Understanding the roles of social and tangible technologies in maintaining social interaction, habits and independence into old age

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Keywords

Internet of Things; Objects; Socio-material relations; Socio-physical relations; Tangible Interaction; Emotion and Design; Social Relations; Ageing; Older Adults;
Abstract

This thesis aims to build on the current limited understanding of the roles of social and tangible technology in maintaining social interaction, habits and independence in older adults. With a focus on socio-physical relations the goal is to not only get a deeper appreciation of how objects currently facilitate social interaction and physical activity but to use this awareness to inform the design of new technology that promotes ongoing socialisation.

In its approach the research explores the concerns that currently face the ageing population in maintaining social connections and how existing measures for ageing in place are assistive and reactive in nature. Existing research on socio-physical relations, tangible technologies, emotional design and human-centred design principles provided the theoretical grounds from which to build.

Using the premise that it is easier to adapt something in existing use than to adopt something new, the research explores how “significant” objects might be augmented with technology to provide a simple way to maintain ongoing connection with loved ones. “Significant” is termed as something which is considered to be really useful, provides pleasure or holds sentimental value.

The methods employed were inspired and developed from the field of participatory design and design anthropology.

As a first step contextual interviews were conducted to explore the ways objects in existing use currently facilitate social interaction and physical activity. Thereafter, participants took part in a design workshop to explore ways they might create their own personalised internet-connected or “smart” objects.
Findings from this research have shown that objects support social interaction and physical activity. Corroborating the work of many including Csikzentmihalyi (1993), Dourish (2001) and Suchman (2006) objects were also found to uphold cultural beliefs and societal conditioning. Objects satisfy emotional needs, support habits and routine activities and enable independent living.

Expanding on the inter-relational work of Boehner et al (2007) it was found that from an interactional viewpoint, the relationship between objects and emotion is mutually constituted: People invest emotional attachment to objects, and objects foster emotional responses in people.

There was a strong emotional attachment to many of the significant objects however it was found that creating this attachment is not as simple as creating a tangible representation of the emotion and physically connecting it to the object. Time and interaction are involved in developing the emotional attachment to the physical object.

Whilst some significant objects have already been augmented with technology, the findings suggest that some objects are more easily augmented than others. Concerns with technology still exist that relate to control, physical ability and privacy and the very fact that humans are social and inhabit shared spaces with shared objects adds complexity to the social and physical interactions that take place within the shared space.

Fundamental steps in the design of internet connected objects from a human perspective include learning to see how everyday objects facilitate social and physical interaction and in developing this understanding recognise the mutuality between objects and emotion. Objects can facilitate feeling connected to another however the emotional attachment to the object is not a simple process of physically attaching a material representation of
the particular emotion to the object. The feeling of connectedness that is fostered in significant objects is a result of time and ongoing interaction.

Our findings show that inspiration for personalised augmentation will be drawn from existing relations provided time is invested into learning, playing and interacting with the objects, the technology and the intended user.
Table of Contents

Keywords i
Abstract ii
Publications Arising From This Research xi
List of Abbreviations xii
Statement of Original Authorship xiii
Acknowledgments xiv

Chapter 1: Introduction 9
1.1 BACKGROUND 9
1.2 CONTEXT 11
1.3 OBJECTIVE 11
1.4 SIGNIFICANCE 12
1.5 THESIS OUTLINE 12

Chapter 2: Literature review 14
2.1 UNDERSTANDING THE ‘USER’ 14
  2.1.1 What is ageing and what is ageing well? 14
  2.1.2 Current use of technology to support ageing in place 16
  2.1.3 Exploring Social Context – Technology Design within the Domestic Setting 17
2.2 UNDERSTANDING SOCIO-PHYSICAL RELATIONS 19
  2.2.1 The socio-physical relationship between people & their things: 19
  2.2.2 Tangible and Embodied Interaction 22
  2.2.3 The ‘Internet of Things’ (IoT) 24
2.3 DESIGNING FOR EMOTIONAL FULFILMENT 25
  2.3.1 Human Centred Design 30
Chapter 3:  Research design  
3.1 METHODOLOGY  
3.1.1 Grounded Theory:  
3.1.2 Participatory Design:  
3.1.3 Ethnography:  
3.1.4 Contextual interviews:  
3.1.5 Cultural Probes:  
3.2 PHASE 1: CONTEXTUAL INTERVIEWS  
3.3 PHASE 2: PARTICIPATORY DESIGN WORKSHOP  
3.4 PARTICIPANTS  
3.5 DATA COLLECTION/ RECORDING INSTRUMENTS  
3.5.1 Phase 1:  
3.5.2 Phase 2:  
3.6 PROCEDURE AND TIMELINE  
3.7 ANALYSIS  
3.8 ETHICS AND LIMITATIONS  

Chapter 4:  Phase 1 Findings and Discussion  
4.1 HOW THE PLANNED PROCESS UNFOLDED:  
4.1.1 Introducing the digital recorder impacted the interaction  
4.1.2 Deep emotion was expressed  
4.1.3 Shared spaces, shared objects and shared stories  
4.2 OBJECTS AND THEIR ATTRIBUTES:  
4.2.1 Reasons for Object Significance are not Mutually Exclusive  
4.2.2 Purpose, frequency of use and perceived value  
4.2.3 Physical attributes and interactions  
4.3 SOCIO-PHYSICAL RELATIONSHIPS:  
4.3.1 Objects Fulfill Emotional and Physical Needs  

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4.3.2 Objects Uphold Cultural Beliefs and Societal Conditioning 62
4.3.3 Enhancing Objects and Social Relations with Technologies 64

4.4 DISCUSSION 66
4.4.1 Learn to see the social in objects: 67
4.4.2 Mutually Constituted Relations: 67

Chapter 5: Phase 2 Findings and Discussion 71
5.1 UNDERSTANDING THE KEY ISSUES 71
5.1.1 Maintaining connections is influenced by time, asymmetric communication preferences and daily habits 72
5.1.2 Making contact makes you feel good 74
5.2 CREATING TANGIBLE CONNECTIONS 74
5.2.1 Inspiration is drawn from past experiences and existing relationships: 74
5.3 AUGMENTING EVERYDAY OBJECTS 76
5.3.1 Enthusiasm and Willingness to Create Connections 77
5.3.2 Emotional attachment to an object cannot be replicated by simply joining together two tangible entities 79
5.4 DISCUSSION 80
5.4.1 Physical Reminders 80
5.4.2 Inspiration is drawn from past experiences and existing relationships 82
5.4.3 Creating emotional attachment takes time and social and physical interaction 82
5.4.4 An acknowledgement of needs not limitations 83

Chapter 6: Conclusions 86
6.1 Future Research: 88

Bibliography 89
Appendices

Appendix A: Phase 1 Participant Consent Form 94
Appendix B: Phase 2 Participant Consent Form 97
Appendix C: Participant Withdrawal Consent Form 100
Appendix D: Objects Interview Questions 101
Appendix E: Phase 2 – Workshop outline 103
Title: Understanding the roles of social and tangible technologies in maintaining social interaction, habits and independence into old age

# List of Figures

| Figure 1. | Reasons for the significance of objects | 51 |
| Figure 2. | Handling of hand-written letters and “Cyrovac” demonstrate underlying emotion and value | 53 |
| Figure 3. | Three Bowls | 57 |
| Figure 4. | Mixing Deck | 58 |
| Figure 5. | Saved cabinet from 1974 Floods keeps the memory alive | 59 |
| Figure 6. | The Toucan bird and “Tiki” symbolize family members | 60 |
| Figure 7. | ‘Hand-made’ Table | 63 |
| Figure 8. | Rolling slide show of photographs | 64 |
| Figure 9. | Picture of the sailing boat | 65 |
| Figure 10. | Examples of Tangible representations of a particular emotion: A pipe-cleaner car and a smiley face | 75 |
| Figure 11. | More Examples of Tangible representations of a particular emotion: Picture of a lady-bug, a heart balloon and a flower; The words “Party”, “Cake” and “Ice-cream”; “Happiness is a red balloon”; | 75 |
| Figure 12. | A “windmill in a field on a sunny day”; “An explosion of love hearts” and a “flower” | 76 |
| Figure 13. | The “Little Bit Kit” on display and in action. | 76 |
| Figure 14. | Participants exploring way to make new connections | 78 |
Title: Understanding the roles of social and tangible technologies in maintaining social interaction, habits and independence into old age

List of Tables

Table 1: Theme of Independence 56
Table 2: Theme of Routine and Comfort 57
Table 3: Theme of Tradition, Status and Prestige 60
Table 4: Theme of Symbolic of Meaningful Relations 61
Title: Understanding the roles of social and tangible technologies in maintaining social interaction, habits and independence into old age

Publications Arising From This Research


List of Abbreviations

HCI        Human and Computer Interaction
CHI        Computer and Human Interaction
IoT        Internet of Things
ICT        Information Communications Technology
WHO        World Health Organisation
GUI        Graphical User Interfaces
Title: Understanding the roles of social and tangible technologies in maintaining social interaction, habits and independence into old age

Statement of Original Authorship

The work contained in this thesis has not been previously submitted to meet requirements for an award at this or any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

QUT Verified Signature

Signature:

Date: 10/12/15
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Chapter 1: Introduction

This chapter provides an introduction to the research conducted, the key objectives and the intended contribution to the field of Human and Computer Interaction (HCI). Section 1.1 provides background information to support the motivation for the study and Section 1.2 outlines the context of the research. Sections 1.3 & 1.4 respectively describe the purpose and significance of the research project, and Section 1.5 provides a summary of the remaining chapters presented in the thesis.

1.1 BACKGROUND

The unprecedented growth of the world’s ageing population and the potential pressure it imposes on current economic, health and aged care systems is an ongoing global concern that has led many sectors to seek ways to support older people to age in place.

It is well documented that people age better in their home environment and that a proactive approach to maintaining wellbeing has a positive impact on one’s ability to remain independent longer (Buys, L., et al; 2005, Windsor, T., et al; 2012). Research also indicates that people remain healthier and happier for longer when they are socially connected and physically active.

Research within the field of Human and Computer Interaction and Participatory Design have explored many ways that technology might support this end. In particular, the importance of embodied interaction and social technologies has been widely recognized however at this point there is still much to learn about the relationship humans have with physical objects that support their daily activities and social interactions. This thesis explores the role that tangible social technologies might play in supporting people to communicate as they age.
More recently, a growing interest in Ubiquitous Computing (UbiComp) and the ‘Internet of Things’ (IoT) has led to speculation about how and why objects could be connected to the internet from a technical perspective; however, a key element of its successful uptake involves having a better understanding from a human perspective.

Older people use a wide variety of tangible objects in their everyday lives, as we all do. This thesis explores the idea that the familiarity and habitual use of tangible objects might offer opportunities for new forms of interface that support older people to share and communicate. Familiar objects, augmented by information and communication technologies, might support particular relationships and activities for older people (and others) in better ways than other general purpose ICT devices such as computers and mobile phones.

Through exploring the existing relationship between the object, the person, other people and the use of space within the home environment this study aims to answer the following research question:

How are tangible objects used by older people to facilitate their independent lifestyles and how might they be augmented by information and communication technologies to promote ongoing opportunities for social interaction?

This understanding will inspire the design of new tangible technology that promotes opportunities for maintained social connections into older age.

This research is part of a larger collaborative study funded by the Australian Research Council for Discovery Grant DP1111999.
1.2 CONTEXT

As outlined in Section 1.1, the aim of this study is to broaden and deepen our understanding of the relationship that older people living independently have with the objects that are significant to them. The study focuses on older people, defined as people over the age of 65 years, and the environment in which they conduct their independent living – their homes.

1.3 OBJECTIVE

The overall objective is to increase what is known about the relationship with physical objects within the domestic environment, to gain insight into the purposes they serve; how they support social interaction, and how they might be designed with internet capabilities. Through gaining a deeper understanding of the ways in which objects currently support social and physical activities and through providing the older person the opportunity to actively participate in the design of the new technology, this study aims to highlight proactive ways of maintaining a sense of connectedness, making older people less vulnerable to social isolation and other mental health issues.

The research objectives are:

1. To broaden and deepen our understanding of the relationship between people & their significant objects; which objects are significant and why, and how they support social interaction and physical activity. The aim is to build on the current knowledge base about existing sociophysical relations and use of tangible technology in relation to ageing in place.

2. To explore ways of augmenting these objects so that they promote opportunities for social interaction. Participatory Design is used to explore design options that will be easily adopted by the 65+ age.
1.4 SIGNIFICANCE

The findings from this research will inform the design of cutting edge technology and broaden the depth of knowledge about designing for ‘Internet of Things’ from a human perspective. It will also provide the opportunity for older people to play an integral role in how this technology is developed, so that it can be adopted easily and willingly by those in the 65+ age group. The application of the research is to give added insight to the design of technology that supports older adults known to be more prone to social isolation and therefore vulnerable to the onset of mental health issues. It will help maintain social engagement and an ongoing sense of connectedness for those ageing in place.

Through focus on the ageing population and wellness application, this research can be extended to any situation where social and physical interactions intertwine. Ultimately, the research will help outline a new dimension in preventative care and build recommendations and strategies for the human centred design of technology.

1.5 THESIS OUTLINE

The earlier portion of this chapter has introduced what this thesis aims to deliver. It highlighted that the contribution will come through answering the research question:

How are tangible objects used by older people to facilitate their independent lifestyles and how might they be augmented by information and communication technologies to promote ongoing opportunities for social interaction?

Chapter 2 explores existing literature within the field of Human & Computer Interaction (HCI) and Gerontology and outlines the current theories on what it means to “age well”; it builds on the viewpoint that perceptions are changing and outlines how technology is currently used to support older adults to age in place and where it might be “letting them down”. Chapter 2 also explores existing theories on socio-physical relations and
the impact that objects have on our lives. The chapter concludes with an overview of research on emotion in design.

Chapter 3 lays out the methods undertaken in order to answer the research question. Chapters 4 and 5 outline and discuss the findings from each phase of the research respectively.

Chapter 6 concludes the thesis and highlights considerations for further investigation.
Chapter 2: Literature review

A decrease in infant mortality and fertility rates coupled with an increase in life expectancy (U.N. Secretariat; 2012) has created a situation where fewer younger people need to support an increasing number of older people and older people need to support themselves for longer.

‘Baby boomers’, the term given to those born in the post-war generation, are now approaching the age where previous generations have started to deteriorate physically and mentally. As it is predicted that nearly a quarter of the population will fall into this higher risk group in the next 20 years the current health care system which is traditionally reactive in principle, must undergo significant change.

An initial literature review was conducted across related work in Human and Computer Interaction and Gerontology. This developed a deeper understanding of the research area and helped formulate the research question and informed the best approach.

2.1 UNDERSTANDING THE ‘USER’

2.1.1 What is ageing and what is ageing well?

“The World Health Organisation’s definition of health does not refer only to the absence of disease but also to the broader notion of physical, mental and social wellbeing.

While some factors that cause poor health are beyond the control of individuals, there are many preventative measures and lifestyle practices that can enhance good health.” (World Health Organisation; 2012)

Ageing is the inevitable process of change experienced by every organism throughout its lifespan. Whilst each stage of life is subject to particular societal expectations, each with its
own characteristics and social meaning, many factors influence the ageing process and the capacity for social functioning. The actual ageing process is complex and people are diverse.

