trade-off was presented to all five individuals who participated in follow-up interviews. Interestingly, while acknowledging that AAL was presented as potentially coercive, the participants focused on the importance of the context in which the older adult would be making such a decision. Bob’s answer sums it up best:

“Well some people would be upset, but some people wouldn’t see it as coercion, they would see it as an opportunity to stay in their home.”

It is interesting that the bulk of the commentary on privacy was of this “relative” variety, in fact, in the entire transcript there is only one response that is clearly negative and this came from Colleen who in response to having the sensor technology explained to her exclaims:

“That would be, privacy you know, encroaching on your privacy”

With the exception of Colleen’s comment, the bulk of the participant’s responses appear to align with Farmer and Mann’s (2003) assessment that “extensive surveillance, in short, is coming into being because people like it and want it” (p.37). The idea of “wanting” extensive surveillance may go beyond the findings in this study, where it may be more accurate to conclude that older adults are willing to accept technologies such as AAL. Rita’s comments express very well Cantor’s (2006) idea that privacy is a fluid concept where she states:

“ Well, I think if I realized I had a problem that could be helped by that (sensor technology and in-home monitoring), at the moment no, it’s interfering with my privacy. So that’s something I could change my opinion on if I was older and more incapacitated, but I mean technically it’s a great idea.”

Further, this acceptance is not blind, and the participants in the present study make it quite clear that privacy is a dimension of home that intersects with the theme of trust. To illustrate this idea, Debra, who in reflecting on Ernesto’s situation in regards to privacy states:

“Well it depends on the good intentions of those who are receiving the data, it’s like a baby monitor in some ways, except that he’s an elderly person who obviously needs to have his caregiving requirements met and you could tell, sense, that in that family it was very well intentioned, very lovingly handled.”

This very rich commentary may serve to inform developers of AAL systems, who are very often focused on the nuts and bolts of the system, or as Sixsmith and colleagues (2010) describe it, are working from the perspective of a technology push. By acknowledging the concerns potential AAL users have in regards to privacy, and understanding that such concerns intersect conceptually with the idea of trust, it may be possible to minimize some of the potential negative unforeseen side effects in AAL technologies currently under development.

4.1.4 Comfort and Warmth

Next to family, comfort is the most reported meaning of home in Sixsmith’s (1990) research, and this finding is echoed in research across this field.

Terminally ill patients for example have reported without exception, that quality of life is the main motivator for choosing their home as a place of death, and being surrounded by a “familiar and comfortable environment (was) the principal reason” (Tang, 2003, p. 247) why they chose to spend the remainder of their lives at home. This research attests to the importance of comfort as key dimension in the meaning of home. While there is no research into AAL and its affect on comfort, Tanner, Tilse, and DeJong (2008) have found that home modifications, by reducing the demands of the home environment were able to

strengthen numerous home meanings including comfort. This existing literature proves useful to inform the present discussion as an AAL system may be akin to modifying one's home environment in the more traditional sense of the word.

Consistent with the findings of Sixsmith (1990) the category of comfort was well populated in the current research with 8 of 12 participants providing a total of 11 comments on how comfort was a part of what home meant to them.

Alex's words bring to life the meaning of this concept:

“ Home means comfort, I have moved many times that's why I wasn't definite about the first part, yeah, it's a comfortable place where I live.”

Interestingly, his commentary introduces an issue that becomes salient in the analysis of AAL's potential impact on the meaning of home. Comfort typically is referred to as the things around us that afford comfort, but “being comfortable” is more of a feeling that can be influenced by factors other than things or objects we bring into the home space. Thus having an AAL system in one's home does not add comfort the way a new pillow would add comfort, but rather, AAL has the potential to impact what being comfortable in one's home means. In the present study there were no comments regarding either a positive or negative impact of AAL upon comfort, and only a single comment on AAL's potential impact upon feeling comfortable in the home. It was Gina who was the exception, when in response to being asked if AAL could change the way she felt about her home stated:

“Oh yeah, you'd be much more comfortable at home, and you'd think well, they know I'm o.k., that sort of thing”.

While comfort was very much identified as a salient home meaning for participants in this study, little was discovered about the potential impact of AAL upon this meaning of home. This perhaps illustrates one of the main limitations in the present study where in a single interview the meaning of home and the impact of AAL upon each and every meaning could not be ascertained.

4.1.5 Belongings and Memories

Belongings and memories was the most populated meaning of home in the present study with 10 of 12 participants making a total of 14 comments pertaining to this dimension. This finding is in line with the research of Sixsmith (1990) who found that “home is perceived to have a special role in preserving memories, or as a place in which reminiscence takes place” (p.184). What is interesting about this finding in the present research is that not one of the twelve participants live in what may be described as the traditional family home. Further, if we factor out the three female participants who have stayed long term in their apartment homes (averaging close to 30 years) the mean amount of time in the current residence for the remaining participants is just 7.4 years. Thus, it appears that reminders of memories are not bound to the place in which they occurred, but they are something that may be transferred into one’s new living space. This would explain in part how the categories of belongings and memories have become intertwined in the present study in comparison to Sixsmith’s study where possessions (e.g. belongings) and memories were categorized separately as two different meanings of home. A comment by Teresa illustrates the importance of

this “stuff” of home and how it both helps to define who one is and connects one to the past:

“It’s messy, I think It’s got, it’s got the books and music so that’s sort of me as a librarian and the teckie stuff is here, that’s what I’m known for, I’m a real teckie, but its got a real sense of my family too, old photos on the wall and such...the memories are more important than the new stuff.”

