Ageing Technologically: Exploring the Motivating Operations of Technology Use by Older Adults

WILSON, CAROLYN,LOUISE

AGEING TECHNOLOGICALLY

Exploring the Motivating Operations of Technology Use by Older Adults

Carolyn Louise Wilson

Doctor of Philosophy in

Economics, Finance and Business

DURHAM UNIVERSITY

January 2014

ABSTRACT

Statistics from the 2011 UK Census revealed that one sixth of the population were over the age of 65, which is the highest recorded ratio in any census history. Although there are discrepancies in the physical, mental and social wellbeing of the older adult population, huge strains have been placed upon the National Health Service, care system and subject population. Previous scholarship has revealed that technology use in various formats can reduce these pressures, however, published work on older adults and technology often focusses on attitudes and intentions rather than motivations of actual use.

This thesis addresses this gap in the literature by examining the Motivating Operations (MOs) on post-purchase technology use of older adults. By adopting a radical behaviourist perspective, the present research attempts to introduce the Applied Behaviour Analysis (ABA) term, Motivating Operation, to consumer behaviour by incorporating the proposed MOs into the already established Behavioural Perspective Model (BPM). This approach encourages the measurement of actual technology use as an operant behaviour alongside the MOs, as independent variables, impacting upon the rate-of-response. Consequently, a longitudinal quantitative and qualitative empirical strategy has been devised to produce a rich and complex set of data to explain older adult technology use.

Overall, by using principles of behaviourism to interpret the technology use of older adults within a post-purchase environment, this thesis intends to break the dominant trend within technology acceptance and adoption literature of relying on either the Technology Acceptance Model (TAM) or Diffusion of Innovation (DIT) to explain behaviours related to technology use. Alternatively, it produces an imaginative but logical analysis of the subject behaviour, which is not in contention with previous models but intends to enhance and expand the consumer behaviour, technology acceptance and adoption literature.

Key words: Older Adults, Technology, Motivating Operations, Radical Behaviourism, Consumer Behaviour.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

My first acknowledgement goes to my supervisor, Dr. Mike Nicholson, for all the support he has given me throughout my Masters and Doctoral research. Not only has he encouraged me to reach my academic potential but he has provided me with a further education of University life - from researching in Durham to lecturing in Frankfurt. I would also like to thank Dr. Sarah Xiao as my second supervisor, for encouraging me to think logically, yet outside of the box.

Secondly, my research would not have transpired without the help of many U3A organisations throughout the country. Therefore, I am forever indebted to these organisations for posting my request for participants on their websites, in their newsletters and emails.

Last but not least, I must thank my family and friends for their prolonged support of my education. From my Grandpa, Sir Robert Honeycombe, who spent his academic career saving money to pay for his grandchildren's education to my parents who have emotionally (and sometimes financially) supported me through my time at Durham University. Finally, I am eternally grateful to my partner, Heather, for her undivided assistance throughout the last year and endless provision of tea and coffee!

CHAPTER ONE

AGEING TECHNOLOGICALLY

1. The ageing population: An expanding problem

In the 2011 UK census it was revealed that one sixth of the population (16.4%) were over the age of 65, recording the highest proportion of older adults in census history (Office for National Statistics, 2012). This figure is continuing to increase as baby-boomers from the 1950s population surge enter into the older adult category (Warburton, Ng & Shardlow, 2012). The rapid growth of the ageing population has prompted three nationwide problems that will continue unless policies, charities and interventions create effective solutions. These issues involve different but interrelated groups of people; firstly the health service managing the ailments of a rapidly growing older patient community (Tadd *et al.*, 2011; Steptoe, Demakakos & de Oliveira, 2012; Porock *et al.*, 2013), secondly the formal and informal carers of older adults (Hileman, Lackey & Hassanein, 1992; Jones & Peters, 1992; Schultz & Beach, 1999; Arno, Levine & Memmott, 1999; Walker & Luszcz, 2009; Suanet, Van Groenou & Van Tilburg, 2011) and finally, the older adults suffering from loneliness and health limitations (Savikko *et al.* 2005; Victor *et al.* 2005; Steed *et al.* 2007; Drennan, *et al.*, 2008; Kirkvold *et al.*, 2013).

When the NHS was first implemented in 1948, 48% of people in the UK were dying before the age of 65; now this figure has dropped to 16% (Tadd *et al.*, 2011). As a result, the pressures on the free health service are immense with 70% of the health budget being spent on those over the age of 65 alongside 80% of the medicines bill (Oliver, 2010). The main services that are being used by older people are General Practitioner appointments, the Accident and Emergency department and hospital admissions (Tadd *et al.*, 2011). Recent literature outlines the possibilities of older adults using NHS direct, either online or over the telephone, to receive advice on the severity of their condition. This service is currently under-used by the ageing community with only 7.2% of calls being made by people over the age of 65 (Hsu *et al.*, 2011). This is just one example of how an understanding of technology use by this population could be inherently useful to the UK health service, who may wish to encourage NHS direct as an alternative source of health care for an ageing community. Other examples include smart homes, in home monitoring, telecare, health information searching and the

application of assistive technologies (Flynn, Smith & Freese, 2006; Homes *et al.*, 2006; Wild *et al.*, 2008; Poland *et al.*, 2011; Mortenson *et al.*, 2012).

Similar to the pressures placed on the health system, an ageing population also places strain on formal and informal carers (Stolz et al., 2004). Although two thirds of people over the age of 65 reported no illness that negatively affected their lifestyle, an increasing ageing community still produces a number of age-related conditions that need to be treated (Tadd *et al.*, 2011). Additionally, these conditions are often long-term and chronic requiring specialist support from formal, family or institutional care (Oliver, 2010). Consequently, 50% of informal carers in the UK are caring for somebody over the age of 75. Of all the UK informal carers, 25% are over the age of 65 themselves. This demographic are also more likely to work over 20 hours a week and be less likely to have a holiday or prolonged break from caring (NHS Information Centre, 2010). As such, an informal carer can experience a loss of income (Arno, Levine and Memmott, 1999), a reduction in social life and mental health (Jones & Peters, 1992), an increase in poor health (Schulz et al., 1997; Walker & Luszcz, 2009) and even premature mortality (Schultz and Beach, 1992). Technology, specifically assistive, has been discovered to alleviate the emotional and physical support required by carers (Mortenson *et al.*, 2012). Understanding older people's motivations for using technologies is therefore imperative within the process of improving quality of life for both carers and patients throughout the UK.