Certain myths of ageism are being challenged: The ageing population is less stereotypical than previous generations; they are more active, healthier and better off than previous generations. Older adults today understand that the more socially connected an individual is, the less risk they have of becoming depressed and whilst they are concerned with ways to maintain their social circles they are more open to change & new technology.

This generation of older adults has a desire to maintain physical and financial independence (Robertson et al; 2012). They have a more educated view on preventative health vs palliative care (Queensland Government; 2012) and acknowledge that wellness is not just about physical and mental wellbeing but emotional wellbeing and spirituality also play an important part (Buys et al; 2005).

Literature relating to ageing well has established:

1. A sense of belonging, social connectedness and a sense of security within ones habitat are key factors in ageing well and living independently (Windsor et al; 2012, Buys; 2005)
2. Older people will live in their homes for longer with technological support (Blythe; 2005)
3. It costs less to keep a person healthy than to treat them once they are unwell (Porter; 2009)
4. There are more than just financial benefits to prolonging the length of time a person remains living independently (Evans; 2009).

By many accounts, humans benefit greatly from having ongoing social connectedness (Buys; 2005; Windsor et al; 2012). Traditionally social interaction involved being in
the same physical space as another, however, the development of ‘social technology’ (ie technology that facilitates social interaction) now enables opportunities for social interaction to take place across much larger physical spaces.

Social Network Sites (SNS) like Facebook, YouTube, LinkedIn and Twitter all rate within the top fifteen most visited websites in Australia (Alexa; 2013) suggesting that Social Media is now an established method of maintaining social connections for at least part of our population. With the increase in numbers in the 65+ demographic, and their vulnerability to loneliness, it is important to understand how technology can provide alternative ways to maintain their social networks irrespective of their physical status and location. Being clear about how opportunities for social interaction arise currently, will provide guidance for designing new technology that promotes ongoing opportunities for social interaction in the future.

2.1.2 Current use of technology to support ageing in place

We know that people age better in the home environment and that technology can be developed to support this outcome. Indeed, technology is already supporting older people to age in place. This demographic has witnessed the introduction of many domestic labour-saving devices over the past 60 years and are well accustomed to being resourceful with the limited means they have (Loe; 2010). However until more recently, most applications of technology designed to support independent living have been reactive and assistive in nature.

Tele-care and home monitoring services are examples of such technology introduced to support the independent living of older people. This method of monitoring high risk individuals within their home relies on the individual wearing a “help button” around their neck that is pressed if they fall or experience distress (Blythe; 2005).
These monitoring services can assist reactively when something goes wrong however they have definite limitations. Successful uptake is strongly influenced by the attitude of the individual and their ability to see the benefit of integrating the technology into their daily routines. Ongoing use requires periodic technical adjustments as the ageing process continues to impact and alter the individuals’ physical and mental capabilities (Lopez Gomez; 2014). Some feel surveillance is an invasion of privacy whilst others are happy to use it as proof they are still capable of independent living (Gutman; 2003, 260). Regardless of the debate on successful uptake, the question remains, is it enough to monitor loved ones & react to situations of distress?

(Blythe; 2005) suggests the need for the development of socially dependable systems that “take account of social context, the need for sociability and the principle of open access for all”. Whilst this is certainly a way forward (and one of the objectives of this research is to increase what is known about the ‘social context’) wouldn’t we also wish for ways to engage and connect emotionally with our loved ones?

2.1.3 Exploring Social Context – Technology Design within the Domestic Setting

Other research projects conducted within the HCI community over the past five years have examined ways that technology and physical objects might support older people to age in place.

Arreola et al (2013) explored how older adults from lower Socio-Economic Status might maintain their independence through the design of technology that stimulated informal communication between peers. Initial observations into their daily social and physical practices inspired the design of the technology and the design is built on an existing habit of “checking in” with others in the community. However, the research doesn’t fully explore the intertwining of social relations with the physical objects and ultimately the
prototype technology designed doesn’t support sustained engagement or an emotional connection with their peers. The technology is reported to enhance feelings of connection and stimulate community involvement - both of which might impact the older persons ability to age in place - however rather than making use of existing objects in the home the technology is something new that needs to be adopted into their existing space and fundamentally it still monitors and reports on activity of the older person.

In another study researchers considered ways of conducting patients’ rehabilitation programs at home rather than in a clinic (Bagalkot; 2012). In this study existing objects and practices, eg the staircase, a swing and the daily prayer ritual are used as props and motivation for them to maintain their rehabilitation programs by incorporating them into their existing daily habits.

Loe; (2010) considers objects that support older people and questions if the technological “support” actually undermines their autonomy. The walker “enables Florence to avoid ambulatory discomfort”, but at the same time, in other ways, it also supports her sedentary life which in the long term undermines her ability to live independently.

Whilst these applications consider the layout of the home and the objects within it they do not fully or specifically explore how social interaction is currently facilitated by objects or how technology might inspire the person to be proactive about these activities.

In response to the gap in HCI literature, Brereton; (2013) conducted a study that specifically explored the types of objects in habitual use and how they support an older person living independently. This highlighted the need to further investigate other domestic settings, the types of activities performed there & the objects that support these activities and prompted the research presented in this Thesis.
2.2 UNDERSTANDING SOCIO-PHYSICAL RELATIONS

One aim of this study is to broaden the understanding of the relationship that older people living independently have with the objects that are significant to them. The first section considered older people, the issues common to ageing, factors that influence ageing well; and how technology in use currently, is assistive and reactive. The ultimate aim is to address how tangible technology might be developed to support social interactions, engagement and connectedness into old age and to do that we need to understand how social interactions and connectedness are facilitated at present. This section reviews literature on the fundamentals of socio-physical relations.

2.2.1 The socio-physical relationship between people & their things:

The term “socio-physical” refers to any situation where the social intertwines with the physical where “social” is defined as ones propensity to live in companionship with others rather than in isolation (Australian Oxford Dictionary, 2004).

“Social interaction” refers to any verbal or non-verbal interaction between two or more people and it also relates to any activity that supports one to live in companionship of other people, within a community rather than in isolation. It also refers to cultural aspects of the society that are upheld as a result.

Despite being within the field of Human and Computer Interaction our investigation is not limited to exploring relationships with existing domestic technology; “things” or “objects” extends to anything physical or material that is considered part of the domestic reality. At this point the domestic environment is more heavily populated with objects that do not contain electronic components. However, as technology becomes increasingly ubiquitous and the ‘Internet of Things’ advances, it is crucial that we develop a deeper understanding of the objects that make up our physical realities, how they facilitate social interaction within the context of the home and how they support independent living within our culture and Society as a whole.
Historically objects have played a significant role in the lives of humans yet despite this, relatively little is still known about our relationship with them.

In “The Meaning of Things: Domestic Symbols and the Self” Csikszentmihalyi (1993) suggests there are three key reasons why we need things.

- Firstly, he suggests they give us the illusion of power; objects become symbols of status and (rightly or wrongly) help us to form judgements about others and their material or financial success.
- Secondly, they serve as an extension of the self; a physical extension, like a sword/knife or a ladder and also an emotional extension as demonstrated by those who are unable to recover from the catastrophic loss of belongings through natural disasters.
- Csikszentmihalyi also suggests objects or things give permanence to the meaningful relationships in our lives. Family portraits and heirlooms are obvious examples to support this stance however objects of sentimental value can be literally anything.

Whilst objects undoubtedly serve all of these purposes Csikzentmihalyi also suggests that “most of the things we make these days do not make life better in any material sense but instead serve to stabilize and order the mind.” (p. 22). In other words, the things that make up our physical realities provide stability through the fact that they are more often than not going to turn up in the same physical place today as they did yesterday. That is, we can expect with a reasonable degree of certainty that the shower or the kettle or the front door key, for example, will be where we expect it to be the next time we go to use it. However, if we cannot rely on the perceived certainty that the physical provides all that remains is ephemeral/ethereal and the uncertainty of that is likely to result in mental instability.

This account alone emphasises the importance of conducting research into this area.
Philosophical discussions about our relationship with objects suggest it is an interdependent relationship. It is built with an understanding of the fact that in order to simply perceive a particular object it must be near enough to you and in it being near enough to you, you must be near enough to it (Ahmed; 2006). As such, a relationship exists that is mutually constituted. Theorists including Latour (1999), Suchman (2006) and Orlikowski (2007) have discussed how our offices, houses, guns, coffee pots etc. materialize the relations between us. “We inhabit and use objects and they in turn shape our interactions and our agency as we shape theirs” (Vaisutis et al; 2014).

How the particular object is perceived is influenced by the previous (social) experience one has had with it and the experience in the ‘here and now’ is influenced by the circumstances or the social norms that are present (Dourish; 2001). The intertwining of the social and the physical is subtle but everywhere; Western Society is built on the physical and metaphorical structures human beings have put in place.

Taking into consideration that “every course of action depends upon its material and social circumstances” (Suchman; 2006) then every situation has the potential to alter or influence the relationship between the object and the person. In addition, the more frequently the object is used the less conscious one becomes of using it, ultimately changing the relationship again. Understanding the relationship between a person and an object is a multi-faceted and complex mission.

Since the aim is to inform the design of new technology that augments physical objects it is important to now review existing literature in tangible and embodied interaction. How do we physically interact with the physical world of objects and other beings around us and how does this translate into technology?
2.2.2 Tangible and Embodied Interaction

Early work in tangible interaction explored how the divide between digital/virtual and physical realities might be bridged. Noticing that so many of the experience learned, sensory, haptic and physical attributes of objects were being lost in computational translation Ishii and Ullmer (1997) see more benefit in augmenting or “awakening” existing objects, tools or surfaces (as opposed to making computers more ubiquitous).

“GUIs fall short of embracing the richness of human senses and skills people have developed through a lifetime of interaction with the physical world” (Ishii and Ullmer; 1997).

Advancements in technology have expanded our view on tangible interaction to mean more than just ‘giving physical form to digital data’. Over the past decade, developments in the design of tangible technology have taken us away from the conventional desk/laptop - keyboard/mouse scenario towards more tactile, user friendly devices (Dourish; 2001). There is now a definite shift in design principles that considers technology as an experience that impacts the senses and the emotions (McCarthy et al; 2004).

The work of Hornecker and Buur (2006) recognises from a design perspective, how the social aspects of an interaction interweave with the material/physical. This more encompassed view is presented in their much cited framework. But whilst the framework certainly serves to systemise the design process, it has been considered to be somewhat heavy to inspire creativity and has been more recently redeveloped into a card game with open ended questions being used to explore and evaluate different aspects of the design (Hornecker; 2010).

A significant amount of the research conducted around tangible technologies has taken place within Education with applications also being implemented in Museums and Art
Gallery’s. Manipulating, playing or tinkering with something physical and augmenting the physical with audio/visual is at the forefront of learning and development. Examples of prototypes explored include augmented tabletops with interactive capabilities, interactive recipe cards and graspable cubes (for example, McLoughlin; 2008, Borner et al; 2015 and Ullmer and Ishii; 1997). One specific example is “Sniff – the interactive tangible toy” (Johansson; 2009). Sniff is a prototype designed to engage children with visual impairment. The design of the interactive toy followed an iterative design and evaluation process focussing mostly on physical qualities and tactile feedback. A great deal of consideration was given to how the toy felt, sounded (to encourage group interaction) and vibrated (to deepen the relationship with the individual).

Particular attention was paid to making sure the toy remained ‘toy-like’ since a challenge arises, particularly for younger children, when the digital representation is too similar to the ‘real thing’. It becomes hard to decipher which is which, particularly if you have no prior experience of the ‘real thing’.

An example conducted in a domestic setting is the History Tablecloth (Gaver; 2006). The History Tablecloth set out to examine the “flow” of objects in a home. “Load sensors are placed under the legs of the table and are used to track the position of multiple objects on top.” The area on the Tablecloth under the object glows increasingly the longer an object is left, and takes roughly 30 seconds to dim after it is removed. The Tablecloth offers a visual representation of our interaction with objects by showing how long some objects sit in place and how others move around. Only the table top is connected, not the objects that are placed on it, so the research explores a single connection only rather than the network of multiple objects that is representative of the ‘Internet of Things’.

Whilst there is much to learn from the Tablecloth prototype itself, the reaction to the awareness it brings is equally interesting from a human perspective. In some instances
it brought “forgotten” objects back into vision and in another it motivated the home owner to tidy up.

Whilst the re-working of the Hornecker and Buur (2006) framework into the card game is an easier way to apply the framework, it still lends itself better to reflecting upon new technology design rather than for augmenting objects that are embedded into the homes and lives of older people. Furthermore, the framework is still more predominantly focussed on the physical and does not really consider design from an emotional perspective.

The domestic space is a complex, changing environment with multiple variables that need to be considered in the design process. This is particularly pertinent to designing internet-connected things or “smart” objects.

2.2.3 The ‘Internet of Things’ (IoT)

The ‘Internet of Things’ is the term given to the network of internet-connected objects. These objects, also referred to as ‘smart objects’ are augmented with computing and communication capabilities that enable them to establish and exchange information about themselves and other objects and/or applications (Beigl, M et al; 2001). Weisers’ (1991) vision of ubiquitous computing will be realised when everyday objects will essentially look, feel and be the same but will have, hidden behind the scenes, the added capability of being able to process digital information.

In his recent paper, Nansen et al (2014) raises some of the issues relating to everyday objects having computing capacities and called for new ways of designing for the ‘Internet of Things’ pointing out that “users” can no longer be assumed to be human. Whilst it is acknowledged our relationship with objects is mutually constituted, objects themselves have a social existence and the ‘Internet of Things’ may provide the opportunity for them to become “social biographers” in their own right.
This idea of objects having their own story might also apply in the context of home archiving. Van den Hoven et al (2012) examines the ways in which everyday memories might be captured, stored and retrieved through the use of digital media. The memories being digitally recorded are not specifically associated with everyday objects used in everyday life, nor are they primarily connected to the ageing population however there may be social and cultural benefits to an object having a digital memory.

Whilst social and cultural factors are increasingly being taken into consideration in the design process, there is a lot to consider from a human perspective before the ‘Internet of Things’ realises its full potential.

2.3 DESIGNING FOR EMOTIONAL FULFILMENT

To look at “social” and not consider the emotional and spiritual relationship would be missing half of the picture. Many theorists have attempted to define what is an emotion however there is yet to be universal agreement.

One theory (James-Lange Theory; 1884) suggests that emotions happen as a result of physiological events rather than being the cause of them. This theory acknowledges that what precedes the physiological event is perception. It is the perception that instigates the change in physiological state which they theorise subsequently produces the emotion. Stimulus on its’ own is insufficient. Perception is required to bring about the physiological change. What is not emphasised is the role that social context and culture played in influencing the perception.