Additionally, Rita, who prior to living in her current apartment home of just two years, lived in the home where she raised four children with her now deceased husband, when asked what part of the personal home was most important to her answered:

“ That would be what I’ve got in that home, such as decorations and souvenirs from travel and things like that, the possessions I’ve brought into the home.”

The cherished objects, identified by participants in this study such as photographs and memorabilia coincide with existing literature such as Sherman and Dacher (2005) where the objects provide “ a link to personal identity and (are) evocative of life’s events” (p.72). It is quite clear from this commentary that participant belongings help to define them as people, and the memories they evoke are a key component to understanding what turns the bricks and mortar of home into a meaningful place in which to live.

Given that this home meaning category was the most populated in the present dataset, one may expect it to have the greatest quantity of commentary regarding the potential affect an AAL system could have upon belongings and possessions? Interestingly, there is not one comment either positive or negative

regarding the potential for AAL to impact this meaning of home category. Speculating upon an explanation, it may be possible, that because the memories and feelings are intrinsic, participants cannot envision how an AAL system could possibly impact them so deeply.

4.1.6 Having visitors in the home

Judith Sixmith's (1986) research into the meaning of home classified home into three experiential modes, namely, the personal home, the social home, and the physical home. One component of the social home was the meaning category "friends and entertainment" which concerns itself with the people we invite into our intimate home space. Sixmith's (1990) research identified home meaning categories titled "bring friends back" and "friendly people around" attesting to the importance of being able to invite others into one's home. In the present study, this was replicated by way of a home meaning category that has been titled "having visitors in."

While having visitors in was one of the least populated categories in the present study with just 6 of 12 participants mentioning this home meaning category with eight responses, it nevertheless remains an important category. When asked to identify the most important aspect of home Walter replied:

"The middle one (referring to the social home), the family and friends, I'm a people person."

Most notable in the present research was the fact that the commentary regarding this home meaning was very consistent across the responses, Meg for instance

almost echoes Walter verbatim when she states that home means a place where she can:

“... have my friends over, my family, and just enjoy my life.”

The participants in the present study did not envision AAL to have much of an impact upon their ability to have visitors into their homes. One exception came from Sarah who commenting on her current care situation reflects:

“They were coming in twice a day, they are coming in once a day now, and I soon will be able to do without them, and it made me think more about it and actually I think I’d rather have that (AAL) than be in a home.”

In the above quote Sarah was discussing how she currently has care aids who visit her home once per day, and she clarified that she looks forwards to the time when she will not have to use the services of care aids anymore. She further envisioned that perhaps with AAL the intrusion caused by the care aids could have been lessened because they would be able to check her condition online, thereby potentially decreasing the number of in-person visits (that Sarah perceived as intrusive) the care aids would have had to make to her home. While the research revealed little regarding the impact AAL could have upon the meaning of home titled having visitors in the home, future research may be directed towards developing an understanding of how AAL may be used as a tool by people who provide services to older adults such as home care aids. At present this dimension remains unexplored with the exception of Reder and colleagues (2010) mixed results that included some paid caregivers feeling they were being watched by way of the technology over the course of the intervention.

4.1.7 Freedom to do what I want/ behaviour change

Sixsmith's (1990) study into the meaning of home identified a well-populated category he defined as "do what I want". It was mentioned previously in the category of independence how freedom to do what I want was a home meaning category that had much overlap with independence. In fact, if independence and freedom to do what I want were pooled together, we would find that 10 of 12 participants provided a total of 21 comments regarding these two themes. Setting aside this overlap, freedom to do what I want in its own right has appeared as a very well populated category with 7 of 12 participants providing a total of 13 responses. Teresa sums up the power inherent in this category when she states in response to being asked what home means to her:

"A sanctuary, a place to just be, and not be disturbed, a place to just do what I want to do."

This freedom to do what one wants is described further by Bob who in commenting how he has expressed himself in his home space said:

"Well, because I own my own home I can decorate, and re-arrange, I recently just painted a wall black in my living room and I couldn't do that if I were in most situations. I've set up my home so that I could, I've set it up so it could feel comfortable (and) inviting."

While our initial reaction to this statement may be that a black wall hardly sounds comfortable and inviting, it is this response that epitomizes what freedom means. In this case Bob's painting a wall black is more than just a feeling of freedom to do what he wants, it is an expression of being so free that he is able to deviate from social norms (regarding colour choice) in his home space. His comment

also displays the manner in which individuals define themselves to others in comparative and relative terms. Bob compares himself to other older adults who he describes as being “in most situations”, referring to individuals less fortunate than himself who may have to rent their homes or live in an extended care type facility. Further, Bob’s linking in of freedom to do what I want with home ownership, is supported in the literature by Annison’s (2000) interpretation of Despres research where home ownership, freedom, permanency, and pride are intertwined into a category where home is described as a place to own.

The freedom to do what I want, in terms of freedom to decorate the home appears to be free from interference with the introduction of AAL. The freedom however to conduct your life in your home is an area where there is great potential for intrusion with the introduction of AAL. In fact, participants in the present study suggest that they may at times conduct their lives differently under the perceived watchful eye of AAL. Alex for example in commenting on whether AAL could change the way he felt about his home replied:

“Possibly yes, oh yeah I am positive that it would because I would have to dress up for all occasions (referring to videoconferencing), I couldn’t just walk dishevelled and unshaven and what not, because I would be watched, so it changes your behaviour a lot... I couldn’t be messy, it couldn’t be messy if people could see it so it would make me work much harder, it would put some responsibility on things being in place and nothing that could disturb the picture, but that’s just me, maybe there are plenty of people that could take it.”