The final and arguably most important issue is that of the health and well-being of the older adults. Health is obviously a prominent concern for older adults, indicated by the pressures placed on the NHS and other institutional care programmes. Mental health, however, is often an overlooked condition and within an understudied population, this issue is enhanced (Porock *et al.*, 2013). Currently, 60% of the older people admitted to hospital develop a co-morbid mental disorder during their hospitalisation; 31% of which develop dementia, 29% suffer depression and 20% are subject to delirium (Royal College of Psychiatrists, 2005). In addition the care of these patients and conditions has been reported as poor (Tadd *et al.*, 2011). Troublingly, a wider spreading mental condition inherent in the ageing process is loneliness stemming from the loss of loved ones and causal isolation. As a result 40% of people over the age of 65 admit to feelings of loneliness (Savikko *et al.*, 2005; Victor *et al.*, 2005; Steed *et al.*, 2007). The health status of an individual is both a predictor and consequence of loneliness; someone in poor health is more likely to feel lonely whilst loneliness is more likely to create poor health

(Drennan *et al.*, 2008). As a result, mental health should be treated as equally important as the physical well-being of older adults. One solution to improving loneliness is to strengthen the communication that older people have with friends and relatives; this can often be achieved through the use of technology such as telephones (Cattan, Kime & Bagnall, 2011; Kirkvold *et al.*, 2012) and the Internet (Karavidas, Lim & Katsikas, 2005; Sum, Mathews, Hughes & Campbell, 2008; Ballantyne *et al.*, 2010).

In sum, the problems associated with an ageing community within the health sector, care system and on an individual level can attempt to be resolved with the use of technology by older people. Searching for health information online or over the telephone (Hsu *et al.*, 2011) could reduce pressures on the NHS, whilst the use of assistive technologies and in-home monitoring could relieve strain on informal carers and the caring system (Wild *et al.*, 2008; Poland *et al.*, 2011; Mortenson *et al.*, 2012). Moreover, the mental and physical health of older adults can be improved by reducing loneliness with communicative technologies (Karavidas, Lim & Katsikas, 2005; Ballantyne *et al.*, 2010; Cattan, Kime & Bagnall, 2011; Kirkvold *et al.*, 2012). As such, it is imperative to understand the motivations behind technology use for this population so that, where necessary, technology can be introduced as a means to improve health and quality of life (Khvorostianov, Elias & Nimrod, 2012).

2. Definitions

2.1 Technology

As is evidenced, different technologies may create alternative solutions to problems associated with the ageing community; these technologies currently vary from communicative devices to assistive technology. At this stage, it is therefore important to define the meaning of *technology* due to continuous reference to the term throughout the thesis. A definition of technology, however, is somewhat complex as its initial discourse was combined by American social scientists with the German word *Technik*, during the beginning of the second industrial revolution (Schatzberg, 2006). As a result *technology* originally meaning the study of useful arts started to incorporate the industrial arts and the material means of production. This historical translation of *Technik* into *Technology* has led to a dual meaning for a single word that in other European languages has two separate terminologies, e.g. *Technik* and *Technologie.* Consequently, present definitions in use are complex and refer to two separate processes; the tools themselves and the processes behind creating and using such

devices. Read Bain (1937), an American sociologist developed a definition still used by scholars and social scientists within present day academia:

> "*Technology includes all tools, machines, utensils, weapons, instruments, housing, clothing, communicating and transporting devices and the skills by which we produce and use them.*"(Bain, 1937: 860)

The confusion associated with such a terminology has led to a division between disciplines; with some academics referring to *technology* as material objects, others associating it with fields of scientific discovery, some academic research discusses *technology* synonymously with knowledge whilst other areas refer to it as a social institution such as police forces or armies. This disagreement over the definition is considerable to the extent that very few academics agree over what *technology* is and how it is to be studied (Faulkner, Lawson & Runde, 2010). There are discrepancies as to the meaning of *technology* by academics in politics (Feenburg, 2010), engineering (Kroes, 2010), archaeology (Dobres, 2010), economics (Metcalfe, 2010) and management (Orlikowski, 2010). The present thesis engages with *technology* in reference to the innovation literature and as such the following definition is the most relevant:

> "*It is therefore useful to begin by thinking of a technology as something like a 'recipe' entailing a design for a final product which, much like a cookbook recipe, concerns a physical artifact together with a set of procedures for achieving it. The recipe specifies a set of actions that need to be taken to achieve the desired outcome and identifies, if sometimes implicitly, the inputs that are to be acted on and any required equipment.*" (Dosi & Grazzi, 2010: 173)

The terminology is applicable to innovation literature, as an innovation is also perceived to be subject to modifications and improvements throughout its adoption process. According to Rogers (2003) there is a progression of adoption that moulds the innovation throughout its lifetime and impacts upon these imperative ingredients: relative advantage, compatibility, complexity, trialability and observability. In other words, an innovation, similar to a technology follows the process and ingredients of a recipe to produce the physical artefact. The usage of the final product of a technological innovation is the central concern of the following chapters.

The domestic technology products that we use in homes, on the move and in offices are the subject technologies throughout this thesis but devices such as smart phones, kindles, laptops and tablets struggle to be placed in one category. There are several

branches of technology that are applicable to these products and their association with the chosen ageing population, which need attention in the subsequent pages. Firstly, the meaning behind assistive technology and secondly the broad label of information technology that can be refined into subsections such as portable interactive devices (PIDs; Gomez *et al.*, 2008) and mobile media devices (MMDs; Zhong, 2013).

Assistive technology (AT) was originally defined as part of the United States Technology Related Assistance of Individuals with Disabilities Act in 1988 and redefined in 2004 with the following terminology:

> *"Any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities."* (Scherer & Glueckauf, 2005: 133)

Scherer and Glueckauf (2005) discuss how assistive technology is often perceived as being complex and high-tech, however, a range of simplistic products can also act as an assistive device to improve an individual's quality of life and enhance independence. These technologies vary from spectacles and magnifying glasses to robots (Pollack *et al.*, 2002; Heerink, Krose, Evers & Wielinga; 2006; 2008a; 2008b) and mobile media devices (Zhong, 2013). Consequently the domestic products that are the subject of this study may act as assistive devices for older people under two conditions; firstly, the older person has a disability and secondly, the device improves the quality of life or independence of that person. Describing the subject technologies as AT may therefore apply to some participants but certainly not all as not all participants have a disability; suggesting that further definitions for these domestic products are required.