The interest in the relationship between emotions and bodily functions has been developing since the early 20th Century. Early theorists, such as Cannon-Bard (1927) and Schauchter and Singer (1962) have set out to scientifically quantify emotions to make them more predictable.
Emotions have typically caused a lot of discomfort in scientific fields. They are seen to be irrational, feminine, spiritual, subjective and therefore un-scientific. Cognition on the other hand is seen to be rational, masculine, logical, objective, predictable and definably scientific. One way that researchers have attempted to rationalise emotions is to try to quantify them as physiological measurements. Researchers have attempted to define emotions as discrete pieces of information rather than being experienced through interaction (Boehner et al; 2007).

In this account, Boehner et al (2007) illustrates how in trying to rationalise emotions scientists are attempting to “tame” them and in doing so, are systematically ignoring the way in which emotions are “interactionally and culturally constituted”.

So, much of work within the associated field of Affective Computing has been conducted in research laboratories using physiological measurements including heart rate, blood pressure and skin conductivity as a way quantify and classify and subsequently infer emotional response.

The basis for using physiological measurements over ‘self-report’ evaluations is due to the perception that ‘self-report’ is subjective and therefore potentially unreliable. However, the process of using physiological measurements to quantify affect involves calibration of the equipment. The calibration involves an interaction where one individual creates different scenarios to test and measure another individual’s self-reported emotional responses. These self-reported responses are what determine the parameters for a “correct” reading in the first instance.

One challenge they face is that identical internal changes can produce very different emotional states and whilst this can potentially be inferred through making assumptions about the given context, the same emotional state may be elicited by a range of situations and the
same individual may respond to the same stimulus in many different ways at different times.

There are many issues with trying to create an information based method for evaluating emotional response in technology design not least of all that real life does not happen as discrete classifiable events. Real life is haphazard, unpredictable and ever changing. Furthermore it is continually influenced by culture, social interaction and reactions to previous emotional response.

In their report, Boehner et al (2007) suggests the need to consider emotions as “interactionally constructed and subjectively experienced” and illustrates how the relationship between emotion and culture is mutually constituted.

Boehner et al (2007) do not try to negate objective approaches to measuring emotion and admit that in some fields it may well be beneficial to develop, within the laboratory, a “reliable, reproducible hypotheses around emotion” (p15). However, when the aim is to inform the design of computing technology that fits seamlessly into our lives and homes then a more accurate reflection of actual lived experiences of emotion as they occur in interaction in real life is crucial. The key to this and to understanding new aspects of human experience is to make resources available that allow people to interpret, communicate and share their emotional experiences.

When considering the emotional response a particular design might elicit, one traditionally refers to objects post-production from the perspective of its commercial viability. Why is it that a person likes this object over another? Why would they purchase or consume this over that?

Don Norman (2002 and 2004) initially felt this was due to two main reasons and then upon reflection, re-wrote his book to include the third reason. These reasons were
attributed to visceral, behavioural, and reflective values of the object. That is, people find fulfilment in their physical environment because it looks good, it serves a purpose or works well, or because it holds reflective value. The story about the object is what gives the person the reason to hold onto it. The social aspect of our personality that enjoys reflecting and making meaning gives the physical objects value. Having something to say about the thing that fills our physical space substantiates meaning in our lives.

With a focus on user experience and the long-term affective impact of technology Kamp & Desmet (2014) explored product qualities assessing them as hedonic, eudemonic or pragmatic or a combination of any two or all three. The research discusses the intertwining of the physical and emotional in terms of whether the object satisfies tangible or intangible needs. That is, whether objects serve a physical purpose or satisfy a subjective or emotional need or both. Whilst it is subjective feedback they seek, their assessment tool still aims to quantify and categorise the responses – not through physiological measurements but through questionnaire.

In summary, there are many ways in which objects might be designed to support emotional fulfilment but how might technology help people feel connected at a distance without them necessarily having to pick up the phone?

Lovers Cups (Chung; 2006), Empty moments (Lotteridge; 2009) and Hug over a distance (Meuller et al; 2005) are just three of many more recent examples of studies investigating intimacy via technology. In “Lovers Cups” Chung (2006) investigates drinking interfaces as new communication channels; “Hug over a distance” (Mueller et al; 2005) looks at replicating the feeling of a physical embrace through an inflatable waistcoat and “Empty Moments” (Lotteridge; 2009) explored the unmet communication needs of remote couples through sharing sounds to create an ambient presence of the other person.
“The shared mundane activities that seemed fine when together seemed emptier when apart” and “They simply wanted stimulation from the other to fill the void” Lotteridge (2009). These statements from the research findings say nothing from an informational perspective but are laden with interactional richness and imply lots about the basic human need for connection.

Do objects currently fulfil this role of “filling the void” and if so, to what extent? How might technology be designed to bridge the gap better?

Do we actually need the object or just what the object symbolises?
Whilst this question leans more towards the subject of spirituality than emotion, the answer is unlikely to be found in HCI literature (Blythe; 2013).

So the question remains: do we need the object – the photo, ornament or heirloom to feel the connection or can one feel the connection if open to it? It would appear that many believe they need something physical to fill the void.

Two examples that have considered the intertwining of the physical and the emotional through creating a tangible representation of an emotional experience are Guto Requena’s ‘Love-Project’ (2014) and the Stanford ‘Gift Giving’ experience (2012).

In the ‘Gift Giving’ experience pairs of participants were asked to explore the act of buying a gift and re-design the gift giving experience for each other based on what they had learned about the other person and their experience. The objective was to get potential designers to put aside their thoughts about functionality and think about feelings.
In the ‘Love Project’, technology was designed to convert biometric readings from the heart, head and voice into a unique 3D printed creation. The measurements were taken as the person spoke of a relationship about which they felt strongly so the emphasis is not on trying to determine or predict the emotions being experienced but create a truly unique and personal object from the experience of talking about it.

Whilst both these examples involved the “user” in the process of creating something tangible from an emotional experience, the experiences they are designing for are one off experiences rather than ongoing interactions.

One way in which this study intends to address this and many other issues is to ensure that the design of this new supportive tangible technology is inspired by those who are going to use it.

2.3.1 Human Centred Design

Technology has traditionally been designed from a usability perspective. It simply needed to be effective, efficient, learnable and satisfying to use. Little or no consideration was given to how it might support, enhance, interact or even fit in with current practises of the individual.

Some believe that technological innovations change the way people live their lives, for example “Ready, Set, Disrupt” (Ford; 2012). It infers that in order for technology to be ‘innovative’ it needs to change the habits of its users. However, Heyer & Brereton (2008) refers to “Sack’s account of new technology adoption” and this suggests that new technologies do not in fact transform the world of their users but are actually made to fit into the existing environment. That is, new technology has to fit in with existing habits or it won’t have uptake.
The basic principles of Human Centred Design involve establishing a clear understanding of the context of use, intended activity/performance requirements and an understanding of the characteristics of the intended users. The next step involves determining what makes it satisfying to use in terms of effectiveness & efficiency; what does the product do for the user and what does the user do for themselves?

The third step involves preparing a simple mock up or prototype and step four involves testing the prototype with the intended user to gain feedback in order to hone the design to be more user-friendly.

Whilst these principles are quite simple in written theory, there are many different methods for achieving this end which will be explored in more depth in the Methodology section.
Chapter 3: Research design

This chapter outlines the methodology adopted to investigate the research objective of understanding the roles of social and tangible technology in maintaining social interaction, habits and independence into old age.

- Section 3.1 outlines the methodology adopted and the reasons for undertaking the research in this way.
- Section 3.2 and 3.3 provide further explanation specific to each phase of the research project.
- Section 3.4 describes the participants and the recruitment methods.
- Section 3.5 details the instruments used in each phase of the data collection; Section 3.6 outlines the timing of each phase and Section 3.7 discusses how the data is to be analysed.
- Finally, Section 3.8 discusses ethical considerations and possible limitations with the choice of research methodology.

3.1 METHODOLOGY

With an understanding and an appreciation for all sides of the ongoing debate about quantitative, qualitative and mixed method data collection techniques (for example Cooper et al; 2012, Creswell; 2003 and Dourish; 2004) it was clear that the method that would allow the relationship between older adults and their significant objects to be researched with greater depth would be a human-centred qualitative approach with a small group of older adults. The focus was on understanding the relationships in their social context in an exploratory study rather than seeking to explain them definitively (Hammersley; 1983).

Human behaviour is characteristically variable and dependent on the social context (Dourish; 2004) so in order to obtain the most valid understanding, interviews needed to be
qualitative and conducted within the context of the home environment.

An important element for consideration was that the nature of the research is “discovery”. There was no hypothesis to test or a list of pre-determined assumptions or ideas. An objective of the research was to increase what is known within the social context of independent living with a view to developing a framework that informs the design of tangible technology that supports ongoing social connection. With this in mind, the investigation might benefit from a Grounded Theory approach.

3.1.1 Grounded Theory:

Developed in 1967 by Glasser and Strauss (1967), Grounded Theory provides a methodology for developing a theory that emerges from an enquiry into the social world. Grounded Theory in practise involves a systematic approach to observing and collecting data about a particular phenomenon. Data is then repeatedly and instinctively analysed and coded for emerging patterns of behaviours, themes and concepts. The concepts are then developed into a hypothesis. Classical Grounded Theory involves time and patience to allow the conceptual abstraction process to emerge from the data. The key point is that “the theory emerges from the data not from extant theory” (Holton; 2009 p41). But whilst this methodology can result in powerful theoretical realisations, it is very easy to veer from the systematic procedure and also hard for most researchers to remain unbiased and open throughout. The key aspect that this research takes from this methodology is that time and repeated analysis will bring emerging themes to the fore.

In a similar way, Participatory Design also seeks to use an iterative process that allows the construction of the design to emerge however it is done in collaboration with the intended user.
3.1.2 Participatory Design:

Whilst this method has been around for over 40 years and has developed in that time, the basic principles have remained the same. Initially it was established to empower those within a community or workplace providing them with a voice and involvement in the decisions that would ultimately affect them and their community or work life.

Participatory Design uses various research methods, including ethnographic observations, interviews and object/prototype analysis to construct the emerging design. The method generally follows a 3 phase process:

1. Initial contextual exploration using techniques such as ethnographic observation and interviews;
2. Discovery process when most of the interaction between researchers and users take place. This stage will frequently take the form of a group workshop where collaboratively “they make meaning out of the work rather than to simply describe it” (Spinuzzi; 2005 p167);
3. Involves creating a prototype.

The crucial point here is that the process involves co-interpretation of the data. The participant who will use the design and the researcher/designer work in collaboration with each other so that the technology is not designed for but designed with the intended user. Additionally, in recognition of the fact that the user holds the key that unlocks their wealth of knowledge, it seems logical to involve them as much as possible when researching potential solutions.

It has been argued that a potential issue with this approach is that the result might not be feasible from an engineering perspective and this unfortunately can be equally as problematic as a great technological solution to the wrong set of “work” problems (Sol;
1984). However, when the Participatory Design team includes people who understand technology design, this is not a problem. Moreover the approach focuses more on collaboratively establishing objectives rather than on very detailed technical design. This highlights the importance of the research being an iterative, collaborative process.

“The developers of participatory design believed that politically and ethically, the two types of knowledge (the participants’ tacit knowledge & the researchers more abstract analytical logic) must be bridged, with each being valued by all involved in the research” (Spinuzzi; 2005 p164).

Since an aim of the research is to ensure that the design of the technology is inspired by those who are going to use it, the methodological approach was influenced and guided by these principles of Participatory Design.

The first step towards a better understanding of the roles of social and tangible technologies in maintaining social interaction, habits and independence into old age is to build a clearer picture of the types of ‘things’ that currently support social interaction, habits and independent living for those doing the ageing. Three options considered for building this clearer picture were ethnography, contextual interviews and cultural probes.

3.1.3 Ethnography:

“Ethnographies are written descriptions based on fieldwork, where an ethnographer participates in people’s daily lives for an extended period of time, observing, interviewing and collecting data within the focus of study.” (Ylirisku and Buur; 2007 p42). There are three over-riding techniques used in ethnographic work; observation, interview and video analysis (Hammersley; 1987).
Traditionally, ethnography involved the researcher being immersed into the lives of those being researched 24 hours a day, 7 days a week. Whilst this is no longer feasible (or necessary), spending considerable time with participants remains the key aspect of this research method (Whitehead; 2005). The aim central to this approach is to develop new insight into existing knowledge.

A benefit of conducting ethnography is that it provides in-person observations of the participants lived behaviour and as such offers insight into social activities from the viewpoint of the participants. Rather than relying on the participants’ recollection of activities, in-person observation synonymous with ethnography provides the researcher the opportunity to see the activities and interactions in real time for themselves.

One issue that might arise with ethnography is called “Observer effect”. It occurs when the participant changes their usual behaviour in response to the researcher being present. Since the research was interested in observing interactions with significant objects, it was anticipated that the interviews might take the form of a “show and tell”. While an “Observer Effect” may occur, with people only choosing objects they are willing to talk about, or possibly only choosing objects that they have positive stories about, the approach is still likely to reveal a lot of insight into people’s relationship with objects.

3.1.4 Contextual interviews:

Involves conducting research in the context where the behaviour of interest occurs. A key objective of contextual interviews in technology design is to gather information based on the types of activities performed in the situation they are performed in. Information like: what does the person do, how do they behave, how do they think, what do they feel, how do they act, why do they do it that way rather than another way, how could it be done better? It is important that the participant understands that the objective of the interview is for the researcher to learn from them.
Contextual interviews also allow the researcher to observe actual activities being conducted in situ and whilst very similar to ethnography in that it can deliver really rich context based information, the focus of the contextual interview is more often to inform the design of a tangible artefact or prototype. Unfortunately, it can also provide distortions of the truth since it relies on self-report and what people do and what they say they do are not always the same (Dourish; 2001 p19 as quoted in Ylirisku and Buur; 2007 p43-44).

3.1.5 Cultural Probes:

The word “probe” has a number of implications depending on the discipline of study. “In the Social Sciences and particularly in social surveys, a probe is an attempt to elicit a deeper or more enlightening response to a question” (Graham et al; 2007). In Human and Computer Interaction, “probes” take the form of a “package” or a “kit” that contains tools carefully designed to provoke reactions and elicit subjective information about peoples existing habits, cultures, thoughts and values over a given period of time. Their aim is to develop an understanding that is a “mingling of observable facts with emotional responses” (Gaver et al; 2004) that becomes a valuable resource for designers.

The tools are specific to the research objective and include a simple way to record subjective ‘in the moment’ information. For example, with the objective of informing the design of technology that supports intimate relations, kits included a digital camera with docking printer, diaries and scrapbooks, pens, scissors, glue and “catch-phrase” stickers. The “catch-phrase” stickers included phrases like “I feel alone when...”, “I feel supported when...” which were used as prompts for self-disclosure (Vetere et al; 2005).

In contrast, in another study, Crabtree et al (2003) wished to collect more information based responses and so the kits in this project didn’t specifically include a tool that would elicit emotional reflection from the participants.
Cultural Probes are a great way to start an ongoing conversation with participants and based on the premise that the participant is the expert in their own life provides an excellent way to investigate reflective information. However, they do require committed involvement by the participant which can be hard to maintain over longer periods of time and whilst they can be a fantastic source of inspiration for innovative design are also limited in as much as that is all they can offer. (Dourish; 2001).