The comment from Alex needs little interpretation as to how he would feel about videoconferencing, a technology that appears to be experiencing an exponential increase in popularity with each passing month. This brings into question the

notion that we are helping older adults with these technologies. As another example, in respect to vital signs monitoring, Olivia assured us that:

“I’d worry about the darn thing... it would only increase my blood pressure.”

Here Olivia is expressing that she would feel under stress having her health monitored so closely on a day-to-day basis. Alex also had some comparable feelings in regards to the cognitive functioning dimension of AAL depicted in the film where he states:

“If solitary for him becomes a test of dexterity, well I would drop doing solitary because I would feel like I am being examined every day, what’s the pleasure, where’s the pleasure in that... no I wouldn’t like that, performance stress, it would be there all the time...it is better to leave people on their own to play games, and really play games, not use it as testing.”

In this example, it is not really behaviour change per se, but rather it displays that the system could result in an older adult abandoning an enjoyable behaviour due to it’s new context as a test of cognitive function. With this idea of behaviour change brought to the surface, Alex further reflected on what it would be like to live in a home where behaviour was expected to be carried out day to day within established parameters. The film *The Future of Aging* clearly depicts that the family members are able to go online at any time and see if Ernesto had been bathing, and eating and carrying out these activities of daily living, and to this Alex exclaimed:

“Yes it is valuable, although you can fake it, I was just thinking you could press the button and the shower goes on, and you don’t even

take the shower, or you open the refrigerator and you don't eat anything... Yes, you could fake it, you could play games with it... Just out of spite I would do it, yes, to see if they are really watching me.”

It is somewhat alarming to think that we are in the midst of developing these AAL systems that could be perceived by older adult users as something to be dealt with in the intimate space of the home environment. This is supported by literature, where it has been found that older adults often attempt to hide the deficits they are experiencing from their adult children and caregivers (Maier-Lorentz, 2000; Miller, 2009). To hide such deficits, humour, evasiveness, leading the conversation, and making up answers to questions that have been asked are all ways in which older adults may use their social skills to mask cognitive deficits. Participants in Wild and colleagues (2008) research have suggested that older adults often try to hide changes in cognition and that monitoring may be able to provide an accurate assessment of the situation. Interestingly, these participants could see such monitoring as useful for their peers but not for themselves. In the case of Alex, his commentary brings to light the idea that the question “how are you doing” is constantly being asked of the older adult when living with AAL technologies. While Alex may not be suffering from any kind of deficit it is clear that living under this constant questioning that is inherent in AAL has the potential to affect how one's behaves in their home. This in turn is a clear imposition on one's freedom to what one wants in there own home.

The pressure of constant monitoring was echoed in Bob's commentary where he envisioned an even more intrusive scenario, a situation in which

caregivers followed up on the information they were viewing at a distance with phone calls:

“If I thought someone was checking up on me, I don’t mind the odd time, but if it was all the time I think it could get to a point where it would become intrusive. Where if it was just occasionally, if they checked on it (e.g., the distant AAL monitoring screen) when there was nothing wrong, but if they checked on it every day and they were phoning you, you should be doing this, you should be doing that, you know we noticed this didn’t happen or that didn’t happen... for me you deal with your life as it comes, if it becomes your whole, if your whole life revolves around your medical condition, then that changes your life.”

Bob’s commentary suggests that even more than interfering with the freedom to do what one once in the home, the monitoring would remind him of his deficits (his medical condition) and that such reminding would in time change not his behaviour but the way he felt about life in general. This is contrary to the conceptualization of home as a restorative place, one where individuals may retreat to in order to forget about their deficits. It is interesting to note that both of the highly negative comments came from men in the present study, a radical contrast to Teresa who has noted:

“I find that when I’m looked at a lot by doctors, I feel more comfortable and not worrying that there might be something wrong.”

The work of Smith and colleagues (2007) was introduced earlier where it was reported that males conceptualize independence differently than females and that this may lead to health damaging behaviours such as health care avoidance and ignorance of health issues. While in no way trying to judge the

intentions of Alex and Bob, their commentary suggests males may be somewhat resistant to the type of health and social care being offered by AAL. While this study does not possess the power necessary to complete a statistical analysis of this association (Cohen, 1992), future researchers may wish to study the interplay of independence and gender, with the acceptance of AAL.

The remainder of the results section will be concerned with other themes that emerged from the present research, namely, safety; the idea of trade-off; I'm already being monitored; who benefits most from the system; non-technological commentary and the importance of family; and the theme of burden. Prior to moving on to these additional themes, a summary of how AAL may affect the seven meaning of home categories identified in this study follows.