Information Communication Technology (ICT) is an umbrella term for information technology, telecommunications, broadcast media, audio, video and network monitoring functions (Sallai, 2012); it therefore refers to technologies that are wireless and mobile alongside computer hardware and software in its various formats. In other words, ICT generally refers to any device that is commonly and colloquially called *a technology*. The term is, however, extremely broad and incorporates the domestic technological products that we use in our daily private lives as well as desktop computers and Internet networks in our working environments. Consequently ICT does define the subject technologies of this thesis but it makes no separation between technologies used in a professional or personal environment and mobile or immobile

technologies. A sub-category of ICT is therefore necessary in determining the personal, mobile, domestic products such as Kindles, tablets, smart phones and laptops.

Within the design literature, the terminology for these products is Portable Interactive Devices (PIDs; Gomez *et al.*, 2008; Gomez, 2012; Jones & Marsden, 2006); electronic products that are mobile and designed to be used in an array of environments and spaces. They have opened up opportunities for interaction; prior to the mass production of PIDs interaction depended on where the device was situated. Currently, however, the portable nature of electronics has allowed social, cultural and personal interaction across space and time (Gomez, 2012). This design description applies to all the technologies of interest in this thesis, however, sections of the definition apply more to some devices that for others. Tablet and mobile phones, for instance, are both interactive and portable; a laptop, however, is still interactive but less portable and finally a Kindle is highly portable but has limited interactivity.

In the marketing literature PIDs are often described as mobile media devices (MMDs), which are "internet-connected handheld computers integrated with or without a mobile phone" (Zhong, 2013: 1742). This definition refers to Kindles, smart phones and tablets that are studied in chapters 3 and 4, but not to laptops as these are not always handheld. Consequently describing the technologies as PIDs is the most appropriate terminology as it incorporates all the devices in question. It must be considered, however, that although under the category of PIDs these technologies do have different functions, levels of portability and levels of interaction, which produce interesting and diverse results when used by the chosen population of older adults.

2.2 Technology acceptance and adoption

Technology acceptance and technology adoption are two different processes that require a differentiation (Renaud & Van Biljon, 2008). The former is an attitude towards technology, which is influenced by multiple variables and various factors. Technology acceptance stems from intention based models such as the theory of reasoned action (TRA; Ajzen & Fishbein, 1980), the theory of planned behaviour (TPB; Ajzen, 1991) and the technology acceptance model (TAM; Davis *et al.*, 1989). Acceptance of a device follows the supposition that positive attitudes towards that particular technology lead the consumer to accepting and using their technology. However, the flaw with this assumption is that intentions to use a technology do not always lead to the subject behaviour (Bagozzi, 2007).

Technology adoption, on the other hand, is a process that begins with the consumer's awareness of a technology and ends with the embracing and full use of the device. "Someone who has embraced a technology is likely to replace the item if it breaks, find innovative uses for it and cannot contemplate life without it" (Renaud & Van Biljon, 2008; 211). Technology adoption was initiated from Rogers' (2003) diffusion of innovation (DIT) theory from which he proposed five stages of adoption; learning about the product, being persuaded that the product is required, deciding to purchase/acquire the product, implementing the use of the product and finally the confirmation that the decision to acquire the product was the correct one. Of these five phases the last two are the most prominent for the present thesis as they are imperative in understanding the post-purchase behaviour of technology use. Adoption, however, is not separate from acceptance as full adoption could not occur without a positive attitude and acceptance of the device (Renaud & Van Biljon, 2008). In other words, for a consumer to repetitively use a technology after the acquisition of the device, both acceptance in reference to attitudes and intentions and adoption in reference to embracing the idea must occur.

2.3 "Older" adults

Chronologically speaking, the age of the chosen population in the present study is 65 years old or older. The problem therein lies in the terminology of this section of society and the justification of this age bracket. Generally, people over the age of 65 in the UK are called elder, elderly or the elderly. There are even subsections within this definition; the *early elderly* are people who are aged between 65 and 74 whilst the *late elderly* are people aged 75 years old or older. It is not clear where this definition has originated from but it is believed that it stemmed from Prince Bismarck, the Chancellor of Germany, who over a century ago chose 65 as the age at which somebody could partake in the national pension scheme. He very consciously chose this age, as he expected the majority of his people to pass away before this milestone was reached (Orimo *et al.*, 2006). Now with advances in health and technology, the expected lifespan has increased substantially, which has resulted in a large section of the population being defined as *elderly*, purely because their age is either 65 or older and despite the variety of health, ability, illnesses and disabilities within this age range (Dixon *et al.*, 2010).

There are arguments that *elderly* should be defined by health and ability, alongside age but this would open up a heavy debate on what factors should be assessed to

determine both health and ability. Orimo *et al.* (2006) suggest grip strength and walking speed to indicate an elderly status, however, with such a variation of illnesses and disabilities, it would be very difficult to decide what measures are both accurate and representative. Moreover, other academic research suggests using *frailty* as an indicator, however, there are discrepancies surrounding how to create such an accurate and applicable measure (Gobbens, Luijkx, Wijnen-Sponselee & Schols, 2010). Consequentially, due to the discrepancies and negative connotations associated with the term *elderly*, this thesis will not refer to its chosen population with the aforementioned terminology. A more appropriate and less disputed term has been selected; the *older adult* is now favoured by much of the ageing literature within such journals as *Ageing & Society* and *Geriatrics & Gerontology International. Older adult* has fewer social prejudices and refers merely to an age group of people aged 65 or over, in a similar manner to *young adult* referring to people aged 18-25.

There is further debate about whether the term *older adults* should include everybody over the age of 65, as there are large health and social discrepancies between the people within this group. For instance, the *new-age elderly* with their youthful outlook on life differ dramatically from the *old-old* (Schiffman & Sherman, 1991; Mathur, Sherman & Schiffman, 1998). As such, Barak & Schiffman (1981) suggest that cognitive age is a better segmentation tool than chronological age; cognitive age has been advocated as being an improved predictor of technology and Internet use than merely amalgamating the over 65s into one age group (Eastman & Iyer, 2005). Limitations with this approach, however, lie in the scale used to measure cognitive age, which has been tested as valid and reliable but mirrors western attitudes towards youthfulness and ignores the changing attitudes to ageing (Catterall & Maclaran, 2001). Therefore, while there are limitations to measuring cognitive age, a chronological age scale will be used. There may be varying levels of abilities, disabilities, illnesses and diseases within this population but these factors could vary within any population chosen by age. Moreover, much of the previous literature and statistics on older adults in the UK use 65 years old as a bench mark, which eases the process of cross-comparison. Consequently, 65 years old and above will be used as a category, however, varying ages, levels of cognition and ability will be factored into the analysis stage of the thesis; the older adult will not be theorised as one homogeneous group.