The logical starting point was to explore in depth the existing practises of the research population. Whilst the design of new technology is a goal, the research was initially interested in broadening existing knowledge around social interaction with objects in general.

3.2 PHASE 1: CONTEXTUAL INTERVIEWS

Contextual interviews were undertaken in the homes of older adults to explore the relationship that older people have with the objects that are significant to them. We wanted to increase our knowledge about how objects currently facilitate social and physical interaction and the discussion about the objects in the home is a way to reveal habits, routines, values and aspirations. Given the interest in designing tangible technologies the first step is to begin by understanding the use of existing objects and technologies in the home. Through gaining an understanding of the purpose and importance of these objects we will be able to consider how they contribute to and encourage social interaction and how they might be adapted to further support their user. Inspiration for designing new kinds of social and tangible technologies will be drawn from these observations.

When exploring how objects currently support social interaction we are not only investigating the moment verbal or non-verbal communication takes place between two or more human beings and the physical things or the environment that supports
it; we are also giving consideration to any cultural and societal beliefs that might be upheld through the objects that support their physical reality. Furthermore, it is not an intentional bias however it has been assumed that the interactions of interest would be social (and not anti-social) although the same object can clearly facilitate both (Latour; 1999).

Interview questions were open ended in order to allow the participant freedom of self-expression when discussing the objects that are significant to them. To understand the influence of time on the depth of their relationship some questions required the participants to reflect on the past, present and the future of their relationship with the object.

The questions prepared were used as a guide to keep the flow of the conversation going rather than as a pre-meditated script for the interview.

They are presented in Appendix D.

3.3 PHASE 2: PARTICIPATORY DESIGN WORKSHOP

“Design is the material exploration of a problem.” (Blythe; 2014)

The second step was to build on the knowledge from Phase 1 and develop considerations for the design of new technologies that support older people to age in place longer through offering ongoing opportunities to maintain social connections. One potential way to better understand how technology might support independent living is to provide the user, the older person, the opportunity to design their own technology. Brereton et al, (2014) discuss the limitations of ethnography and the importance of engagement and reciprocity in design.
The issue under investigation is how can technology be designed to support older people to maintain a feeling of connectedness and help them age in place longer? Knowing that it is easier to adapt something already in use than to adopt something new the interest is in giving the user the opportunity to create personalised connections in objects that are in their current daily use.

The format of the workshop involved two key influences:

- The “gift giving” exercise; conducted at Stanford (2013) which examines ways to create something tangible from an emotional experience
- The MaKey MaKey workshops (Rogers et al; 2014) which explored how creativity is inspired when older people create novel connections with MaKey MaKey kits and fruit.

The aim of this phase is to explore tangible representations of a specific emotional need (feeling of connectedness) and using this creation go on to design personalised connections with an existing object and Little Bit Kits.

Many studies consider the emotional fulfilment at the end of the design process. We wish to bring the emotional fulfilment into focus at the start of the design process.

An outline of the Phase 2 workshop can be found in Appendix E.

3.4 PARTICIPANTS

There are two requirements for participation in this study; participants need to be over the age of 65 years and they need to be living independently. In keeping with the key principles of Participatory Design our aim is to elicit the “rich” and “messy” of the lived experience and so the number of participants is restricted to less than ten participants.
Recruitment strategies involve approaching members of the investigators’ extended social network, the local CWA, Men’s Shed, Probus and Rotary. Contact is either made in person, by phone or via email. An explanation of the entire project is provided and participants are given the option to participate in all research activities or just Phase 1. Participants are also given the option to withdraw at any time.

The reality of conducting human-centred research over a six month time period is that circumstances and availability are subject to change. This initially held up the Phase 2 workshop and ultimately meant that additional participants needed to be recruited using the same recruitment methods.

Examples of the consent forms can be found in the Appendix.

3.5 DATA COLLECTION/RECORDING INSTRUMENTS

3.5.1 Phase 1:

The intention was to digitally record the interviews for both an audio and visual record. As a way of respecting the participants’ privacy and security it was envisioned that they would hold the video recorder so that they had control over what aspects of their home were recorded. This also meant that the participant would be behind the camera instead of in front of it and this would also safeguard their anonymity. A third reason for suggesting the participant control the camera was to increase active participation in the interview. In addition to the Audio/Visual digital record, the objects were photographed ‘in place’ and discussions digitally audio-recorded.

3.5.2 Phase 2:

Audio/Visual Digital recorders were used to capture the proceedings of the Phase 2 workshop. Audio recorders were placed on each table to record individual conversations
and the A/V recorders were set up to provide a visual record of the interactions.

Other materials used in this phase included: Little Bit Kits, three or four easily sourced objects that were representative of those highlighted in the Phase 1 interviews and a variety of miscellaneous craft items for constructing prototypes and the tangible representation of their personal emotion.

3.6 PROCEDURE AND TIMELINE

Initial interviews followed an informal format. Questions were arranged prior to the interviews so that the interview flowed however the intention was for the interview to be conversational and led by the participant. It was anticipated that the interviews would be approximately 1 hour in duration however the reality was that they went overtime. The 9 interviews were conducted within 2 months of each other for no other reason than to keep the research project timely.

Phase 2 was conducted approximately 9 months after the initial interviews. The delay was due to the difficulty in getting all of the participants together. There were delays through participants experiencing ill health and undertaking interstate and overseas travel.

3.7 ANALYSIS

Initial observations, overall impressions and evocative comments were noted at the end of each data collection phase. Thereafter an-depth analysis was conducted on the data.

The recordings and photographs from the Phase 1 interviews were documented and stored digitally. Interviews were subsequently transcribed and reviewed. Audio data were analysed and the objects that had been highlighted for their significance were grouped thematically. Themes describing the socio-physical interactions were documented as they emerged over time.
Phase 2 audio/visual recordings have been reviewed and analysed repeatedly over the period of study. Emerging themes were grouped and documented.

3.8 ETHICS AND LIMITATIONS

This research is being conducted in accordance with QUT Ethics Approval Number 130000436. There are no unusual ethical considerations or risks involved in conducting this research project.

The researcher is aware of the risks associated with conducting research that is qualitative in nature. However, it is inevitable when conducting human-centred research that the subjective personal impressions, opinions and sentiments of the participant will be uncovered. Great care has been taken to provide an objective account of the participants’ subjective responses. It is not anticipated that there are any threats to the validity of the results.
Chapter 4: Phase 1 Findings and Discussion

The findings of each Phase and ensuing discussion are outlined in the following Chapters. Phase 1 has been split into 5 sub-sections:

- How the Planned Process Unfolded;
- The Objects and their Attributes;
- Sociophysical Relationships;
- Discussion from Phase 1 findings

4.1 HOW THE PLANNED PROCESS UNFOLDED:

Participants were called ahead of the Phase 1 interviews to arrange a mutually convenient time to meet. At this time they were asked to consider what might be their significant objects. Significant was termed as being really useful, provides pleasure in some way or has sentimental value. An “object” extended to anything material or tangible.

Nine interviews were conducted in total. The interviewees included 5 men and 4 women. Their individual living arrangements and the length of time they had lived in their homes were quite varied. All had been married at some point during their life; five still live with their partners, one participant lives alone. Another participant was widowed many years previously and has adapted her home with a ‘granny flat’ for herself downstairs leaving the upstairs to accommodate the participants’ daughter and her family. On two occasions the male of the household had been recruited and their female partners then also expressed a desire to be involved in the study.

The interest was not specifically in their socio-economic status however the recruitment channels probably affected this slightly so that the majority of participants fell into the category of middle-class retirees.
The life experiences and employment history of the participants were also really varied. Again, the demographics of our participants were not of particular interest, but this information was freely offered by the participant during the discussion about their significant objects.

Observations and Considerations:

Despite rigorous planning and preparation, unexpected complications arose during the course of the interviews. Interviews required a heightened set of personal communication skills, including active listening skills, mindfulness, empathy and self-confidence. However, the objective of conducting the interviews in context is to gain experience of the lived environment and the ‘unexpected’ is what produces the richness and the depth of information. Some reflections are presented here for the consideration of others who are also contemplating research within the context of older peoples’ domestic environments.

4.1.1 Introducing the digital recorder impacted the interaction

Unforeseen limitations of older adults and their home environments meant that it would have been insensitive to ask them to control the digital recorder. An assumption was made that participants would be comfortable with and able to use the recorder however this was not always the case.

It was anticipated that participants might be selective with the areas of the home that were open for discussion (Leonardi et al; 2009) and that they might prefer that some items remain “off record”. This had been the primary reason for getting the participant to be in control of the digital recorder. However, in reality, and in three situations in particular, it would have been insensitive to ask this of the participant. A short description of the interactions in these three situations followed by an account of the observations will be presented to support this finding.
The first interview was conducted in a studio type apartment that consisted of a kitchenette, a bed, a sofa and a coffee table. Movement about the home was somewhat restricted and all objects of significance could be observed whilst sitting on the sofa. The participant had no objections to photographs and videos being taken but hesitated to take the recorder when it was offered. As a guest in their home, showing respect for their personal physical space also involves being sensitive to the boundaries of their emotional comfort zones.

It is very difficult to give someone something if they aren’t prepared to take it. Whether it was for fear of doing something wrong, breaking or deleting something, for reasons that remain unclear, the participant was not willing to take control of the technology.

Showing sensitivity to the participants changing physical needs was another unforeseen consideration that only came to light during the interview process.

In the second instance, the participant had undergone recent surgery and whilst her rehabilitation program was well underway it became apparent within the first 10 minutes of the interview that her physical ability and balance were still compromised. Whilst the participant was really keen to help with the research it would have been insensitive to ask her to navigate her home with a camera in hand or to stand for extended periods of time whilst we discussed the objects in place. It would also have been insensitive and potentially detrimental to her self-confidence to suggest that we reschedule the interview for a future time.

At the time of the interview interaction with the technology was impacted by the participants’ compromised physical ability.

The participant in another household expressed general concern around having video
and photographs taken. The interview commenced, as with all interviews, in the “safe” zone of the home, that is, the kitchen, living room or other areas of their home deemed suitable for entertaining guests. As the conversation progressed and common interests were established, the participant became more open with the types of objects and areas within the home she was willing to share. Building rapport and developing trust is vital in any social interaction and this becomes heightened when the subject matter and/or context is personal, emotional or private.

**Observation 1:**

Whilst an objective of the interviews was to explore the relationship between the person and their significant object, introducing the digital technology into the interaction brought into awareness concerns about control, physical ability and privacy.

4.1.2 Deep emotion was expressed

Participants expressed deep emotion when reflecting about what their significant objects mean to them and this required active listening skills and empathy from the researcher.

All relationships, whether between one or more individuals or their physical objects, involve a degree of emotion however; it was not anticipated that such depth of emotion would be so openly expressed by participants.

The beauty of conducting interviews in context is the richness of the information that is shared (Dourish; 2001). For some, the process of reflecting on the significance of their belongings appears to be a little confronting. If an object connects them with someone who is no longer alive (or physically there) it serves as a reminder of this missing relationship and of their own impermanence. This subsequently brings up concerns about what might happen with their own belongings and fears that they might burden
others with ‘stuff’ they don’t want or care about as much as they do.

Others were quite grateful for the opportunity to talk about their objects and reflect on the history tied up in them and seemed to find comfort in the memories. One participant in particular had already started to take care of her estate and shared that she had found releasing the things that were no longer needed cathartic.

Observation 2:
Interactions around objects provoked a depth of different emotion.

4.1.3 Shared spaces, shared objects and shared stories

On two occasions the female partner had volunteered to be involved after the male of the house had been recruited. Rather than make arrangements to come to the home on two separate occasions, interviews were planned for the same visit. Interviews were intended to be informal discussions so it was anticipated that the participants would take turns in talking about their significant objects. However, interviewing two participants at once raised its own challenges.

In one instance the male suggested that his (more dominant & talkative) partner would definitely be more interesting than he was and unfortunately, thereafter, did not really contribute. On another, the partner not being interviewed popped in and out of the interview as we went from room to room and offered her opinion about what she thought should be his significant objects and why. In some situations it was helpful to have a prompt for his memory; in others it may have interrupted his flow.

In two other interviews objects like the miniature screwdriver and the Suduko book had been placed in a particular spot for ease of access. This positioning was deliberate and facilitated the activities of one member of the household. Yet the positioning of the
object contributed to clutter/mess for other members. One might expect to find that object where it had been left ready for ease of use only to find that it had been moved or tidied away by another member of the household. These negotiations add complexity to the relationship the object has with the different members in the house.

**Observation 3:**

Shared spaces require a series of negotiations, not just through the verbal interaction between the people sharing the space but also through the objects that support them in the daily life activities that take place within the shared environment.

**Considerations:**

Conducting interviews in the homes of older adults entailed having the ability to adapt to their changing physical, mental and emotional needs. It required confidence and open-ness to allow the thread of the conversation to meander and digress so that the subtleties of their relationship with their objects might be revealed.

The role of researcher, as guest of the home in a contextual interview, in particular foregrounds the importance of respect for the host and negotiation of the interview agenda with the interviewee/host.

Three key observations emerged through the process of conducting the interviews:

1. Interactions with the objects were impacted by introducing the digital technology through concerns about control; physical ability and privacy;
2. A depth of different emotions was willingly and openly shown;
3. Interactions with objects within shared space require negotiations that involve physical and emotional concerns.

The relationship older people have with the things that make up and support their
physical reality is complex but it will ultimately influence how technology might be designed to support these activities.

4.2 OBJECTS AND THEIR ATTRIBUTES:

The purpose of the contextual interviews was not to determine a definitive list of objects deemed to be significant by those over the age of 65 who are living independently yet it is still interesting to reflect on the types of objects selected and the reasons given. It is conceivable that a different list of objects would have been found if the sole focus had been on an objects affordance for communication or ability to facilitate engagement. Regardless, understanding more about the physical aspects and attributes of the objects will contribute towards determining whether and how they might be augmented.

The next section reflects on the findings about the objects themselves and their varied attributes. As a way of discovering themes around the objects they were categorised according to their different attributes. These included their physical qualities, placement of keeping, use and histories. Through the process of analysis and continual comparison the following themes emerged from the data.

4.2.1 Reasons for Object Significance are not Mutually Exclusive

Participants were asked ahead of the interview to select objects that were significant to them where significant is defined as something that was considered really useful, provides pleasure in some way or holds sentimental value.

In total 49 objects were selected and whilst there was very little duplication between the households in the objects selected for their significance, many objects were significant for more than one reason. In some instances, objects that “provide pleasure” did so because its owner held value in its qualities of usefulness. With others, the object
was considered to “provide pleasure” because the sentiment attached to the object was positive or humorous. In most cases, and perhaps not surprisingly, objects were selected for their sentimental value.

Figure 1. Reasons for the significance of objects
Observation 4:

Despite the fact that participants were offered three distinct criteria from which to define their objects’ significance the criteria were still subject to the participants’ interpretation and many objects were significant for more than one reason.

4.2.2 Purpose, frequency of use and perceived value

The physical layouts of each home varied considerably and despite the fact that all of the homes had a space to cook, eat, wash, relax and sleep; the physical space the “significant objects” inhabited was equally varied.