4.1.8 Summary: the impact of AAL upon the meaning of home

The participants in the present study identified seven meaning of home categories. They did not envision AAL to have much of an impact upon the meanings: comfort and warmth; belongings and memories; and having visitors into the home. In the meaning category referred to as freedom to do what I want, the participants felt AAL would have little impact in regards to how they decorate their homes, but there was great potential for AAL to affect behavioural freedom within the home space. This finding appears to be unique in the current literature, where little has been reported on the potential for AAL to affect individual behaviours. Only the research of Coughlin et al., (2007) possesses like sentiments where a theme referred to as loss of dignity appears to have some conceptual overlap with the commentary collected from participants in the

present study. The category of independence was seen to possess a great deal of overlap with freedom to do what I want. Overall, AAL was seen as a tool that could enhance independence and empower older adults to remain in their homes longer. While these positive comments appear in contrast to the findings regarding freedom to do what I want, the reason appears to be part of the broad theme of trade-off that will be discussed in the upcoming section concerned with other themes emerging from the research. In regard to security and AAL's potential to affect this home meaning the commentary from the participants was very much positive. Here participants envisioned that AAL could make them feel more secure in their homes. Finally, the theme of privacy was a major topic of concern and participants focused on the importance of consent, and how it was important for the older adult to maintain control over what information was being collected and how it was to be used. The findings from these three themes, independence, security, and privacy coincide with much of the previous research.

Interestingly, having participants identify what home meant to them, and then having them envision and comment on how AAL may affect these home meanings did not result in many new findings. The great benefit of this approach however, is found in the upcoming section where in having participants focused on the home versus the technology itself, resulted in both the development of unique themes as well as new perspectives on old themes.

4.2 Additional themes emerging from the research

4.2.1 Safety

The theme of safety has been reported in previous studies such as Tomita et al., (2007) and Sixsmith (2000), and safety and security is in fact one of the use-cases currently under development in the SOPRANO project (Sixsmith et al., 2010). It is not surprising then, that in the present study 9 of 12 participants provided a total of 12 comments that were coded as concerned with safety. The participant responses in the present study are characterized in the words of Walter who stated:

“ It may make you feel safer, but as far as I’m concerned it would be good to have someone else who knew what the hell was going on besides me, and if anything had to be done they would take care of it.”

It is possible that the participants in the present study were especially concerned with safety given that four of them had suffered from falls in their homes. Additionally the theme of safety was very much connected to independence as apparent in the words of Rita who when asked if the technologies would change the way she felt about her home said:

“Well I, yes, I think it would make me feel that I am safe in my home and that I don’t need to worry about having to move to an assisted living place.”

Rita’s comment because she has said the system would make her “feel” safer brings to the surface an excellent question that has been asked by Reder et al., (2010) simply does AAL provide any true safety to the older adult or does this all

have to do with perception? The fact remains, and in the present study the data collected regarding safety was consistently positive, with the exception of Bob who rather fatalistically commented:

“The concept is good (referring to sensor technologies and monitoring movements in the home), but at some point I think people have to just sort of say just leave me alone, if I’m going to die I’m going to die.”

While not negating the generally positive commentary on safety in the home, Bob’s comment challenges some of the basic assumptions we have about older adults. In many ways AAL technologies are being developed in response to what Sixsmith et al., have coined as the “problems” of aging (2009), and in the case of safety Bob’s comment suggests that older adults may not wish to be protected from every problem of safety that we as researcher’s and developer’s may envision. This at the outset may sound both illogical and impractical, but Bob’s commentary may suggest a resistance on the part of older adults to have their experience of aging socially constructed (Kaufman, 1994) as consisting of a series of problems. This concept parallels the research of Becker (1994) who called for a reconsideration of frailty as a marker of independence after finding that the categories that serve as the markers of frailty did not in fact reflect older adult’s views of who they are as individuals. To avoid following this same path, future research in the realm of AAL must also be directed towards developing a better understanding of the assumptions we possess regarding the manner in which older adults wish to age.

4.2.2 The idea of a trade-off

A trade-off may be defined as making a decision in light of knowledge of the advantages and disadvantages that such a decision may entail. The idea of trade-off whereby accepting AAL into the home space as an alternative to moving into some form of care facility was articulated by participants in the present study in the independence and privacy meaning of home categories.

Rita for example noted:

“Oh yeah, but if I was able to realize that I was having a problem, and it would go back to the same old thing, if I can’t handle it by myself, if I need help... I would be happy with help, instead of having to move out and someone give me help that way.”

The commentary collected in the present study and the emergence of the trade-off theme, was seen previously in Wild et al., (2008) where these researcher’s identified a theme they titled the trade-off between privacy and usefulness. Interestingly, the findings of these researcher’s that “privacy was not a major concern as long as there were proper controls in place” (p.193), were echoed by participants in the present study who felt it was important to maintain control over the information that is being collected, and to have control over those people in your life you allowing to provide you with care. Sarah for example notes:

“Those people that you’re allowing (into your home) are people that you trust, you allow them into your home anyway.”

It is clear that older adults are willing to trade-off privacy with being able to remain in one’s home, but the present research stresses the importance of

realizing such a trade-off is not a blind trust. The participants in the present study have very much emphasized the importance of being able to maintain control of decision making regarding the nature of the data collected and who is to have access to such data.

4.2.3 I'm already being monitored

The theme titled "I'm already being monitored" appears to be unique in comparison to existing AAL literature. The theme emerged in the very first interview when in response to answering the question: How would you feel about receiving a phone call from a family member if you did not take your medication?

Sarah responds:

"Oh, I'm already getting that (referring to the questioning she receives during phone calls from her son)."

The theme grew from that point on, where 9 of the 12 participants in the study offered a story of how they were already being monitored at present. Teresa's example is particularly interesting since her story involves the use of technology already in existence, here she states:

"I know my nephew worries about me when he doesn't know what I'm doing and the way we keep in touch right now is Facebook, he can tell that I've been on Facebook, so everything is o.k."