In summation, the term *older adult* is preferred to the heavily negatively associated terminology of *the elderly*, as it has fewer connotations with the unfortunate aspects of

ageing. *Older adult* refers to an age group within population, which can be measured objectively by chronological age and compared to previous studies and datasets such as the 2011 Census. As such, 65 and older has been used as a category outline despite debates that 65 is too young to define somebody as old. The present thesis does not intend to humour this debate but to measure results of technology use by people within this age bracket in an attempt to understand the behaviour and create recommendations for practitioners, policy makers and charities alongside future academics who wish to investigate this topic.

3. Understanding older adults and technology use

3.1 The silver surfer

Literature on older adults' use of technology, specifically ICT, computer and Internet use, started to become a prevalent topic in 1994. As the older population grows, the research surrounding technology use by this age group is also expanding. The two disciplines with the most journal publications on this topic are Gerontology with 40 and human-computer interaction with 56 between 1994 and 2008. Over time, business studies and healthcare research are also paying increasing attention to the issue of computer use by older adults whilst on the other hand; psychology and education have produced few publications on the topic (Wagner, Hassanein & Head, 2010). Being a relatively new area of interest, there are strong investigations into particular elements of technology use whilst other factors have been overlooked or lack the depth of further investigation. For instance, studies on age as a variable of technology use and technology performance have been popular (Eastman & Iyer, 2005; Thayer & Ray, 2006; Czaja *et al*., 2006; Peacock & Kunemund, 2007; Arning & Ziefle, 2007; 2008; 2009) whilst studies linking environmental factors such as the usefulness of the device to the behaviour of technology use are limited (McCloskey, 2006; Wagner, Hassanein & Head, 2010). Consequently, there is promising scope for further research into a few key areas within the topic of older adults and technology use.

Firstly, the majority of publications focussing on technology use by older adults, use attitudes and intentions to decipher whether their participants use technology. For this literature, understanding technology acceptance is the central aim and therefore models such as TAM (McClosky, 2006), TPB (Morris & Venkatesh, 2000) and the unified theory of acceptance and use of technology (UTAUT; Nagle & Schmidt, 2012) have been applied. In reference to older adults technology use, there are limited

studies on the diffusion of innovation (DIT; Rogers, 2003) and the actual usage rather than the intended behaviour. Consequently, the research on older people and technology generally outlines the acceptance of that technology and intentions of use. There is less research on the post-acceptance or post-purchase phase of usage, where technology, according to Rogers' (2003) stages of adoption, is either fully embraced or discarded (Olson *et al.*, 2011). Actual usage has been recorded to some degree with descriptions of what technology is used for; for example, communication and social support (Thayer & Ray, 2006) and information searching (Rosenthal, 2008), however the recording of frequency of usage in relation to antecedent stimulus is limited.

According to Wagner *et al.* (2010) this is because the majority of studies on older adults' use of technology are cross-sectional and only record a snippet of information at one single point in time. There is consequently a strong argument for further longitudinal and cross-sectional studies on technology use by this age group. A few longitudinal studies have been successful at indicating Internet usage by older adults for everyday uses (Lam & Lee, 2006; Hedman *et al.*, 2013) or specific purposes such as searching for health information (Flynn, Smith & Freese, 2006) or maintaining social connections (Berkowsky *et al.*, 2013). For the majority of these publications, the older adult participants are generally between the ages of 55 and 65. As such, more longitudinal research is required on people over the age of 65 and their use of domestic technology products such as PIDs, home computers and the Internet.

Secondly, with the assumption that technology use benefits older adults' quality of life (Karavidas, Lim & Katsikas, 2005; Khvorostianov, Elias & Numrod, 2011), much literature analyses how computer use can be learned (Lam & Lee, 2006; Buse, 2010) or whether age affects the ability to use a device (Arning & Ziefle, 2007; 2008; Mata & Nunes, 2010; Nagle & Schmidt, 2012; Chevalier, Dommes & Matins, 2013), in an attempt suggest ways of teaching technology consumption to this population. It is, however, difficult to teach a skill to a large body of people if the incentive to learn is non-existent. Consequently to compliment these studies, it would also be beneficial to the field to have academic research on the motivations of technology use. Currently, a lack motivation to use technological devices by people over the age of 65 has been demonstrated (Morris *et al.*, 2007; Peacock & Kunemund, 2007), although recently, this assumption was heavily contested (Zaphiris, Kurniawan & Ghiawadwala, 2007; Mitzner *et al.*, 2010). There is, however, little investigation on positive motivations of actual technology use; with the exception of a couple of qualitative studies (Selwyn,

2004; Ng, 2008) that need to be quantitatively supported and updated. A study that investigates the underlying motivations of older people who use technology would therefore complement the aforementioned attitude based and learning and teaching literature.

Finally, the majority of literature that identifies older adults as technology users often focusses on general ICT such as computer and Internet use (Wagner, Hassanein & Head, 2010). As previously indicated these studies commonly investigate the influence of age on usage and technical performances alongside attitudes towards ICT. Literature that does explore the use of more specific technologies in the context of older adults, often investigates assistive technologies such as robotics (Heerink *et al.*, 2006; 2008a; 2008b) and in-home monitoring (Wild *et al.*, 2008; Poland *et al.*, 2011; Mortenson *et al.*, 2012). Investigation into everyday technologies is limited, with the exception of the mobile phone literature (Lee, 2007; Mallenius, Rossi & Tuunainen, 2010; Hardill & Olphert, 2012; Joe & Demiris, 2013). As such, there is scope for research into PIDs and everyday devices such as tablets and Kindles to decipher how older adults interact with these technologies and how technology use differs between the devices.

In sum, the topic of older people and technology use has only emerged into academic literature in the past 20 years. There are, consequently, strong areas of interest such as the influence of age as a variable on technology use, attitudes and capability whilst other areas are lacking in depth and investigation. These areas have been identified as the adoption of technology and post-purchase behaviour of the present population, the longitudinal frequency of use of the older adult, the motivations of older adults to use technologies and finally, the use of everyday devices such as PIDs. As a result, this thesis intends to contribute to these areas of understudy with longitudinal research on the motivations of post-purchase usage of PIDs by older adults.