Some objects with aesthetic value like the collection of 70-80 teapots, the collection of pigs and the ornaments were set up on shelves; the portraits/photographs, family trees, clocks and religious artefacts were displayed on walls throughout the house. Others with more utilitarian attributes like the pocket screwdriver, the shoe horn, the bowls, the Suduko puzzle book and the fridge magnet were kept within reach for ease of use. A few objects, like the teapots or the clocks have not been in use for many years however unexpectedly most of the objects termed as significant were in frequent use.

Observation 5:

From a physical perspective, it was found that the physical space inhabited by the objects was relative to its purpose, frequency of use and perceived value.

4.2.3 Physical attributes and interactions

Some objects of sentimental value, like hand written letters and jewellery were stored away for safe keeping. In a couple of situations the objects were stored under 2 or 3 additional layers of physical material for extra protection.
For example, they were first wrapped in tissue or a leather wallet, and then put inside a box which is then placed inside a cupboard. The owner of the hand-written letters very carefully unwrapped the letters to talk about them and then very carefully re-wrapped them once the story had been shared.

This deliberately considered physical interaction with the object indicates the age or fragility of the objects’ physical attributes. However, it also highlights, in a different way to other participants who openly expressed their emotional attachment through laughter and/or tears, the depth of emotion invested in the object.

It is also in contrast to the physical interaction observed with the Suduko puzzles or the camping book which were slid across the table or unconsciously popped back onto the shelf when the next object came into focus.

It was also interesting to observe that the participant who took great pride and care when unwrapping and re-wrapping her mother’s letters also paid the same level of respect and care when unpacking another of her significant objects - the “Cyrovac” (food vacuum sealer) demonstrating the strength of the underlying value for her in being able to preserve food.

**Observation 6:**

The level of care shown by the participants as they physically interacted with the objects in some instances gave an indication of its physical fragility or durability. It also pointed to the social relationship they have with it and the underlying values of the individual that the object expresses and upholds and the degree of emotion they have invested in it.
Considerations:

The contextual interviews conducted in the homes of older adults living independently have found that the types of objects considered significant were not a definitive list but are varied and idiosyncratic. Many objects were considered significant for more than one reason showing that flexibility in the purpose the object fulfils already exists. The objects purpose, frequency of use and perceived value all influence how and where the object is kept.

Whilst the physical attributes of the object would inherently come into consideration when interacting with it, the physical interaction can also indicate, in different ways, the underlying value the object upholds and the degree of emotion invested. Objects carefully wrapped and preserved in layers of physical material which can be seen might also be wrapped in ‘unseen’ history, cultural beliefs and emotion.

4.3 SOCIO-PHYSICAL RELATIONSHIPS:

Whilst the objects themselves were varied, themes emerged around what the objects mean to their owners based on the stories that accompanied the object. These themes, presented in the published paper “Invisible Connections: Investigating Older People’s Emotions and Social Relations around Objects” (2014) are outlined below.

4.3.1 Objects Fulfill Emotional and Physical Needs

Through talking with the participants about their objects in context we were able to get a deeper understanding of the socio-physical relationship that exists. Examples of objects and the underlying reasons have been provided to illuminate the emerging themes.
**Objects of Independence:**

One participant had quite practical significant objects that included a shoe horn, a set of steps, a ‘handy vac’ and a miniature screwdriver. The connection he has with them was demonstrated through his enthusiasm. The shoe horn not only promotes physical activity by enabling him to put on his shoes without bending over, it also fosters social connection with his grandchildren through its use as a walking stick and a sword in their role play. His expression of disappointment at the thought of something happening to it and the fact that it also accompanies them on holiday further reinforced evidence of this emotional attachment.

Another participant described the importance of her car for supporting her independence. It not only represents a link to social connections like going to her weekly choir practice and looking after her grandchildren but also facilitates the mundane routine physical activities like grocery shopping and attending doctors’ appointments. When she talked about the cars she has had in the past she did so with pride and passion. However, the emotion tied up in the object parked in her carport at this stage of her life is sadness. Her current health situation does not permit her to drive and her dependence on others for transportation leaves her feeling really inadequate.

The laundry basket on wheels fulfils more than one role in another household. It supports the couple’s preference to buy their groceries without consuming plastic bags by enabling them to easily transfer the goods from the boot of the car to the kitchen cupboard. It is also used, as one might expect, to carry washing from the house to the washing line down the garden. The participant remembers a time recently when her youngest daughter and her infant family were staying with them after their house had been inundated by flood water. The grandchild would ride in the basket with the wet washing turning the chore into a game between the two. As she retold the story she smiled and unconsciously rocked the basket back and forth gently as one might do with a pram with the child in it. Seemingly mundane
objects and activities become part of the family history. These social interactions are re-lived and re-played through using the object.

Objects that satisfy the need to be independent also satisfy an aversion to being dependent.

Table 1. **Theme of Independence**

<table>
<thead>
<tr>
<th>Objects of Independence:</th>
<th>Reason given:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suduko puzzle book</td>
<td>Reminds the participant that her brain functions well</td>
</tr>
<tr>
<td>Ikea foot stool</td>
<td>Enables him to change lightbulbs and get things down so he doesn’t have to ask his son to do it for him</td>
</tr>
<tr>
<td>Pocket sized screwdriver/toolset</td>
<td>Reminds him he can fix things</td>
</tr>
<tr>
<td>Computer</td>
<td>Enables her to learn about family health issues and escape from always being the primary carer;</td>
</tr>
<tr>
<td>Car</td>
<td>Enables him to live in the rural setting he likes</td>
</tr>
<tr>
<td>Car – for caravan</td>
<td>Permits them go on an adventure, also allows them time together without having to feel responsible for extended family</td>
</tr>
<tr>
<td>Scooters</td>
<td>Gives him mobility</td>
</tr>
<tr>
<td>HAC scheme magnet</td>
<td>Means someone will fix up the shower with safety rails so he doesn’t slip and fall. Furthermore they will do it without him having to ask for the assistance</td>
</tr>
<tr>
<td>Medication</td>
<td>Supports independent living but also promotes dependence on external factors for health</td>
</tr>
<tr>
<td>Veggie patch</td>
<td>Supports not being dependent on bought food, provides proof she is still physically able.</td>
</tr>
</tbody>
</table>
Objects of routine and comfort:

Some participants identified objects that supported their daily routines such as at mealtimes and making tea. In some instances within this theme, the object itself provides comfort whilst in others the objects enable the person to avoid discomfort. In other instances it is in the routine of the objects use that the comfort is found.

One conversation with a couple was held around the kitchen table. He had prepared the objects he wished to discuss next and they were 3 different coloured bowls. The participant said playfully, “Would it be known or unbeknownst to other people” (he nods at his partner) he uses “the yellow one for cereal, the green one for salad and the other one for hot food”. “Oh, well, now I know!” an admission from the partner of twenty years.

The use of the different coloured bowls is undoubtedly embedded in one member of the households daily routine yet it was interesting to discover that the little idiosyncrasies of daily habits and attachments to objects are not always known to family members, regardless of the length of time they had shared together.

<table>
<thead>
<tr>
<th>Objects of Routine and Comfort:</th>
<th>Reason given:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kettle</td>
<td>Enables him to have his preferred 2 cups of tea per day;</td>
</tr>
<tr>
<td>Shoe horn</td>
<td>Embedded in his daily routine and enables him to avoid physical discomfort when putting on his shoes</td>
</tr>
<tr>
<td>Favourite cup;</td>
<td>Embedded in his daily routine</td>
</tr>
<tr>
<td>Laundry basket on wheels</td>
<td>Supports routine acts of independent living</td>
</tr>
<tr>
<td>Wheelbarrow</td>
<td>Supports routine</td>
</tr>
<tr>
<td>Portable washing line</td>
<td>Supports routine and provides comfort in the knowledge that the clothes will be dry because it can be moved into the sun or out of the rain</td>
</tr>
<tr>
<td>Cyro food packer</td>
<td>Provides comfort in the knowledge that no food is wasted.</td>
</tr>
<tr>
<td>Reading chair</td>
<td>Comfort when reading daily news which is a habit</td>
</tr>
</tbody>
</table>

Table 2. Theme of Routine and Comfort
**Objects for creativity, relaxation and social interaction:**

A couple of participants freely expressed joy and enthusiasm as they explained what their chosen objects meant to them.

The stereo was not simply a device on which to play music but it physically (and musically) accompanied him during the speech he gave at his daughter’s wedding. Through the discussion the object was also identified as being key to facilitating dancing, laughter and social connection at family get-togethers.

The piano is mentioned by another participant; it “is important because it was the first thing I tried to do when I came out of hospital”. Once a creative outlet, the piano is currently instrumental in her rehabilitation program. It is not only exercise for her fingers but also for her brain that underwent surgery a couple of months earlier. However, the piano has always held the association with her being the pianist for her choir which had always been one of her main social events. She explained that it had not been easy to establish new friends when they first emigrated “until the piano reminded me I could always join another choir.”

In other situations it wasn’t the object itself but how it was positioned that promoted social interaction; conversation pieces like a ‘grey nomads’ camping book and collectors’ items were laid out on the coffee table and pictures or clocks were in view on the wall.

These objects connect people with others and to particular times in their lives.
Objects of tradition, status and prestige:

The car in this instance was more than just a method of getting around. The participant recalled a trip to Tasmania with the Mercedes Benz Club, only at that particular time he owned a Volvo. He laughed as he recalled that his car was “the only one on the ferry that wasn’t a Merc!” The emotional connection he has with the object extends much further than the object itself to an expression of pride and social standing. The underlying desire to belong was also apparent in comments made about his other significant objects.

During another interview it was pointed out that in the front sitting-room there was an old wash-stand which houses several old artefacts including cast iron keys and another cabinet that was visibly full of more. The reason they are described as “old” rather than “antique” is that the participant commented that he always loved antiques but could never afford them. This statement shows that for him the cultural distinction between the two categories is not just about time.

There is a tapestry on the wall – “handed on from a family member”, a cabinet “saved from the 74 floods” - the wood is warped by water and a door is missing. There is a lounge suite also salvaged from the ’74 floods that had been re-upholstered and a clock from WWII which is “missing the Eagle” and the connection that has with War on top. This participant also spoke of his watch that was made “the same year as the Eiffel Tower”.

Significant, “monumental” or life changing events are connected with the everyday objects within this home and these connections are kept alive by the owners. They expressed their fear that their stories might not be shared by the next generation of family that seemingly has no interest in holding on to such objects and the history they represent.
Chapter 4: Phase 1 Findings and Discussion

Objects of tradition, status and prestige:

<table>
<thead>
<tr>
<th>Item</th>
<th>Reason given</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tea-pots</td>
<td>Enabled the participant to perform her “afternoon tea” ritual. It was more than a routine habit however, it was a ritual steeped in tradition.</td>
</tr>
<tr>
<td>The house</td>
<td>It was not entirely clear whether this satisfied the need for tradition, status or prestige. It could easily have been all three.</td>
</tr>
<tr>
<td>Caravan brochure</td>
<td>Conversation piece on the coffee table which symbolises status; not just financial status but also their time of life.</td>
</tr>
<tr>
<td>iPod/iPad</td>
<td>Presented in the interview as status symbols</td>
</tr>
<tr>
<td>Collectors’ items/ trinkets/ garage sale items</td>
<td>These objects were more about the tradition of collecting rather than status symbols</td>
</tr>
</tbody>
</table>

Objects symbolizing relationships with loved ones:

On some occasions it was the words that weren’t spoken that indicated the depth of emotion associated with the objects. One man, who lived alone with very few belongings, selected two ornaments as being significant; a “Tiki” (a Polynesian and Maori wooden carving of humanoid form) and a “Toucan” bird.

The man described how they symbolize his daughter and granddaughter and as such he feels a connection to them through the objects in an emotionally safe, structured way. He indicated that he wants more contact with his daughter and is open to the possibility that through internet technologies the objects might allow him some form of connection with his daughter that may be asymmetric in nature. This indicates considerable scope and a framing for a personal and intimate design in relationships that may harbor both the desire for connection but also where guardedness about the connection exists due to the history of the relationship.
The definition of “significant” for the purpose of this study may have potentially biased the participants’ choice of object. As such there were lots of objects that symbolised relationships with loved ones. These objects serve to give material permanence to meaningful relationships. They also have the most reflective value giving the participant something to speak about in the interview. However, what it does indicate is that objects connect people with other people and their relationship is given permanence and substance through its material properties.

<table>
<thead>
<tr>
<th>Objects Symbolic of Meaningful Relations:</th>
<th>Table 4. <strong>Theme of Symbolic of Meaningful Relations</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Photographs</strong></td>
<td>Giving permanence to meaningful relations</td>
</tr>
<tr>
<td><strong>Coffee filter</strong></td>
<td>European in design like the one his mother used</td>
</tr>
<tr>
<td><strong>Grandfathers’ clock</strong></td>
<td>Handed down from his Grandfather.</td>
</tr>
<tr>
<td><strong>Cabinet salvaged from 1970’s floods</strong></td>
<td>Giving permanence to a significant event</td>
</tr>
<tr>
<td><strong>Antique chairs</strong></td>
<td>Handed down from an Uncle</td>
</tr>
<tr>
<td><strong>Clocks</strong></td>
<td>Handed down from family</td>
</tr>
<tr>
<td><strong>Old photos</strong></td>
<td>Handed down from family</td>
</tr>
<tr>
<td><strong>Family portrait</strong></td>
<td>Described by the Participant as being symbolic of his highest value</td>
</tr>
<tr>
<td><strong>Handed down lounge suit</strong></td>
<td>Handed down from mother</td>
</tr>
<tr>
<td><strong>60yr old hand down wheelbarrow</strong></td>
<td>Handed down from his father</td>
</tr>
<tr>
<td><strong>Mothers hand written letters from (1936)</strong></td>
<td>Giving permanence to meaningful relations</td>
</tr>
<tr>
<td><strong>Precious (sentimental) jewellery</strong></td>
<td>Connection to heritage</td>
</tr>
<tr>
<td><strong>Collectables</strong></td>
<td>Giving permanence to meaningful relations</td>
</tr>
<tr>
<td><strong>Pictures of the boat worked on</strong></td>
<td>Giving permanence to meaningful relations</td>
</tr>
<tr>
<td><strong>Sentimental painting on wall</strong></td>
<td>Giving permanence to meaningful relations</td>
</tr>
<tr>
<td><strong>Family history book/family tree</strong></td>
<td>Giving permanence to meaningful relations</td>
</tr>
<tr>
<td><strong>Old Rusty Locks</strong></td>
<td>“interesting pieces”</td>
</tr>
</tbody>
</table>
In some situations the stories shared didn’t obviously fall into a particular theme but were still nonetheless thought provoking. It would be remiss to not include them because they demonstrate how conducting interviews in this way can lead to a deeper insight into the relationships between the people in the house and the objects that dwell there.

An example where the connections to the past are kept open through the objects is the “Mothers lounge suite”. The “significant” sofa belonged to the participant’s mother who, reportedly, was really protective of the suite and wouldn’t let anyone sit on it. The participant laughed as she recalled that when her mother passed “everyone went onto the sofa!” The participant explains how she had “held on to the suite” so that “it could be used for what it was MEANT to be used for”. Yet during the interview we sit at a nearby dining table and never actually use the more comfortable chairs inferring that perhaps the habit of abiding by her mother’s rules is still upheld years later.