As another example, Sarah in her follow-up interview expressed a second excellent vignette of how she is already being monitored:

"Well my neighbour across the road and I have this thing with the blinds, if my blind isn't up by 10 o' clock (in the morning), she will either phone or come over and see if I'm alright, we have each

other's keys, and she is a diabetic, so if she's not up by 10 o'clock I check on her."

It was fascinating to hear these various stories because they display quite clearly that older adults have the ability to deal with issues that concern them in ways that are both innovative and cost-effective. This notion that older adults require the complex monitoring currently being developed in AAL systems is put into question. It also raises another question that was explored in the present study: Who benefits most from AAL, the person receiving the care or the caregiver?

4.2.4 Who benefits most from the system?

One advantage of using an iterative qualitative method is the freedom to probe themes that emerge as the data is being collected. One such question concerns itself with who is to benefit most from the introduction of an AAL system, the user for whom it is intended or those who are providing care. It is well acknowledged in the literature that family members who provide care to their older aging spouses, parents, and grandparents are prone to suffer from caregiver burden (Fredman, Cauley, Hochberg, Ensrud, & Doros, 2010). This burden includes stress, anger, loss of privacy, and a diminished social life resulting in numerous negative health outcomes such as increased likelihood of depression (Burns, 2000). The participants in the present study proved to be a wealth of information, because in addition to being older adults themselves, many of them had experienced what it was like to be a caregiver at some point in their lives.

Seven of 12 participants provided commentary regarding the theme of who benefits most from AAL. One participant felt that the family benefited the most, two felt the person receiving care benefited, and four felt there was a split with benefits accruing to both the person cared for and the caregiver. Walter for example notes:

“It’s a split responsibility, or split trust whatever you want to call it, they trust he is fine because they get all the right signals and he feels o.k. because no doubt he wouldn’t let them ‘into’ the house unless it is explained by the family that it is letting them know you are doing fine, or you need help. So it is a split trust as far as he’s concerned: hey they know I’m fine.”

Walter’s comments are very clear in displaying that all parties using AAL technology are benefiting. Another interesting point is how this comment cuts across a number of other themes such as privacy and independence. Here, consider the emphasis Walter’s statement puts on the importance of trust and consent with regards to AAL. The perspectives of the participants in this study are very unique because Walter was able reflect on how it was to care for his aging mother, who lived into her tenth decade, regarding the peace he would have been able to feel if he had had some way of knowing she was o.k. from a distance. Further, and from a different perspective, Walter’s comments regarding trust and “letting them into the house” came from the first person perspective where he is echoing the kind of social contract that would need to be in place for he himself to use such a system.

The commentary of Walter suggests a very even split regarding the benefits of AAL. While only two participants sided 100% that the person receiving

the care benefits most, it should be noted that most of the comments where the benefits were thought to be split, leaned more towards benefits that accrued to the family. Rita's words very much emphasize this finding:

“I think it's equal, but I think it's his family, I really do.”

This theme is rather interesting because in many ways it is contrary to the stated goals of those in the field of research and development of these technologies. The goal of the SOPRANO project, for instance, is to “map out an AAL system that will have practical benefits for users in their everyday lives” (Sixsmith et al., 2010, p.6). In this case the users referred to appear to be only the older adults receiving the care versus a system development goal of helping caregivers. There is no judgement implied here because the goal of assisting the older adult is an admirable one. The key recommendation is that, because of AAL's potential to assist the caregiver and potentially reduce caregiver burden, this goal should be highlighted further in existing conceptual frameworks. Some progress has been made in this area, where in AALIANCE's AAL roadmap (2009) it has now been acknowledged that “the primary target group is of course older or disabled people, but it should also be remembered that people who care for them... are important users who might even use services from their own location” (p.16).

4.2.5 Non-technological commentary and the importance of family

There is great debate regarding how changing family structures will evolve in the future and the implication this may have upon the support older adults

receive as they age (Stuijbergen, Van Delden, & Dykstra, 2008). McPherson (2004) notes that “adult children represent the predominant monitoring system and source of physical, emotional, and financial support for elderly parents” (p.255). The family has been subject to research and investigation for some time, but this theme is very much lacking in the AAL literature, where the technology-push (Sixsmith et al., 2010) dominates the stage. In commenting on the film depiction of AAL in the present research Alex comments:

“The only problem I have that you know it was the ideal situation where there is a big family not far away, and there is a house, and everything goes all right, and somehow they are affluent and have money for good food and wine, and it’s sunny all the time, and from my experience and also statistically people at that age are alone. Alone, they don’t have family, or they have family that couldn’t give a damn, or they have family that is on the other side of the globe somewhere, and that will be more so in the future not less. So I wonder about those people who are really alone, for those people I think would be even more important than for the ones with the family.”

Alex’s comments very much bring to light this debate of family structures and the role an AAL system may play in such a dynamic environment. He closes with the idea that maybe an AAL system would be more important for those people who do not have family supports in place. This however raises the question of who would be doing the monitoring and responding to monitoring concerns? In the film *Imagine the Future of Aging* the family, provides they key monitoring for Ernesto, and the nurse and doctor play a supporting role in what is described as the care-giving network. If the son, his wife and their daughter were eliminated from the picture, researchers must ask who will be providing the human support

required for such a system to work? Another important question may be whether or not an AAL system developed to help families, would be the same as an AAL system developed to help professional caregivers?