3.2 Evaluating post-purchase technology use

TAM and DIT are the two prominent perspectives within ICT acceptance and adoption literature (Bhattacherjee & Sanford, 2006). TAM is primarily concerned with attitudes towards a technology, which leads to the acceptance of the technology as an idea and the acquisition of the technological device (Davis *et al.*, 1989). Whilst DIT, on the other hand, conceptualises ICT use as being shaped by a process of communication and social influence; a network of users report the benefits of using a device and encourage others to follow suit (Rogers, 2003). With the exception of the evaluation phase in

Roger's (2010) stages of adoption, neither model specifically focusses on the post-purchase or post-adoption processes of using a technology. The overreliance on these two models in academic research has resulted in areas of understudy within the present coverage of technology acceptance, adoption and usage, especially in reference to post-purchase behaviour. As such, Lee (2011) and Lee *et al.* (2013) strive for further research into post-consumption variations that encourage a user to retire, replace or continue to use a particular innovation, after the purchase or acquisition of the device has occurred.

Current literature on post-adoption explores brand loyalty (Lee, 2011), self-service IS in the work place (Saeed & Abdinnour, 2011), product attachment (Mugge *et al.,* 2010) and mobile phone adoption (Lee, Trimi & Kim, 2013). There have been theoretical and methodological contributions in the form of a longitudinal study and extension of the DIT literature. However, this area of research within business and management studies is still in its infancy and requires further exploration and support. There is, consequently, scope for post-adoption research to expand the mobile phone related study (Lee, Trimi & Kim, 2013) to include further everyday technological devices such as PIDs. Moreover, theoretically a shift is required from the two leading adoption and acceptance models in the field, TAM and DIT, towards an alternative predictor of behaviour. Consequently, a behavioural perspective within this field would expand the reliance upon the two models and create required debate and contention.

Methodologically, the reliance on TAM and DIT has encouraged survey methodologies recording attitudes, behaviour and social factors in one place and one point in time. The flaw in this approach obviously stems from the lack of quantitative and qualitative data spanning over a period of time. As such, previous data is limited to a single cross-section and shows little temporal variation of technology use and its variables. Lee, Trimi and Kim (2013), therefore, argue for additional longitudinal studies on technology adoption to enhance the richness of the data being collected and thoroughly analyse any post-purchase and post-adoption behaviour. The longitudinal nature of the present research therefore contributes to the post-adoption literature by providing an alternative research methodology through the exploration of everyday technology use by older adults.

Using a population of people over the age of 65 is also extending the post-adoption research as students are generally the primary participants for technology adoption and acceptance models (Lee, Trimi & Kim, 2013). Moreover, with TAM evolving from

the management and organisational behaviour sector of business studies, there has been difficulty in successfully applying this model to environments outside of the workplace (Holden & Karsh, 2010) and participants that are not employees. Consequently, providing a collection of data on older adults as domestic technology adopters within the context of post-purchase will provide novel research on alternative populations to students, young adults and employees.

In brief, a depth and richness is required within the technology adoption and acceptance literature to include studies on behaviour after the purchase of a device or software has been made. The current post-adoption literature is sparse and requires contention to present theoretical and methodological processes with alternative theories to TAM and DIT and further longitudinal research. Moreover the populations used in this field of study are unimaginative and pleading for investigation into post-purchase adoption by different groups of people such as older adults.

3.3. A behavioural perspective and motivation

Radical behaviourism, the theory of the present thesis, has suffered from the reluctance to be included within mainstream consumer research. For instance, previous consumer researchers who have taken a preference to cognitive-behavioural theories such as the social learning theory (Bandura, 1977) and social behaviourism (Staats, 1975) have explicitly rejected the ontological and methodological implications of radical behaviourism (see Nord & Peter, 1980; Rothschild & Gaidis, 1981). The rejection of this paradigm within consumer research is understandable as radical behaviourism reached its peak in the 1940s and 1950s before cognitive psychology emerged in the 1960s and continues to claim dominance. Moreover before his death, B.F. Skinner, the founder of radical behaviourism, openly labelled cognitive thinking as "the creationism of psychology" (Vargas, 1990: 409). Consumer researchers were therefore extremely cautious of claiming allegiance with radical behaviourism in fear of creating conflict with the dominance of cognitive thinking (Foxall, 1995).

In 1995, however, Foxall identified a damaging debate within the field of consumer behaviour between a purely positivist perspective, which refused to acknowledge the pluralism of behaviour and a highly hermeneutic analysis, which was lacking in scientific rigour. In a sense, this pre-school debate between quantitative and qualitative research methods was hampering the collection of adequate data on the phenomenon of consumer behaviour. One side of the coin was holding whole-heartedly onto the scientific past of consumer research by lying firmly within a realist framework, whilst

the other side was striving for change but without acknowledging the occasional requirement of positivist approaches. As such, Foxall (1995) made a plea for consumer researchers to stop tearing their discipline apart and start concentrating on the importance of consumer research; to primarily and fundamentally learn about consumer behaviour. His solution was presented as a radical behaviourist approach that encapsulated science and interpretation to attest meaning to complex behaviours through recognising their environmental determinants such as *behaviour setting*. This approach provided the acclaimed change that the discipline was striving for whilst providing unison between positivist approaches and the interpretation of behaviour.

As a result Foxall (1994; 1995) developed the Behavioural Perspective Model (BPM), which accounts for the complexities of consumer behaviour through a radical behaviourist perspective. The BPM is comprised of environmental influences that impact upon the behaviour, the consequences of performing said behaviour and the likelihood of future behavioural occurrences. Key terms within the model include *consumer behaviour setting*, *learning history*, *consumer situation*, *consumer behaviour*, *utilitarian reinforcement and punishment* and *information reinforcement and punishment* (Foxall 2010). The function of these terms will be explained within the succeeding section but the current focus is on the importance of the BPM within the field of consumer behaviour.

After the introduction of the BPM into consumer behaviour research, there have been several stages of adoption of this model (Foxall, 2010). The *conceptual* phase was between 1980 and 1990, which involved the critical analysis of the then present cognitive paradigm domination within consumer behaviour. Then between 1989 and 2000 came the *theoretical* phase, which involved developing a model for a radical behaviourist methodology of analysing and interpreting behaviour. The third phase; the *empirical* phase, which began from 1997 onwards involves the utilisation of the model to predict consumer behaviour within varying consumption environments. In 2000, the fourth phase began which involved coupling the BPM with behavioural economic approaches to create the *behavioural economic* phase. The final phase, the *philosophical* phase from 2003 onwards has involved post-behaviourists' models of consumption such as intentional behaviourism (Foxall, 2007a; 2007b). The present thesis intends to contribute to two phases of the BPM literature; firstly the *empirical* phase by providing a radical behaviourist approach on technology use by people over the age of 65 and secondly, the *philosophical* phase by incorporating MOs into the BPM

(Fagerstrom *et al.*, 2010). Note that the second contribution is not post-behaviourist but uses the work of Jack Michael (1982; 1988; 1993; 2000) who reintroduced motivating operations back into behavioural psychology in the 1980s.