4.3.2 Objects Uphold Cultural Beliefs and Societal Conditioning

In each of the interviews stories and comments were shared about the different objects that offered insight into generational conditioning and inherited cultural values. Seemingly flippant throw-away comments made in relation to certain objects alluded to the way that objects keep active the person’s connection with the struggles at different times in their lives.

When talking about her car one participant explained that her “better” car is being used by her Son-in-law whilst his not-so-nice car is sitting stationary in her driveway. She commented “Someone may as well get the use of it” suggesting that it may not be such a waste to let the not-so-nice car sit un-used.

Whist another participant commented how the Cyrovac “appeals to my frugal soul”. Two comments that support the conditioning “waste not, want not” that is characteristic
of many from this generation who may have struggled with poverty and food shortages during the Second World War.

In other interview, the participant spoke of the health concerns he had struggled with which meant he didn’t “fit the norm” growing up. His ‘hand-made’ table is a reminder of the emotionally difficult time in his life when “they didn’t know what to do with me”. The table has been kept as a reminder of this time but is kept hidden away in a corner behind a chair.

During another interview the “Meds” which were also referred to as “bio-technology” were given the emotionally loaded responsibility of “keeping ‘Susie’ alive”. This participant spoke of several struggles and health related concerns during the interview.

While examples are given and quotes are used to indicate what objects meant to their owners, one might argue that objects mean different things at different times and that one cannot draw a strong conclusion from any one example or reflection. Two aspects of the research method work to mitigate against this concern. First, the context in which the interactions took place provided an added depth of knowledge. Secondly, the process of grounded theory works to gather themes that are expressed repeatedly in the data. We can therefore be confident that the kinds of attachment to objects expressed in the data are characteristic of those experienced by older people.

**Observation 7:**

Objects satisfy different emotional and physical needs. They are as equally able to support independence, comfort and routine as they are able to also support the avoidance of dependence, discomfort and chaos.
Objects hold the memories and stories that connect people to others and to personally significant events at particular moments in time. Stories like these offer insight into family history, aspirations, depth of relationships, cultural influences, societal conditioning and ultimately contribute to a better understanding of human behaviour.

4.3.3 Enhancing Objects and Social Relations with Technologies

There were a couple of situations where technology had added to the significance or permanence of the objects and facilitated the way social interaction happens. In one household, the computer was significant not because it was seen as a way of maintaining communication with friends and family overseas but because it houses the husband’s creative work. A professional photographer in his working life he has scanned all his negatives and his life’s work now sits on an endless slideshow over two computer screens.

The old photographs now are able to be viewed and enjoyed so much more freely than they ever would have been as negatives and prints stored in boxes in a cupboard or limited by the available wall space and a finite number of frames. The participant is visibly proud of his creative work and takes pleasure in someone showing an interest in it.

For another, technology has been adopted to support his physical activity. As a result of major mobility issues this participant has a number of electronic scooters (different sizes for different uses). During the interview the participant demonstrated how one particular scooter goes in and out of the car. The car is custom fitted with a remote control lift so that he can easily put his scooter in & out. It is a process that has been finely tuned that involves towels covering various spots to protect the boot of the much loved car. It is a very meticulous, time consuming, technology enabled procedure which
concurrently provides him with the freedom to live independently and autonomously in a rural suburb.

In another household the partners use technology to promote social interaction by sending links to articles that might be of interest to each other so that they might discuss them at a later (mutually convenient) time. They are retired and live in the same home but still inhabit two different spaces. Over the years they have worked out that the best way to communicate and share and show respect for each other’s time is through technology.

Another participant had worked as a cook on a ship for 2 ½ years. Two pictures of the ship hang on the walls indicate the significance of that time in her life. Whilst capable of doing so, she has not personally used technology to find a way to make the many photographs that she keeps easier to access or share. She mentions that she “just gave all the albums and photographs to the ‘Association’ and they turned it into a rolling DVD for the 20th Anniversary of the boat’s launch.”

Recognising that her family members might not share the same values, she has taken steps to hand on her things. “I figured I may as well give it to someone who’s interested. I’m 78 – you’ve got to start taking care of these things otherwise it’s just something else (for someone else) to get rid of. So I just gave them away.”

**Observation 8:**

Whilst some participants have seen the benefits of technology for facilitating their independent living and prolonging their memories it would seem that some objects are more easily augmented by technologies than others and some people are more inclined to seek out technological means than others.
Chapter 4: Phase 1 Findings and Discussion

4.4 DISCUSSION

In 2005, Blythe suggested the need for the development of systems that “take account of social context, the need for sociability and the principle of open access for all” and yet a significant issue lingers with many technologies developed by technologists with the intent of assisting older people; rather than being designed to enhance social connections and engage the older person, it has been designed to monitor their daily activities and react to situations of distress. The aim of this initial phase of the research was to provide contextual insight for new technology design through developing a deeper understanding of the existing socio-physical relations between older people and their significant objects.

In the process of conducting the interviews three participants expressed different concerns about interacting with technology. These related to concerns with control, physical ability and privacy. Whilst recent studies show that long-standing stereotypes of older people are being challenged in that they are more open to change and new technology (Rogers et al [2014], Robertson et al [2012]) and most of the participants in the study supported this stance, it was also found that concerns around the use of some technology still exist and legitimately so.

Contextual interviews conducted gave insight into the physical layout of the homes with respect to the way objects and their owners share the space and how they contribute to independent living.

Reinforcing the views of many including Leonardi et al [2009], Gaver [2006] and Norman [2002, 2004] it was found from a physical perspective, that a relationship exists between the physical space inhabited by the objects and their purpose, frequency of use and perceived value. That is, the more frequently an object is used the more accessible it is and often the more emotionally laden, the more protected.
4.4.1 Learn to see the social in objects:

It is undoubtedly possible to add interactive capabilities to many objects through the ‘Internet of Things’ and participants indicated they saw possibilities for networked objects to facilitate communication. However it is interesting to note that many of the objects highlighted as being significant had not previously been consciously linked to facilitating their social interactions or physical activity. Some of the participants initially found it difficult to “see” the object as being something that facilitated the social interactions in their life. Yet when asked about the object they would automatically relate stories that involved social relations with family.

Nevertheless, if you have not comprehended the ways in which the shoehorn, for example, facilitates your morning walk or your grandchildren’s role play then it might take time to conceive that it could also have the technical capability to communicate with another via the internet.

So whilst the desire for sociability is acknowledged (Blythe, 2005) if the IoT is to support ongoing connections one must first be able to “see” the social in everyday things and acknowledge the important role ‘the social’ plays in our daily lives. Even when the social aspects of objects are identified, they are often particular, idiosyncratic and arise from particular histories of use and encounter. How design can build on this is not straightforward, nonetheless, seeing the social in objects is a first step.

4.4.2 Mutually Constituted Relations:

Existing research has shown that objects facilitate daily habits and routines (D'Adderio; 2011); they not only serve as an extension of the self, give the illusion of power and give permanence to meaningful relations (Csikszentmihalyi; 1993) they also enable the fulfillment of at least three of the basic human needs for shelter, safety and connection (Maslow; 1943).
Chapter 4: Phase 1 Findings and Discussion

The initial findings from Phase 1 have certainly shown support for these points of view. The investigation found that whilst the majority of the objects expressed as being significant are not currently explicitly associated with communication (excepting mobiles, ipads etc.) many of them are routinely used in social interaction and others facilitate physical activity.

However, socio-physical relations are not limited to the ways in which objects facilitate social interaction and physical activity. During the process of finding out more about the objects deep emotion was revealed. People have strong emotional attachments to their things. They use objects in their routines and through their use, however mundane, they are wrapped into life-stories and become intertwined and connected in the intricacy of their owners’ lives.

The mutually constituted relationship between humans and objects has been demonstrated by theorists such as Latour (1999) and Suchman (2006). More recently, the work of Boehner et al (2007) presents the theory that the relationship between human emotion and social interaction/culture is also mutually constituted. Humans learn to recognise what they are feeling through expressing it and seeing how others react to it. Reactions are dependent on and therefore influenced by social setting and culture (eg Lutz; 1988).

This mutually constituted relationship assumes emotion to be defined as a product of social interaction and culture (Boehner et al; 2007, McCarthy et al; 2007). It is not based, as many in Affective Computing would assume, on emotion as a tameable, discrete physiologically measurable event.

This research has found that objects facilitate social interaction, they also satisfy emotional needs, foster emotional responses and uphold cultural and societal beliefs.
Based on this same understanding of emotion as a product of social interaction and culture, it is proposed that the relationship between objects and emotion is also mutually constituted. People invest emotional attachment in their objects and objects in return foster emotional responses in people.

The level of care shown by the participants as they physically interacted with the objects in some instances gave an indication of the fragility of the objects physical attributes. However, it also pointed to the underlying values the object upholds for the individual and the degree of emotion they have invested in it. This physical expression of the emotion was different to others who expressed their emotion through laughter or tears.

However it is expressed, it is the emotional attachment invested in the object that recreates the feeling of being connected to the person or the moment in time.

Using the example offered by Wensveen et al [2002] that a slap and a caress leave two very different physical traces on a face, one must also consider that the emotional impressions or ‘fingerprints’ would also be very different.

Whilst many have investigated how to digitally recreate the physical trace of an object, (Gaver; 2006) it is arguably more difficult to take account of all potential iterations of emotional fingerprints created over generations of interaction.

While reductive attempts to quantify emotion fall far short or fundamentally misconstrue how emotions are made and remade in context, understanding the way in which emotions become invested in objects may be key to learning how to design means of augmenting objects to support socialisation and emotional well-being.
Fundamentally, it has to be acknowledged that communication or connection is not simply the transfer of information. There is an emotional component that needs to be somehow factored into the design if we are to digitally support feelings of connectedness through networks of everyday objects.

The next phase set out to investigate ways in which this might happen.
Chapter 5: Phase 2 Findings and Discussion

During Phase 1 it was revealed that the relationship between older people and their significant objects is complex and emotional. Through their usefulness, aesthetics and reflective appeal, objects can support social interaction and physical activity, and as a result, enable older people to maintain their independence longer. (Vaisutis et al; 2014). The physical nature of objects can also give the illusion of power, serve as an extension of the self and give permanence to significant relationships (past and present) (Csikszentmihalyi; 1993). As a consequence objects fulfil particular emotional needs and foster different emotional responses in humans.

With this in mind, and an over-riding interest in informing the design of interconnected objects for the home that facilitate communication, the next phase aimed to explore ways of connecting objects to the internet and to explore how a specific emotional response might be incorporated into the initial design process.

5.1 UNDERSTANDING THE KEY ISSUES

This exploration of how older people might engage in the design of connected objects to support their emotions was seen to be an important first step in the process that would clarify our understanding of the issues that face older adults in maintaining social connections as they age.

Participants were split into smaller groups of three to encourage more intimate discussion. To start, they were asked to consider a particular relationship with a friend or family member whose company they really enjoy but for one reason or another are not in touch with on a regular basis. Participants were then asked to discuss the various reasons that inhibit their connection with this person.
The relationships that the participants mentioned and considered included friendships formed during their childhood/school days and family members living overseas. Those known to be suffering illness were also mentioned and whilst it wasn’t specifically indicated, a general assumption was made by the group that the method of connecting with the friend/relation would be via the telephone.

5.1.1 Maintaining connections is influenced by time, asymmetric communication preferences and daily habits

In addition to mentioning whom they would like to keep in touch with, various barriers and asymmetries were raised in discussion about the difficulty of keeping in touch. Key points identified as creating issues for maintaining connection included: timing, asymmetric communication preferences and “out of sight, out of mind”.

**Timing:**

Timing plays a significant role in determining whether or not one person gets in touch with another. Participants commented about being conscious of family members differing routines, particularly where grandchildren were involved. What might be convenient for them might not be convenient for another and they definitely didn’t want their attempts to connect with the other to be an inconvenience. This timing issue was equally relevant to maintaining relations across time zones as well as within the same city. They would think about making the call but are not sure of the others’ availability so would put it off and then get busy with something else. When they remembered later it was not “the right time”.

**Asymmetric communication preferences:**

Another perceived issue with maintaining connections is the differences in preferred methods of communication. One participant prefers to write emails because it is quicker and a more instant way to connect, but the friend in mind doesn’t have the internet; this
friend prefers to write and receive letters but the other feels her handwriting is difficult to read and getting to the post office involves more effort.

Another participant shared how she enjoys talking on the phone and would like to talk more but her friend only has a mobile so it is costly to talk for any length of time and acts as a deterrent. Another lamented the fact that she wanted to talk with her friend in the UK but since the friend had been hospitalized, getting in touch was practically impossible. The friend doesn’t have a mobile and there is no telephone access in the ward.

Two members of the group expressed annoyances with talking on the phone because of hearing difficulties; one shared how he had learned a way around this by using the phone on “speaker”.

Overall, it was very clear from the discussion that this particular group of older adults see the telephone as the main method for communicating with those outside their physical day to day activities, but that the telephone also has limits in enabling connection and communication.

**Out of sight out of mind:**

One participant put forward another reason for not maintaining social connections outside the physical day to day routine that came down to “out of sight, out of mind”. If the person is no longer physically involved in the participant’s daily routine then maintaining contact with them does not necessarily come to mind. A physical reminder is needed to keep the connection with that person alive. During the Phase 1 interviews, this participant had very few objects of significance; but the two he did mention were significant because they remind him of his daughter and grand-daughter. These objects fulfil the purpose of keeping the connection alive.
5.1.2 Making contact makes you feel good

Participants were then asked to recall the last time they were in touch with a person that they had mentioned and how it had made them feel when they re-connected with them. Without exception they agreed it made them feel good and that they should do it more often. One confesses to talking for over 2 hours to her friend and the participant that prefers to send emails admits that she gets a “real thrill” when she gets her friend’s letters. They are usually very long and about 4 times a year and she “reads and re-reads them and visualizes where her friend might be and what she is doing now”. There was definite support through their expressions, laughter and body language that making connections with old friends and family has a positive effect on their disposition.

Emotion emerged as such a prominent theme in the findings from Phase 1 there was also interest in considering how a specific emotional response might be assimilated into the design of the augmented object.

5.2 CREATING TANGIBLE CONNECTIONS

Whilst focussing on one particular type of relationship, that is, one that fulfils the desired emotion of feeling “connected” they were then asked to create a tangible representation of this feeling with the craft items made available. The available craft items and the time provided posed some limitations on what they were able to create however there was an enthusiastic effort to create something.

5.2.1 Inspiration is drawn from past experiences and existing relationships:

Whether it was a conscious decision to do so or not, all drew on past experiences and existing relationships for inspiration.
One participant from Phase 1 had selected his car as one of his significant objects. During his life, the car had represented social standing and belonging to a particular group of car lovers. His material representation was a car made from “connected” pipe-cleaners.

![Image of a pipe-cleaner car](image-url)

**Figure 10.** Examples of Tangible representations of a particular emotion: A pipe-cleaner car and a smiley face

Another participant from Phase 1 had selected photographs as one of her significant objects. Her material representation of feeling connected is a smiling face.