In contrast to Alex's comment, Colleen suggests that AAL would not be for her because:

“ I've never been like a family or anything like that, you know if you had children that would really apply, you see I've been single all my life and I've never had a family so...well I mean it's a good video to show people, especially if you've had a family.”

While Colleen is exactly the person-situation that Alex imagined an AAL system would be useful for, she in turn could not see any benefits accruing from using such a system as she did not have family and was living alone. Thus the question remains open as to whether or not the system is more beneficial for those with or without family. Another figure in this equation concerns itself with the functioning of the family unit, here Walter has commented:

“Well it doesn't show in the pictures that he felt like he's being spied upon, he's quite happy with the situation. I think one of the key things in that picture is that its not technology, you know what it is? It's the granddaughter... She's the glue that keeps things together, just like that little lady over there (points to a photo of his granddaughter).”

Walter's words raise another important question for developers of AAL, namely, how well does the system work in absence of a well functioning family?

Walter can clearly see the benefits of an AAL system in his own context, because he is able to envision how such a system may help his caring family.

Debra, who also envisions a positive experience within her own family provides words of caution when she says:

“I know in my instance, I know that they would be doing that out of their love and concern for me, but if I had the type of children who sort of now treated me like a child instead of as their mother then I might feel that the role reversal was not to my liking. I don’t have those kind of sons where it would be payback time.”

One of the key things to be learned not just in regards to the role of the family, but in the system as a whole concerns itself with the importance of control and consent in regards to the older adult. Teresa in commenting on the film reiterates the importance of this concept:

“He had to give them permission, because it specifically said that, I think there are some people in my family I would never give that permission to, and to others I would say please look.”

While Teresa’s comments provide some excellent insight regarding the smooth functioning of an AAL system, this line of questioning does open up some suggestions for future research, namely, how do we ethically obtain consent in cognitively impaired users of AAL, and how do we allow these users to maintain control over the information that is being collected?

4.2.6 The Theme of Burden

The concept of caregiver burden is well established in the research literature. Caregiving is both physically and emotionally demanding and has been associated with numerous adverse health outcomes including high blood pressure, depression, and increased mortality (Fredman et al., 2010). One study

in the AAL realm designed to evaluate the psychosocial impact of monitoring technologies, assessed by way of the Modified Caregiver Strain (CSI), and Caregiver Burden Interview (CBI), reported no statistically significant changes in scale scores (Alwan et al. 2006). The present study does not have much to offer to the formal literature in this subject, nevertheless, the participant commentary displays the feelings and desires of these individuals to not become a burden and also provides some speculation as to the role AAL may play in this dynamic.

The idea that knowledge/information is power was apparent in the present research where Alex speculates on how AAL may help the family:

“It just relieves the pressure, and the stress, you know what’s going on, they think they are doing the right thing, they have proof of it, you know that sort of thing, they don’t worry about it, it’s certainly much less stress for the family.”

This commentary is particularly interesting because Alex has stated they “think” they are doing the right thing, and this suggests that even if there were absolutely no material benefits to AAL, that simply knowing the older adult is doing fine, has the potential to provide family members with a sense of relief in times when they cannot be with the older adult in-person. This comment however, reminds us of one of the worries of AAL where such a system may decrease actual contact between caregivers and the older adult (Percival & Hanson, 2006). Interestingly, some words from Sarah, suggest that it is not the quantity of visits that are important, but rather the nature and quality of the visits. In talking about videoconferencing, she states:

“You wouldn’t need them to come and visit you as much if you could just plug into that and see them, you know that they’re well, and they can do the same for you... I think it would be nice because my son wouldn’t have to come over as often, because I could see him (using videoconferencing).”

Sarah’s comment is contrary to our assumption that individuals such as herself want and desire more contact from family and caregivers. In the case of Sarah, under the present situation she feels guilt that her son takes so much time out of his own life to provide care for her, and can envision that AAL could replace some of this need for him to visit her in-person (she lives approximately one hour from her son). Additionally, in talking with Sarah, there was a sense that the son’s actions were in part out of an act of duty, and it was clear that she desired to have more authentic visits with her son, where she did not feel he was there because he had to be, but rather because he wanted to be. This idea connects back to Sixsmith’s (1986) study on independence where it was noted that independence was linked to feelings of obligation and not wanting to be beholden to others. The theme of burden overlaps with our question regarding who benefits most from AAL the family or the older adult, and this cross cutting theme will provide the backdrop for the discussion of the present study’s results.

CHAPTER 5: DISCUSSION

This chapter discusses the highlights of this exploratory study in the context of cross cutting themes, theoretical considerations, limitations, and future research and recommendations. The first section focuses on the broad ideas that have emerged from this research. The second section looks at the potential implications this research may have upon theory. Finally, the discussion section closes with suggestions for future research guided by the present study's findings.

5.1 Highlights

The highlights begin with a review of the results in terms of the research question the study was designed to probe. First, the manner in which participants expressed what their homes meant to them coincided with existing literature (Sixsmith, 1990; Sixsmith, J., 1986) in the field. The meanings of home identified in the present study were fewer than the cited literature but included: independence; security; privacy; comfort; memories; having visitors; and freedom to do what I want. The categories of home in the present research is not as extensive as in the literature cited, but it is presumed that this was due to the shorter time that present participants were probed to discover what home meant to them. Regarding the potential for AAL to affect these home meanings, the participants did not envision that AAL would have much of an impact upon their

comfort, memories, or having visitors into the home. The findings regarding independence, security, and privacy coincide with existing research and are generally positive. In the present study AAL was seen as possessing an empowering quality whereby it could assist older adults to remain independent in their homes. Similarly it was thought that AAL could enhance security and make one feel more comfortable being at home alone. Regarding privacy, participants had concerns for privacy and security of information but for the most part felt such issues could be overcome. Only the meaning of home categorized as freedom to do what I want had findings that were different from those in previous studies.