Empirically, the BPM has been adopted to investigate a plethora of consumer behaviours including consumer brand choice (Foxall, Oliveira-Castro, James & Schrezenmaier, 2007), consumer channel choice (Nicholson, 2005), environmental conservation (Foxall, at al., 2006) and counterfeit purchases (Xiao, 2006). Uses of the BPM that are highly relevant to the present study include Internet shopping (Fagerstrøm, Arntzen and Foxall, 2010; Fagerstrøm 2010) and the demand for innovations in the telecommunications sector (Yermekbayeva, 2011). The behavioural approach is yet to be applied to the post-purchase usage of domestic technology such as PIDs and especially within the context of usage by older adults. The environmental influences are different for people of different generations and hence the present research will provide an insight into the influences on this generation of technology user.

The second contribution is within the *philosophical* phase. Previous philosophical adjustments have included the verbal behaviour of consumers (Foxall, 2010a), the evolutionary bases of consumer reinforcement (Nicholson & Xiao, 2010a) alongside post-behavioural consumer models such as intentional behaviourism (Foxall, 2007a; 2007b). The succeeding chapters champion for the inclusion of MOs into the BPM by testing the motivating impact of certain factors on the frequency of usage within the 6 month period post-purchase. The introduction of MOs into consumer behaviour is based on the work of Jack Michael (1982; 1988; 1993; 2000) and the argument of Fagerstrom, Foxall and Arntzen (2010) that the BPM ought to make an explicit distinction between discriminative stimuli (S^d) and MOs within the consumer behaviour setting as they have different effects on the behaviour. As such, the present research identifies potential MOs of technology use and calculates the influence of proposed MOs on the frequency of technology use in an attempt to philosophically progress Fagerstrom *et al.*'s (2010) argument to include MOs in the BPM.

4. A behavioural analysis of technology use by older adults

To summarise, the expanding ageing population in the UK has placed great strain on the NHS healthcare service, the formal and informal caring system and the lives of the older adults. Often technologies can act as devices of relief to these three groups of

people and services; the issue therefore lies in process of adoption and post-adoption use of the various beneficial devices. Literature on technology use by older adults is a relatively new area of interest and as such it is lacking in details of actual longitudinal technology use for the period after the attainment of the device. Generally, the field of technology acceptance and adoption is dominated by two perspectives; one based on attitudes and intentions (TAM) and the other on the social influence of adoption (DIT). As such, the post-purchase phase of technology use receives little scholarship and within the context of older adults, it is almost non-existent. By examining the motivational influences of technology use within the post-purchase period, this thesis intends to discover what factors evoke or abate the usage of everyday devices such as PIDs so that these factors can be considered within any policies or future projects that are endeavouring to encourage technology use by older adults.

Considering the dominance of the two technology adoption and acceptance approaches, this thesis intends to adopt radical behaviourism as an alternative perspective of technology use, which is not in contention to the aforementioned frameworks but in an attempt to compliment previous academic research. The BPM, as a radical behaviourist tool for investigating consumer behaviour, seems the obvious choice to apply to post-adoption technology use. The model, however, under the nature of radical behaviourism, is subject to the constant evolution of theory and thought. Consequently, the following chapters attempt to advance the BPM by combining MOs into the framework so as to investigate; a) the environmental motivational influences on post-purchase technology use, b) the actual frequency of use through the nature of operant responding and c) the consequences of responding on the probability of future occurrences.

Structurally, the thesis begins by identifying the three different areas of research. Firstly, it outlines how behavioural psychology emanated from contentions towards the psychodynamic perspective before resembling the radical approach ascribed to in the present research. Secondly, it examines the radical behaviourist perspective within consumer behaviour and applied behaviour analysis in relation to the technology acceptance and adoption literature. Thirdly, further academic research on older adults and their current acceptance of technology is used to develop proposed MOs that may evoke or abate post-purchase technology use.

This thesis then proceeds to present an empirical strategy that intends to tests the proposed MOs in relation to technology use for a representative population of people

over the age of 65. It is based on the pragmatic positivist approach of previous radical behaviourists and expands previous applied behaviour analysis MO methodology to suit the consumer nature of the research. As such, the empirical chapter uses qualitative self-report diary data to validate the MOs as independent variables and form a functional analysis of PID usage, before generating reliable quantitative psychological scales to measure each MO.

Finally, drawing on the longitudinal quantitative survey data and qualitative self-report diary data, this thesis develops a discussion on the motivating influences of post-adoption technology use for people over the age of 65. It applies the proposed MOs to the BPM framework by amalgamating the various independent variables into the operant classes of consumer behaviour and innovation adopter categories. Following this discussion, the contributions, strengths and weaknesses of the present empirical work are identified, which highlights areas of interest for practitioners and policy makers and recognises further scholarship for academics within the field of consumer psychology. The overall contribution of the thesis is the expansion of the BPM to include MOs through the application of MOs to the consumer behaviour of post-purchase technology use.

In summation, the three predicted key contributions of the thesis are as follows:

1. *To develop a detailed account of older adults' post-purchase usage of a technology from a radical behaviourist perspective, detailing the motivations behind behavioural response through the assessment of MOs and their evoking or abating qualities.*

2. *Extending the technology acceptance and adoption literature by providing a behavioural perspective on post-purchase consumption by the older adult consumer market, focussing on the motivation of usage.*

3. *Updating the BPM research to incorporate MOs into the conceptual model and discover their motivating impact upon post-purchase behaviour in the context of technology use by people over the age of 65.*

CHAPTER TWO

THE MOTIVATING OPERATIONS OF TECHNOLOGY USE

1. Introduction

The research seeks to explore the motivational operations of technology use and incorporate these MOs into the BPM framework. The context in which the MOs are being tested is on older adults during the post-adoption phase of technology use; in other words, the frequency of technology use after the device was acquired. The previous chapter outlined the issues associated with an ageing population and how these can be alleviated with technology use before identifying gaps within the literature of a) older adults and technology use b) post-adoption within technology acceptance/adoption models and c) MOs within the BPM. The thesis, therefore, intends to make three contributions to the aforementioned areas of academic research.

The present chapter seeks to identify, through the literature, which MOs may impact upon the frequency of technology use by older adults during the post-adoption phase. It therefore begins by giving a historical account of the birth of behaviourism into mainstream psychology before outlining the different forms of radical behaviourism within consumer behaviour and applied behaviour analysis. The second section further explores the Technology Acceptance Model and Diffusion of Innovation in relation to post-purchase technology use by older adults. The final section explores the older adult literature, as it stands and in relation to technology use, in an attempt to formulate valid MOs.