Another announced “My grandson loves those lady bugs – that puts a smile on my face” and selected a lady bird sticker and a love heart balloon with a flower to go with it.

Another participant connected with the words “Party”, “Cake” and “Ice-cream” and added a blue feather to her artwork. Another participant created a drawing of a red balloon and wrote the words “Happiness is a red balloon”.

![Image of a lady bird sticker, heart balloon, and flower](image-url)

**Figure 11.** More Examples of Tangible representations of a particular emotion: Picture of a lady-bug, a heart balloon and a flower; The words “Party”, “Cake” and “Ice-cream”; “Happiness is a red balloon”;
Chapter 5: Phase 2 Findings and Discussion

Other individual creations included a “windmill in a paddock on a sunny day”, a drawing of a multi-coloured explosion of love hearts and a flower.

![Windmill](image1)
![Explosion](image2)
![Flower](image3)

**Figure 12.** A “windmill in a field on a sunny day”; “An explosion of love hearts” and a “flower”

5.3 AUGMENTING EVERYDAY OBJECTS

Having built the physical representations of the feeling they associate with being connected with loved ones the interest moved to exploring how they might use their creations to make meaningful “Smart Objects” with a selection of objects from Phase 1 and “Little Bit” Kits.

“Little Bit” Kits claim to “put the power of electronics into the hands of everyone” ([http://littlebits.cc/intro](http://littlebits.cc/intro)).

Essentially through a series of components which click together with magnets and a bit of imagination any object can be transformed into an internet-connected device.

![Little Bit Kit](image4)

**Figure 13.** The “Little Bit Kit” on display and in action.
The group were given a brief explanation of each of the components in terms of:

- What they do; pink for control, blue for power, green for output and
- How they work; click them together in the correct sequence and they connect. If you try to connect the wrong sequence then the magnets repel.

In addition, the group was given a brief explanation why one might want to give an object these capabilities and offered a couple of examples (like a rotating flower on a hair clip) to illustrate what others had created previously. The kits were then handed to the groups to play with.

The objects used in the workshop were not actual objects belonging to the participants but objects of the same type as those highlighted in Phase 1 so the objects were unknown to the participants. There were two reasons for this:

1. It was not the intention for participants to feel like they were participating in a “show and tell” scenario; and
2. We did not want any existing emotional attachment to the object to be interfered with in the workshop situation.

### 5.3.1 Enthusiasm and Willingness to Create Connections

Participants took a few minutes to read the boxes and familiarize themselves with the different “bits”. Initially they wanted to work it all out on their own rather than work together in their groups. However, once one had succeeded in making the connection work they were willing to help others in their group and worked together to play with the order to enable the fan to work, the buzzer to sound or the LED lights to flash. The room was a hive of activity and there was lots of noise for a period of time where they all got involved and played away happily.
One participant succeeded in getting a buzzer to sound when the sensor was activated however he could not see how he might add his material “feeling” into the sequence. Another in this group created a connection and then personalized it with her “feeling” however, it was a very similar outcome to the rotating flower hair clip example that had been given when the kits were first introduced.

Overall, the participants were very involved in trying to master what was in front of them. None had any previous experience with electronics and the whole concept was new to them all. Despite these facts, there was no resistance to trying the new technology.

In fact, they were so consumed in mastering the task before them that when asked, they found it difficult to immediately think of how they might use the kits in their own homes with their own objects. They could see the benefit in having alternative ways of connecting/communicating with loved ones however couldn’t immediately see how it might work in their own homes. Once a couple of examples like the “messaging kettle” [Brereton et al.; 2015]; or an “ambient tea-cup” [Chung; 2009] were offered, they were able to again grasp the vision.

Unfortunately, time constraints of the participants placed limitations on exploring their visions further.
5.3.2 Emotional attachment to an object cannot be replicated by simply joining together two tangible entities

Whilst an aim of this phase of the research is to explore ways of connecting objects to the internet there was also interest in exploring ways that a desired emotional response could be factored into the initial design phase. It was clear from observing the participants during the workshop that an emotional attachment to some ’thing’ is simply not that literal.

That is, creating the desired emotional response in the initial design is not as simple as physically adding a tangible representation of it onto an object. Both object and emotional response are encountered in contexts and ways of recreating the response and the desirability of doing so are not straightforward.

There was amusement and creativity in crafting the tangible representation of their desired emotion and there was eagerness and inventiveness in making connections using the “Little Bit” Kits however, a connection with the two tangible entities and the unknown object was not accomplished in the time available and setting of the workshop.

An emotional response might occur instantaneously but the emotional attachment has grown and developed through interaction and over time.

The tangible representations of the desired emotion were as distinct as the life experiences that had inspired their creation and were as idiosyncratic as the stories that created the objects significance in the first place.
5.4 DISCUSSION

An application of the research is to give added insight to the design of technology that supports older adults to age in place. Known to be susceptible to social isolation and vulnerable to the onset of mental health issues, the key interest in this phase of the research is investigating ways that older adults might be encouraged to engage with friends and family through networks of significant objects and the ‘Internet of Things’.

Knowing that people age better in their own homes and an overall sense of connectedness is an important factor in ageing well (Buys, L., et al; 2005, Windsor, T., et al; 2012) Phase 1 of the research set out to develop a more detailed understanding of the socio-material relations between older people and their significant objects where ‘significant’ is termed as being really useful, provides pleasure in some way or has sentimental value.

Phase 2 of the research subsequently explores avenues of augmenting familiar objects already in habitual domestic use by providing the older person the opportunity to actively participate in the design of the new technology.

This section discusses key aspects of the research findings presented earlier in this chapter.

5.4.1 Physical Reminders

During Phase 2 workshop participants discussed the issues they face when trying to stay connected to friends and family. Three main concerns were highlighted; time, asymmetric communication preferences and the idea that if the person is ‘out of sight’, they can be ‘out of mind’ unless a physical reminder exists to keep the connection open.

The idea of being ‘out of sight, out of mind’ or conversely not being ‘out of sight’ and
therefore not ‘out of mind’ also featured in the selection of their significant objects. It was found that whilst some objects had not been used for years, most of the objects termed as significant were in frequent use. The physical reminders needed to keep the lines of communication open also fulfil the role, as Csikszentmihalyi (1993) suggests, of giving permanence to meaningful relations through keeping the emotional connection alive.

It is acknowledged that it is possible that the object was selected by the participant on the merit of it being in frequent use. In being used frequently the person would see the object habitually and as a consequence it would be at the forefront of their minds when asked to consider objects that are significant to them.

However it is also possible that their selection was based on an underlying belief that the properties of usefulness are favoured over aesthetics, at least for this group of older people. To reiterate an earlier point; how a particular object is perceived is influenced by the previous (social) experience one has had with it and the experience in the ‘here and now’ is influenced by the circumstances or the social norms that are present (Dourish; 2001).

In his 2014 OzCHI keynote speech, Pelle Ehn calls for “Social Integration and Policy Making research that is open to possibilities rather than being fixed.” An interpretation of this could be an acknowledgement of the viewpoint “You cannot solve the problem with the same thinking that created it” that is commonly attributed to Einstein. That is, to only consider that which is definable or measurable is to needlessly limit the possibilities.

This again highlights the fact that technology design is not just about defining a task and seeking ways to solve it. It stresses the importance of having an ongoing and developing understanding of the social and cultural context in technology design.
Chapter 5:  Phase 2 Findings and Discussion

Given that there is more success with new technologies that have been made to fit into the existing environment (Heyer & Brereton 2008) it would seem logical to augment objects that are seen and used habitually. But since one aim of the research is to determine whether sustained interpersonal engagement can be supported through augmenting everyday objects with ICT capabilities somehow, the existing socio-physical relationship must also be factored into the equation. As Lotteridge (2009), Meuller et al (2005) for example have explored, a ‘sense’ of the other person must also be conveyed if the communication is to be more than just information passing.

When asked to remember how it felt to be in touch with these friends/family, without exception they said it made them feel good and they didn’t know why they didn’t do it more often. Based on this unanimously positive response from the participants there was definitely support to find ways to make this easier for them to do. Furthermore, there was definite enthusiasm towards being involved in the process.

5.4.2  Inspiration is drawn from past experiences and existing relationships

When asked to create a material representation of what a specific emotion symbolized for them, participants all drew on past experiences and existing relationships for inspiration.

This finding was similar to that found in the MaKey MaKey project (Rogers; 2014) where participants drew on past experiences and existing relationships to come up with ideas for other uses of the kits. Participants initially found it difficult to see how the augmented object might fit into their own homes. Once they had been given a couple of examples they were then able to make suggestions and project uses onto other objects.

5.4.3  Creating emotional attachment takes time and social and physical interaction

If a particular object already holds an emotional connection to another individual it
is possible to conceive that enhancing this connection with ICT may strengthen their relationship further. However, it was found that creating an emotional connection with an object was not as simple as physically attaching the tangible representation of that emotion to an unfamiliar object. Objects symbolise interactions with friends and family and specific periods in time. The unfamiliar objects in the workshop, despite being the same type of object selected by the participants as being significant, were almost alien to the participants and consequently didn’t feature when the were making their connections with the kits.

All of the participants were determined to master the “Little Bit” Kits and played with the components in collaboration with each other but due to various limitations were unable to fully explore how they might create their own “Smart Object” personalized with their crafted emotion.

Whilst it was found that creating an emotional connection with an object was not as simple as physically attaching the tangible representation of that emotion to an unfamiliar object, many of the significant objects in their homes were wrapped in emotion and this attachment has grown and developed over time through repeated interaction.

“What we feel is not simply a pre-existing fact, but something that develops over the course of conversations and interactions with one another” Boehner et al (2007).

5.4.4 An acknowledgement of needs not limitations

Time plays a significant role in the lives of older people. Older people comment about other people’s time or lack thereof, how their family’s routines vary from theirs and they are very conscious of the fact that they need time when learning new things.
In the Phase 2 workshop more time was needed for participants to feel that they had grasped how the “Little Bits” worked. Their preoccupation with trying to master the technology completely overshadowed their earlier enthusiasm with creating their personalised meaningful objects. Participants got caught up trying to work out how to connect the “Little Bit” kits and needed some guidance to visualise how their newly created personalised “smart” object might fit into the context of their own homes.

This emphasized the fact that the amount of time required to fully understand all of the components and how they come together should not be underestimated and highlighted the need for ongoing interaction and conversations about potential solutions.

In summary, each phase of the research produced insight into older people, their relationship with their significant objects and their willingness to connect in novel ways highlighting the importance of having a diverse approach when researching objects and social relations from a human perspective.

A framework that addresses considerations for the design of ICT enabled objects that support ongoing communication and a sense of connectedness in older adults must incorporate:

- Learning to see the social in everyday objects
- Recognition of the mutuality between objects and emotion; that the physical trace and the emotional footprint of an interaction are equally significant but potentially very different and that creating the emotional attachment is not as simple as physically adding a tangible representation of the emotion onto an augmented object.
- Opportunities to draw inspiration from and build on existing uses of objects and existing relationships in order to project onto other ideas and new uses.
- Opportunities to spend more time listening to users’ needs allowing them more
time to learn, play and tinker.

Reflecting upon the workshop, from the perspective of enhancing communication and connection with older people, the findings have identified that older people are enthusiastic to participate in the development of technology that:

- Bridges different communication preferences;
- Is simple and convenient to use and remains front of mind as part of their existing daily routine;
- Is not time specific;
- Caters for concerns relating to changing physical ability, control, and privacy.

Ultimately, more time and research is needed to ascertain whether an existing relationship was strengthened through enhancing a known object with ICT capabilities or whether the enhancement actually interferes with it however, further investigation was regrettably beyond the scope of the Masters thesis research.
Chapter 6: Conclusions

This study was conducted with the objective of increasing what is known about the role of social and tangible technologies in supporting ongoing social interaction, habits and independence in older people.

Initial interviews were conducted on a one to one basis within the context of the older persons’ home. Interviews explored existing relationships between the person and the object and how socialisation is currently facilitated within the existing context.

The second step involved a design workshop and explored ways to create “Smart” objects through integrating a personalised, physical representation of the emotion associated with ‘feeling connected’ with “Little Bit” kits.

Corroborating the views of others in the field, (eg Dourish; 2001; Suchman, 2001) the findings have shown that objects satisfy specific emotional needs and they also uphold cultural beliefs and societal conditioning. The findings also reinforce the views that objects facilitate daily habits and routines (D’Adderio; 2011); they not only serve as an extension of the self, give the illusion of power and give permanence to meaningful relations (Csikszentmahalyi; 1993) they also enable the fulfilment of at least three of the basic human needs for shelter, safety and connection (Maslow; 1943).

Based on the existing knowledge that the relationship between humans and objects is mutually constituted (Latour; 1999, Suchman; 2006) and that the relationship between human emotion and culture/social interaction is mutually constituted (Boehner; 2007) this research found that the relationship between objects and emotion is also mutually constituted. Humans invest emotional attachment to objects and objects foster emotional reactions in humans.
Emotion featured very strongly as a recurring theme in the Phase 1 contextual interviews highlighting its importance in socio-material interactions. Having an understanding around the ways in which emotion becomes invested in the object in the first instance may help to determine if, how and which emotional responses can be supported through networks of everyday things.

There was evidence that this group of older people saw the benefit in having alternative ways to maintain their connections. In four situations participants have already augmented their significant objects and/or daily communication habits with technology. However, it would seem that some objects are more easily augmented than others and some people are more likely to seek technological solutions than others.

The development of the ‘Internet of Things’ from a human perspective has to acknowledge that communication or connection is not simply the transfer of discrete information. It will involve learning, as an important first step, to see the ‘social’ in objects. The mutually constituted relationship between emotion and objects needs to be acknowledged and consideration should be given to the fact that objects not only have a physical trace but an emotional fingerprint also.

As with the MaKey MaKey workshops (Rogers; 2014) this research found that inspiration for creativity is drawn from past experiences and existing relationships. Other uses for the new technology are then projected onto other known experiences and relationships. It was also found that communication and connection is facilitated when the technology bridges different communication preferences; is simple and convenient to use and remains “front of mind” as part of their existing daily routine; is not time specific and caters for concerns relating to changing physical ability, control, and privacy.
The overall process will involve spending time building (and playing) with new kinds of objects in order to understand their capabilities, how they fit together and the consequences of their connection in terms of functionality, privacy and ease of use.

6.1 Future Research:

The question remains, can the ‘Internet of Things’ help to strengthen the social ties and communication between older people and their loved ones? It certainly has the potential to change the way we communicate through the design of tangible technology that provides a simple and unobtrusive way of connecting with loved ones. However, a number of gaps still exist between the way we think now and the understanding required for the ‘Internet of Things’ and it is clear that it is going to take ongoing research to determine a definitive set of criteria.