The freedom to do what I want in terms of decorating one's home was not envisioned to be affected by an AAL system. The freedom to do what I want in terms of conducting one's life in their own home however, was very much envisioned to be affected by AAL. Many of the studies contained in the literature review section assessed older adults' perceptions of AAL with the use of yes/no type questionnaires and questions with Likert scales. In asking the participants in the present study to envision what it would be like to live with AAL in their homes, participants were able to describe, not only whether or not they would accept AAL, but the potential for such a system to affect their behaviour in their homes. Participants envisioned a number of scenarios: that the person and home would need to be neat in order to videoconference; that vital signs monitoring could cause stress; that out of spite one might play games with the AAL system; that cognitive function monitoring could lead to performance stress; and that

excessive monitoring could remind one of the deficits they are experiencing in their lives. These are all new perspectives on the user, with the exception of playing games with the system. This theme is well related to existing first generation call alarm research where it is reported that false alarms may occur when users either test the system or just want the company of talking with the responder at the other end of the line (Farquhar, Fonda, Danek, and Ryan, 1992). These findings suggest that future research should be directed towards not only asking potential users if they would accept the system, but rather probe the effect such technologies may have upon the user. The findings of this study suggest that AAL could in fact act as a stimulus to cause individuals to behave differently in their own homes. In terms of the original research questions, new findings were somewhat limited, however the behavioural findings are very unique. The true value in the present study was in exploring this new lens to gather feedback from potential AAL users.

The results of this study display that the depiction and visualization approach to AAL research is an efficacious method of inquiry. Additionally, the “lens” of home meaning must also be viewed as a major contributor to the success in uncovering unique concerns among potential AAL users. This methodology in fact has resulted in some perspectives that have not previously been reported in AAL literature, namely, the potential for AAL to affect individual behaviours (described in the meaning of home category: freedom to do what I want), and the importance of the family dynamic in the effective functioning of AAL. The latter category revealed that AAL should not be seen as a stand alone

system, rather that AAL must be viewed as part of a broader holistic paradigm whereby it is part of an overall framework to assist older adults with the goal of aging-in-place. Two additional areas probed in the present study, namely, “ I’m already being monitored” and “who benefits most from the system” may serve to inform AAL developers as to the extent of this holistic paradigm.

Van Der Ryn and Cowan (1995) have described the intersection between the natural world and the humanly designed world as a fabric composed of dozens of layers. Layers that, as they are woven together, result in one “coherent fabric or dysfunctional tangle” (p.520). In unearthing this broader holistic paradigm, the present research provided many clues regarding how AAL may function efficiently or descend into a dysfunctional tangle. The family was viewed as being vital in this equation and the positive versus negative commentary was almost equal. Participants envisioned that the system would accrue many benefits to family caregivers who could achieve peace of mind at a distance when they were not able to be with their loved ones in person. This peace of mind was envisioned to spill over to the older adult whereby he or she would feel more safe and secure in the home environment. On the darker side it was thought that information collected by way of AAL could be used against the older adult by less than caring family members, to gain control such as power of attorney. In addition to this family commentary, the concern for those potential users who did not have family was discussed. Here, it was questioned whether or not such a system would be of use to professional caregivers, and this remains a key question for future researchers. Interestingly, the findings from the present

study were mixed where one participant envisioned the system to be especially important for someone without family, while another senior who was living alone felt the system would not be of any use to her since she did not have family? It is clear from the commentary gathered in the present study that a great deal of research remains regarding how AAL is to be part of a broader holistic framework to assist older adults to age-in-place.

5.2 Cross cutting themes

The highlights section provides a summary of the results obtained but does not completely report the cross cutting nature of the themes that emerged from the present research. The grand theme of this paper is concerned with the idea of trade-off. A non-specific example of a trade-off would be how if something dear and meaningful to an individual was willing to be sacrificed (in whole or in part) by the individual in order to maintain another cherished item, thought, or feeling. Privacy for example is something that is dear and meaningful to participants in both the present and previous studies on AAL. In the present study it was widely reported that participants would be willing to sacrifice some of their privacy if it meant they would be able to stay in their homes longer. Interestingly being able to stay in one's home was seen as remaining independent, even if it meant having to rely on AAL to do so. In many ways it was as if the participants in the study held in their possession a master balance sheet with all the positives and negatives of accepting an AAL system. Giving up some privacy by way of sensor technologies for example was seen as a trade-off for having a home that was more safe and secure.

The theme of a trade-off that is linked to privacy and independence led to plentiful commentary regarding who actually benefits from the AAL system, the user or the caregivers. While no absolute answer to this question was uncovered, the inquiry fed back upon itself where participants were able to reveal details regarding how much privacy they were in fact willing to give up. There were a fairly wide range of responses, however the key point was that participants felt it was important for older adults to maintain control over and be able to negotiate the terms of the system. Specifically participants felt it was important for older adults to decide both what information would be collected and who would have access to such data. Additionally it was felt that older adults should be able to opt out of components of the system that did not appeal to them, for example cognitive function monitoring. Thus it is important for AAL developers to avoid spending research dollars in attempting to create an ideal one-size-fits-all system and focus on a component based system that would be able to operate seamlessly with the addition or subtraction of various monitoring options.