2. The Stimuli of Radical Behaviourism

2.1 The psychodynamic perspective

In the beginning of the twentieth century two different schools of thought began to emerge within the discipline of psychology. The first of these was the psychodynamic perspective, which originated from the works of Sigmund Freud (1856-1939) whilst the second school of thought was behaviourism, which originated from the work of

psychologists such as Ivan Pavlov (1849-1936), Edward Thorndike (1874-1949) and John Broadus Watson (1878-1958). The present thesis is primarily concerned with the latter, behaviourism, however to begin to understand the origins of this era of thinking, one must first comprehend the field of psychology that the behaviourist school sought to displace. To understand this perspective and why early behaviourists sought a different method of analysis and data collection, this section will firstly outline the history of psychoanalysis and secondly summarise the central theories and concepts behind this way of thinking. Two case studies involving the conditioned fear of two little boys, Hans and Albert, will be used to highlight the differences between Freud's psychodynamic approach and Watson's behaviourism. Finally, the birth of behaviourism will be outlined as an alternative and replacement approach to Freud's theories of psychoanalysis.

The psychodynamic perspective is a psychological school of thought that was originally influenced by Freud's theories of psychoanalysis. Freud developed a collection of theories between the 1890s and 1930s, which included the interpretation of dreams, the unconscious mind, the psyche, childhood experiences, stages of development, symbolism and instinctual drives such as aggression and sex (Hoffman, 2010; Chung & Hyland, 2011). These all comprise to formulate the basis of the psychodynamic perspective, which is still used in psychology and psychological therapy today (Khantzian, 2012; Shedler, 2010). Freud began to establish himself within the field of psychology when he assisted Breuer in 1895 to write a book called *Studies on Hysteria*. The publication referred to case studies of patients such as Anna O, who were often middle aged women from Vienna suffering from what was termed at the time as Hysteria (Gelfand & Kerr, 2013; Chung & Hyland, 2011). Through these case studies, Freud and Breuer's (1895) initial theory was developed. They believed that every case of hysteria is the consequence of a traumatic experience during childhood, which cannot be accepted into the person's understanding of the world. In other words, a disturbing event during a person's younger years can be so traumatic that the person cannot accept the event into their everyday lives. As a result of this, the person hides their true feelings and identity within their subconscious, which can eventually lead to a state of hysteria (Szasz, 2011).

By 1896, the theory first established in *Studies on Hysteria,* was further developed and named by Freud as psychoanalysis. In 1900 Freud published is own first major work, *The Interpretation of Dreams*, which outlines his theories on dreams and the unconscious.

In his opinion, dreams are a manner in which the unconscious can attempt to resolve a conflict. This conflict could be a recent event from the previous day or preceding week or alternatively from the depths of somebody's past or childhood experiences, similar to the psychoanalysis theory. In other words, the preconscious censors the information present in an often disorderly and disturbing unconscious and disallows the raw, uncensored information to be passed into the conscious. During a dreaming state the preconscious is less efficient in its role but still adequate; the unconscious therefore distorts the information into various symbolic meanings, which in turn avoid the sieve of the preconscious state. According to Freud, pictures and scenarios within dreams are not what they seem; they are symbols of unconscious thought. Through their analysis, the unconscious can be deciphered and studied in an attempt to cure conflict from previous experiences, which as previously stated by Freud could cause hysteria if untreated (Gelfand & Kerr, 2013; Chung & Hyland, 2011).

Following on from Freud's first solo publication in 1900, he founded a group of psychologists called the *Pyschological Wednesday Society* or later known as the *Vienna Psychoanalytic Society.* This society provided Freud with a group of followers, including academics such as Sandor Ferenczi, Hanns Sachs, Karl Abraham, Ernest Jones, Max Eitingon and Otto Rank (Lieberman & Kramer, 2012). In 1909 Freud and his fellow society members went to Massachusetts to lecture about their understanding of mental illness and hysteria. The lecture series included topics on the basic principles of psychoanalysis, hysteria and the psychoanalytic method, the aetiological importance of dynamic mental forces in contrast to degeneracy theories, dreams and the unconscious, infantile sexuality and the nature of transference (Hoffman, 2010). From this trip to the United States, Freud founded the *International Psychoanalytic Association*, whose principal aim was to spread psychoanalytic thought through America and Europe. Carl Jung was appointed the leader of the association; his role was to regularly discuss with the designated congress, the logistics of applying the new theory and therapy of the discipline to different cultural areas.

Jung, as Freud's successor, continued to promote psychoanalytic thought with his study on schizophrenia and publication *The Psychology of Dementia Praecox* (1909). He had a strong collaboration with Freud until 1912 when Jung started to critique Freud's highly sexualised definitions of libido and incest (Barnett, 2013). Jung's critical nature led him to publish the work *The Psychology of the Unconscious*, which contested Freud's theories of sexual libido. Following this theoretical disagreement, the two

psychologists were no longer close colleagues and consequentially parted ways. Jung, at that point, began to develop his own theories, which he placed under the new umbrella term, Analytical Psychology. He focussed his life's work on exploring the unconscious state by using evidence from dreams, myths and folklore (Shamdasani, 2012). Another successor to Freud's psychoanalytic thought was his daughter Anna Freud. She adopted her father's beliefs and continued to teach and write about the theory from 1927 to the early 1970s. Anna Freud's central research area was within child analysis and ego psychology (see Freud, 2011). She became an ambassador for her father's theories, which meant that this school of thought continued within Europe and the UK until her death in 1982 (Stewart-Steinberg, 2012). It is through Freud's followers that the psychodynamic perspective was born; whilst psychoanalytic refers to Freud's theories, psychodynamic is in reference to the overall works of Freud and his successors.

Freud's central theories behind the psychodynamic theory, originate from his fundamental model of the *unconscious mind,* which still has a large impact on how many people describe *the unconscious* within today's society (Bargh and Morsella, 2008). The unconscious mind was specifically described in detail by Freud as being a state where people's deepest and darkest thoughts, feelings and memories are contained. We are not aware of their existence but they do, however, have a significant impact upon our daily actions and verbal behaviour. In other words, anything we consciously do or say may be hidden projections of the subconscious state; actions and words can have symbolic connotations of the thoughts, feelings and memories compressed within the subconscious mind (Chung & Hyland, 2011). This leads on to one of Freud's other theories; *Symbolism*, which implies that if we understand certain actions, mistakes and dreams these can be symbols of the contents of the unconscious. By identifying these symbols, Freud believed that he could interpret dreams to reveal their true meaning (Ffytche, 2011).