As a starting point for future research, there would be benefit in exploring how a sense of connectedness might be strengthened through conducting a trial where one specific type of object that is in habitual use is augmented with ICT capabilities and use those findings to inform the design of others.
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Appendices

Appendix A: Phase 1 Participant Consent Form

<table>
<thead>
<tr>
<th>RESEARCH TEAM</th>
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<tr>
<td>Principal Researcher: Kathleen Vaisutis Masters IT (Research) Student, Queensland University of Technology (QUT)</td>
</tr>
<tr>
<td>Associate Researchers: Prof M Brereton (Supervisor) and Prof L Buys (Associate Supervisor) QUT Prof T Roberston University of Technology, Sydney (UTS) Prof F Vetere University of Melbourne (UniMelb)</td>
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<table>
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<th>DESCRIPTION</th>
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<tr>
<td>This project is being undertaken as part of a Masters project for Kate Vaisutis.</td>
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The purpose of this project is to explore how particular objects facilitate your daily routines, what they mean to you and whether or not they contribute to your overall sense of belonging. Having ascertained the objects in use, we will then get together with other participants to discuss ways in which these objects can be enhanced by technology so that they are able to promote opportunities for on-going social interaction.

You are invited to participate in this project because you have expressed an interest in being involved and you satisfy the research criteria of being over 65 years old and living independently.

<table>
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<tr>
<th>PARTICIPATION</th>
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<tr>
<td>Your participation will involve an audio / video recorded interview at your home that will take approximately 40 minutes of your time. The types of questions that will arise out of our conversation about your significant objects will include:</td>
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<tr>
<td>- Which objects do you consider play a significant role in your daily routine?</td>
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<td>- What is the object?</td>
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<td>- Where does it “live” in your home?</td>
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<tr>
<td>- What purpose does it serve?</td>
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<td>- How does it make things easier for you?</td>
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<td>- Does it have any sentimental value?</td>
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<td>- Is its use associated with connecting with others?</td>
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Your participation in this project is entirely voluntary. If you do agree to participate you can withdraw from the project without comment or penalty. If you withdraw, on request any identifiable information already obtained from you will be destroyed. Your decision to participate or not participate will in no way impact upon your current or future relationship with QUT.

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<th>EXPECTED BENEFITS</th>
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<tr>
<td>It is expected that this project will not benefit you directly. However, it may benefit the wider population of older people.</td>
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To recognise your contribution should you choose to participate, the research team is offering the opportunity to trial the prototype of the technology you have helped design.

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<th>RISKS</th>
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<tr>
<td>There are no risks beyond normal day-to-day living associated with your participation in this project.</td>
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<th>PRIVACY AND CONFIDENTIALITY</th>
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<tr>
<td>All comments and responses will be treated confidentially unless required by law. The names of individual persons are not required in any of the responses.</td>
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</table>
The project involves audio/video recording and these recordings will be destroyed after a period of 5 years from publication date. The faces and speech of all video participants will be included in the video. QUT understands that video participants may not wish to be named in this video. As a result, the names of all video participants will be excluded from this video. The video recording will be used by the researchers listed on this form for the purposes of this project including any publications or conference proceedings that arise from the findings of the research.

Photographs will be used in the Principal Researchers Thesis as well as in academic publications and conference proceedings where accepted.

Furthermore, non-identifiable data collected in this project may be used as comparative data in future projects or stored on an open access database for secondary analysis.

The project is funded by ARC Discover Grant however they will not have access to the data obtained during the project.

**CONSENT TO PARTICIPATE**
We would like to ask you to sign a written consent form (enclosed) to confirm your agreement to participate.

**QUESTIONS / FURTHER INFORMATION ABOUT THE PROJECT**
If have any questions or require further information please contact one of the research team members below.

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**CONCERNS / COMPLAINTS REGARDING THE CONDUCT OF THE PROJECT**
QUT is committed to research integrity and the ethical conduct of research projects. However, if you do have any concerns or complaints about the ethical conduct of the project you may contact the QUT Research Ethics Unit on 07 3138 5123 or email ethicscontact@qut.edu.au. The QUT Research Ethics Unit is not connected with the research project and can facilitate a resolution to your concern in an impartial manner.

*Thank you for helping with this research project. Please keep this sheet for your information.*
CONSENT FORM FOR QUT RESEARCH PROJECT
– Phase 1: One on One Interview In residence of Participant –

Understanding the roles of objects and technology in maintaining social interaction for older people

QUT Ethics Approval Number 1300000436

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STATEMENT OF CONSENT
By signing below, you are indicating that you:

• Have read and understood the information document regarding this project.
• Have had any questions answered to your satisfaction.
• Understand that if you have any additional questions you can contact the research team.
• Understand that you are free to withdraw at any time, without comment or penalty.
• Understand that you can contact the Research Ethics Unit on 07 3138 5123 or email ethicscontact@qut.edu.au if you have concerns about the ethical conduct of the project.
• Understand that the project will include an audio and video recording and photographic images
• Understand that non-identifiable data collected in this project may be used as comparative data in future projects.
• Agree to participate in the project.

Please tick the relevant box below:

☐ I agree for the interview to be audio / video recorded.
☐ I do not agree for the interview to be audio / video recorded.

☐ I agree for photographic images of me to be used in academic publication or conference proceedings relating to this project.
☐ I do not agree for photographic images of me to be used in academic publication or conference proceedings relating to this project.

Name

Signature

Date

MEDIA RELEASE PROMOTIONS
From time to time, we may like to promote our research to the general public through, for example, newspaper articles. Would you be willing to be contacted by QUT Media and Communications for possible inclusion in such stories? By ticking this box, it only means you are choosing to be contacted – you can still decide at the time not to be involved in any promotions.

☐ Yes, you may contact me about inclusion in promotions.
☐ No, I do not wish to be contacted about inclusion in promotions.

Please return this sheet to the investigator.
PARTICIPANT INFORMATION FOR QUT RESEARCH PROJECT
– Phase 2 (Focus group): Objects, technology & Social Interaction –

Understanding the roles of objects and technology in maintaining social interaction for older people

QUT Ethics Approval Number 1300000436

RESEARCH TEAM
Principal Researcher: Kathleen Vaisutis Masters IT (Research) Student, Queensland University of Technology (QUT)
Associate Researchers: Prof M Brereton (Supervisor) and Prof L Buys (Associate Supervisor) QUT
Prof T Roberston University of Technology, Sydney (UTS)
Prof F Vetere University of Melbourne (UniMelb)

DESCRIPTION
This project is being undertaken as part of Masters Study for Kate Vaisutis.

The purpose of this phase of the research project is to discuss the objects from the initial interviews with the other participants and to explore how technology can be designed so that it supports opportunities for on-going social interaction through the use of these objects.

You are invited to participate in this project because you are over 65 and are living an independent lifestyle and participated in the phase 1 of this project.

PARTICIPATION
Your participation will involve an audio recorded / video recorded focus group at Kenmore Library Meeting rooms or other agreed location that will take approximately 60mins of your time. The conversation will develop around:

A discussion about the objects you each considered to be significant & why; whether or not their placement within the home added to the objects significance and how could technology be used to support your independent lifestyles further.

Your participation in this project is entirely voluntary. If you do agree to participate you can withdraw from the project without comment or penalty. Your decision to participate or not participate will in no way impact upon your current or future relationship with QUT.

EXPECTED BENEFITS
It is expected that this project will not benefit you directly. However, it may benefit the wider population of older people.

To recognise your contribution should you choose to participate the research team is offering the opportunity to trial the prototype of the technology you have helped design.

RISKS
There are no risks beyond normal day-to-day living associated with your participation in this project.

PRIVACY AND CONFIDENTIALITY
All comments and responses will be treated confidentially unless required by law. The names of individual persons are not required in any of the responses.

The project involves audio/video recording and these recordings will be destroyed after a period of 5 years from publication date.

The faces and speech of all video participants will be included in the video. QUT understands that video participants may not wish to be named in this video. As a result, the names of all video participants will be excluded from this video.

Appendix B: Phase 2 Participant Consent Form
The video recording will be used by the researchers listed on this form for the purposes of this project including any publications or conference proceedings that arise from the findings of the research. Photographs will be used in the Principal Researchers Thesis as well as in academic publications and conference proceedings where accepted.

Furthermore, non-identifiable data collected in this project may be used as comparative data in future projects or stored on an open access database for secondary analysis.

The project is funded by ARC Discover Grant and they will not have access to the data obtained during the project.

CONSENT TO PARTICIPATE
We would like to ask you to sign a written consent form (enclosed) to confirm your agreement to participate.

QUESTIONS / FURTHER INFORMATION ABOUT THE PROJECT
If have any questions or require further information please contact one of the research team members below.

Kate Vaisutis
School of Human Computer Interaction – Science and Engineering Faculty
0419 296 991
kathleen.vaisutis@student.qut.edu.au

Prof M Brereton
07 3138 8365
m.brereton@qut.edu.au

Prof L Buys
07 3138 1146
l.buys@qut.edu.au

Prof T Robertson
Interaction Design, School of Software
Engineering & Information Technology, UTS
02 9514 1966

Assoc Prof F Vetere, Deputy Head (Research)
Computing and Information Systems
UniMelb
03 8344 1496

CONCERNS / COMPLAINTS REGARDING THE CONDUCT OF THE PROJECT
QUT is committed to research integrity and the ethical conduct of research projects. However, if you do have any concerns or complaints about the ethical conduct of the project you may contact the QUT Research Ethics Unit on 07 3138 5123 or email ethicscontact@qut.edu.au. The QUT Research Ethics Unit is not connected with the research project and can facilitate a resolution to your concern in an impartial manner.

Thank you for helping with this research project. Please keep this sheet for your information.
CONSENT FORM FOR QUT RESEARCH PROJECT
– Phase 2 (Focus group): Objects, technology & Social Interaction –

Understanding the roles of objects and technology in maintaining social interaction for older people

QUT Ethics Approval Number 1300000436

RESEARCH TEAM CONTACTS
Kate Vaisutis
School of Human Computer Interaction – Science and Engineering Faculty
0419 296 991
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Prof M Brereton
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Prof L Buys
07 3138 1146
l.buys@qut.edu.au

Prof T Robertson
Interaction Design, School of Software Engineering & Information Technology, UTS
02 9514 1966

Assoc Prof F Vetere, Deputy Head (Research)
Computing and Information Systems
03 8344 1496

STATEMENT OF CONSENT

By signing below, you are indicating that you:

• Have read and understood the information document regarding this project.
• Have had any questions answered to your satisfaction.
• Understand that if you have any additional questions you can contact the research team.
• Understand that you are free to withdraw at any time, without comment or penalty.
• Understand that you can contact the Research Ethics Unit on 07 3138 5123 or email ethicscontact@qut.edu.au if you have concerns about the ethical conduct of the project.
• Understand that the project will include an audio and/or video recording and photographs
• Understand that non-identifiable data collected in this project may be used as comparative data in future projects.
• Agree to participate in the project.

Please tick the relevant box below:

☐ I agree for the focus group to be audio / video recorded.
☐ I do not agree for the focus group to be audio / video recorded.

☐ I agree for photographic images of me to be used in academic publication or conference proceedings relating to this project.
☐ I do not agree for photographic images of me to be used in academic publication or conference proceedings relating to this project.

Name ...........................................................................................................................................................................

Signature ........................................................................................................................................................................

Date ...........................................................................................................................................................................

MEDIA RELEASE PROMOTIONS

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☐ Yes, you may contact me about inclusion in promotions.
☐ No, I do not wish to be contacted about inclusion in promotions.

Please return this sheet to the investigator.
Appendix C: Participant Withdrawal Consent Form

Understanding the roles of objects and technology in maintaining social interaction for older people

QUT Ethics Approval Number 1300000436

RESEARCH TEAM CONTACTS
Kate Vaisutis 0419 296 991
kathleen.vaisutis@student.qut.edu.au

Prof M Brereton 07 3138 8365
m.brereton@qut.edu.au

Prof L Buys 07 3138 1146
l.buys@qut.edu.au

I hereby wish to WITHDRAW my consent to participate in the research project named above.
I understand that this withdrawal WILL NOT jeopardise my relationship with Queensland University of Technology.

Name ____________________________________________________________

Signature _________________________________________________________

Date ___________________________________________________________
Appendix D: Objects Interview Questions

Examining The Physical (Past & Present):

- Can you describe what it is? What does it do? Is it singular or multi-functional?
- Has it always done this or have you re-appropriated it? How long have you had it? When was the last time you used it? Why is it significant? What purpose does it serve? (eg emotional, aesthetic, practical, memorabilia, power, identity?)
- Where does it normally “live”? Is it fixed or portable? Is its positioning significant in any way?
- Does it promote social interaction in any way? (eg a cup enables us to drink tea or coffee & that activity is often connected with talking or socialising with someone)

Invisible Connections of Emotional Attachment: (Past, Present, Future)

- Are you the only person who uses it or is it shared? Does it or did it belong to anyone in particular?
- What does it mean to you? How or why is it valuable? Where did you get it?
- Do you associate it with anyone or anything in particular? Does having the object influence, improve or impact your relationships in any way?
- Why do you keep it? Will you always?

Emotional fulfilment through objects: (Past, Present, Future)

- Do you associate any kind of routine with the use of this object?
- Are you aware of feeling a particular way before you use it or whilst you are using it? Are you conscious of any emotions or thoughts that arise after you have used it? (eg the coffee machine might have a particular “routine” associated with it)
- How would you feel if it broke or if something happened to it? (eg in floods)
- How would you feel if it could be enhanced or augmented with new technology that promoted social interaction?
Examining the SocioPhysical:

- Do any of the objects support you in your physical activities?
- Are there any that link you to people or that are related to social activities and hobbies?
- Do any of these objects inspire your creativity?
- Are there any that actually inhibit your social communication or physical activities?

Keeping the connections open:

- Who do you ‘check in’ or keep in touch with?
- Do you prefer to use email/phone/skype? Or do you prefer getting together face to face?
- How do you keep in touch with distant relatives & friends? What about overseas relatives/friends where there is a time difference?
Appendix E: Phase 2 – Workshop outline

**WORKSHOP 2 – IDEAS & RUN SHEET:**

Introduction & Objective: (5 mins – KV)

Explain format & aim of the workshop. Provide participants with a summary of the types of objects that were highlighted in the first round of interviews and offer some background information about the ‘Internet of Things’.

**Workshop Format in Summary:**

Form groups of 3:

**Introductions within the groups to relax and acquaint everyone:** (3 mins)
Say name, favourite hobby/past-time and a unique talent or skill that not many people know about you.

**Discussion in groups of 3: Existing practices (10 min) – clarifying the problem**
Think about a friend or family member that you know is still alive whom you enjoy being in touch with but don't get to do it very often.

- What inhibits your being in touch with each other?
- Think of the last time you were in touch with them. What worked?
- What factors facilitate the feeling of connected-ness with this person?

**Tangible representation of the emotion:** (10 mins KV)
- What does “feeling connected” look/feel/sound/smell like?
- What image/sound/sensual stimulus never fails to put a smile on your face or lift your spirits?
Individually create a sketch or craft a version of it. That is, create a tangible or material representation of what that feeling is for you.

**Introduce Kits with brief demonstration:** (5 mins RH)

‘Internet of Things’ in action: (10mins)
Within the groups select an object & create a "connection" piece/object with the use of items from the kit & their personalised representation of the feeling.

**Discussion & morning tea:** (15 mins)

**Conclusion and thanks**