5.3 Theoretical considerations

The present research has the potential to connect to numerous theoretical considerations. This section will endeavour to display the paradigm under which we currently view aging and the development of technology (in this case AAL) and how it appears to have evolved little over the years. Consider the following excerpt from Jacques Ellul's (1962) treatise on technology:

“The further we advance into the technological society, the more convinced we become that, in any sphere whatever, there are nothing but technical problems. We conceive all problems in their

technical aspect, and think that solutions to them can only appear by means of further perfecting techniques” (p.414).

The manner in which we currently view aging as problems (Sixsmith et al., 2010) that require technological solutions such as AAL suggest we have made little progress in our approach since Ellul’s words almost fifty years ago. To confound matters Ballinger and Payne (2002) have noted that these problems are transformed into risk by way of a completely rational perspective. Simply, a risk is identified as a predictable event that health professionals, system developers, and researchers have a duty to try and prevent. In many ways AAL represents a set of technological solutions developed to deal with a cluster of risks. Consider some of the components of AAL contained in *Imagine the Future of Aging*: the risk of falls is solved via sensor technology; the risk of medication compliance is solved via a dispenser and watch; the risk of safety is solved via smart technologies; and the risk of social isolation is solved via videoconferencing. The commentary from participant’s in the present study suggest that these risks for the most part have been identified by experts rather than in consultation with older adults. Such a perspective is akin to having experts rather than older adults identify environmental press in Lawton and Nahemow’s (1973) ecological model. This raises the question that the apparent assumption of AAL, that older adults want to be protected from every imaginable risk, may in fact be misguided. Participants in the present study identified many ways that older adults are capable of managing challenges by way of non-technological solutions or

in using existing technologies such as the telephone. This finding supports Lawton's (1989) concept of environmental proactivity whereby older adults' actively change their physical or social environments prior to the environment actually creating a stimulus or pressure for change. Additionally, it was reported by participants that too much "help" only serves to remind them of the deficits they are experiencing. This "reminding" of deficits is also connected to the ecological model in that individual competence possesses a perceptual component (Lawton & Nahemow, 1973). In the present research it is possible that an AAL system, in acting as a reminder of one's deficits, could lead to a decrease in one's perceived ability to manage the environment in which they live. A broad theme within the present research may be that it is important not to excessively monitor older adults and that AAL should be developed as a component based system.

Ellul's (1962) treatise on technology also includes the rather important observation that:

"...each technological evolution raises new problems, and that as a consequence, there is never one technique which solves one problem. The technological movement is more complicated; one technique solves one problem, but at the same time creates others" (p.415).

This theme was apparent in the commentary and beliefs held by participants in the present study. To illustrate this example, it was found that participants typically overestimated exactly what an AAL system could

do and monitor. Several participants commented on how nice it would be to have the system watching them. They stated this with the knowledge that the sensor technology could only track their movement in the home and act upon irregularities, and thus is far from perfect in detecting an event such as a fall. This finding parallels the research of Sixsmith (2000) where it was reported there was divergence between client perceptions of the system and its actual function. The findings from the present study and the work of Sixsmith are set here within these theoretical considerations and it may be speculated that differences between system performance and belief on the part of the user could lead to a new problem, namely, a false sense of security in the home. These findings further suggest that it would be wise for future researchers to investigate in detail the theoretical underpinnings of AAL technology. Likewise, it would be useful if developers of these systems could incorporate such theoretical considerations into their developmental frameworks for AAL.

5.4 Limitations

The study was small and the sample size does not allow for any quantitative statistical analysis of the data. The qualitative approach nevertheless resulted in rich data that identified numerous concerns for potential AAL users in the context of the meaning of home. It is also possible that in spite of precautions taken on the part of this researcher, a favourable rapport occurred with virtually all participants, and taking into account the social desirability response (Babbie, 1990) it is possible that respondent commentary was biased towards the positive.

Additionally, the film *Imagine the Future of Aging* is so well produced it almost resembles a sales promotion DVD, and thus it is possible that this may have also biased responses towards the positive. Finally, while the sample included both participants that owned and rented their current homes, the sample was not specifically screened for socioeconomic status. The present sample therefore is likely higher than average in terms of education and socioeconomic status.

5.5 Future Research and Recommendations

The present study is small thus additional research into the potential for AAL to affect users meaning of home should be undertaken. While this may be true, the present research in identifying the usefulness of employing a home meaning lens could be used to inform the development of a workshop or toolkit for ICT engineers and developers. Such a workshop it is envisioned may be used to raise the awareness of the importance of understanding how AAL is conceptually related to ecological theories of aging. In addition to this potential knowledge translation activity, future research designs should ask not only how AAL may affect the meaning of home, but also how such a system may change the way one feels about life in general. Preliminary findings in the present study suggest this line of inquiry would yield plentiful data that could be used to inform the development of AAL systems. In terms of system development it is recommended that theoretical frameworks be further researched and brought into the knowledge that informs the development of AAL. Finally, it is recommended that older adults be brought fully into the process of developing a broad holistic framework in which AAL is merely part of an overall empowerment

system that may help older adults age-in-place and experience the highest possible quality of life.

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