Through this reckoning, the idea of *the psyche* was founded. It is a term that is more commonly known as *personality*, however, its characteristics lean more towards the human soul. Freud believed the psyche to be the overall result of three different parts of a human mind that are continuously at loggerheads with each other. These sections have been named: the *id*, *ego* and *superego* and, according to Freud, it is the result of their eternal conflict that determines human behaviour (Ffytche, 2011). The id is the animal section of the psyche and is ruled by instincts to eat food, drink and have sex.

Its aim is to satisfy these instincts and if these desires are not met, the id can become frustrated and aggressive. In contrast, the superego is the section of the psyche that holds all the morals; it pushes one to behave in ways that their parents and society would approve of. If these morals are not abided by, the superego releases feelings of guilt and unease. The ego is a combination of both the id and the superego; it attempts to balance out the two forces to form a compromise. It is this section of the psyche that is in touch with reality. In other words somebody's ego is what is seen of that person within the outside world (Chung & Hyland, 2011).

Freud also focussed much of his attention on the childhood of his patients. He concluded from this research that the first few years of somebody's life is vital in influencing their future development. The main importance of these early years is the relationships formed with others; parental and alternative experiences can influence a psyche, which in turn can impact upon the personality and behaviour displayed in adult years. He developed this theory further to incorporate *stages of development,* which imply that childhood development can be broken down into stages; each one can have an influence on the adult psyche. The oral stage (0-1 year), the anal stage (1-3 years), the phallic stage (3 to 5 or 6 years), latency (5 or 6 years to puberty) and genital (puberty to adult) all contribute towards an adult personality. Take the oral stage, for example, it is theorised that from birth and until the age of one a child should be breast fed by its mother. If this instinct is satisfied a child will develop normally into adulthood, however, if the child is either weaned too early or too late this anxiety can transgress into adult life and create a maladaptive oral fixation (Chung & Hyland, 2011).

There are criticisms surrounding this theory as there has been no evidence that breast feeding for an extended period of time leads to an oral-stage fixation. The stance that this thesis takes is surrounding the validity of the theory (Fisher & Greenberg, 1996; Xiao, 2006); Freud has developed a concept that is difficult to prove but at the same time, impossible to refute, which ironically may be its demise (Popper, 1963). For example, if somebody had what Freud termed an 'oral-stage fixation', there is no way to prove that this personality is linked to the duration of breastfeeding when that person was an infant; Freud's theory states that both an over stimulation and under stimulation of infantile breastfeeding can lead to this fixation yet there is no specified ideal measure to indicate the perfect amount of time to breastfeed for. Consequentially, whatever time period is placed on breastfeeding the infant, this according to Freud has

created an oral-stage fixation. As such, there is no way to prove or disprove the relationship between cause and effect, which according to Karl Popper (1963) implies that the theory itself is flawed. Popper believed that statements and theories were valid and acceptable until proven to be false; his central issue with Freud was that his theories were unfalsifiable and lacking in substance (Chung & Hyland, 2011).

Not only is it difficult to both prove and disprove Freud's *stages of development*, but his theories on the unconscious are also impossible to fathom. The subjectivity behind Freud's thinking and those of his followers within the psychodynamic discipline make it extremely difficult to scientifically measure these thoughts and suggestions (Boring& Gardner, 1967; Rachman, 2004). There is, consequently, a significantly small amount of empirical data surrounding the psychodynamic approach. Moreover, the evidence for the psychodynamic theory is based on case studies of Freud's patients. Often these case studies are in-depth and provide a large amount of data; however, they cannot prove or disprove theories on the unconscious and psyche. In this situation, case-study data is additionally restricted as evidence by the narrow representation of the population (Bargh & Morsella, 2008). The majority of Freud's patients were middle aged women from Vienna; to stipulate that evidence from these participants relates to the worldly population appears to be a symptom of Freud's self-righteous omniscience.

Freud believed his own theories were comparable to the greatness of Copernicus who first argued that the earth is not at the centre of the universe and Darwin who pioneered that humanity is not unique amongst beasts (Hoffman, 2010), however, modern empirical tests have produced scepticism of the Freudian model (Bargh & Morsella, 2008). Followers such as Shedler (2010) have attempted to introduce psychodynamic therapy (PT) into mainstream psychology, however, in this particular instance key methodological processes were generalised and contentions towards the psychodynamic approach were ignored (Anestis, Anestis & Lilienfeld, 2011). Evidence indicating the discrepancies of the psychodynamic approach involved comparisons between PT and cognitive behavioural therapy (CBT) on participants with personality disorders (Hardy *et al.*, 1995) and suicidal tendencies (Liberman & Eckman, 1981). Both studies showed an improvement in the patients receiving CBT but no improvement and often a worsening in patients receiving PT.

Other contentions to Freud's methods centre on his analysis of children and their stages of development; one child in particular was a famous case study of Freud's that received both unprecedented following and heavy criticism. Little Hans, also known as

Herbert Graf, was a boy of 4 years of age who had a fear of horses. The boy was only treated by Freud in person on one occasion but Little Hans' father, whilst in communication with Freud, carried out psychoanalysis on the child to decipher the cause of his fear of horses. There were several conclusions made from the psychoanalysis but the most heavily recorded were that the child was suffering from an Oedipus complex. In other words, the child feared his father would punish him (through castration) for having sexual interests in his mother, which triggered the child to fear horses. These conclusions were created from the child's fascination with his own penis, the horses' penises and the fact his mother has no external genitals alongside Little Hans' recorded recollection of the horses' black eye pieces and muzzles, which were assumed to represent his father's monocle and moustache. From these observations and conversations, Freud and the boy's father deduced that Little Hans' fear of horses was due to his Oedipus complex (Freud, 1955; Eysenck, 2004; Chung & Hyland, 2011; Freeman & Freeman, 2012). They proceeded to treat the boy by 'enlightening' him about his condition and reaffirming his intrigue with sexual organs by explaining that females have no penises but males do. The boy eventually overcame his fear as one would expect of a mild phobia of somebody of that age but Freud still presented this case an argument that behind every fear and anxiety there is an external danger, which in this case was castration (Freeman & Freeman, 2012).

It was discovered in the psychoanalysis of Little Hans that his phobia began when he witnessed a horse fall over whilst pulling a bus, it would therefore make sense that the phobia was caused by this incident (Wolpe & Rachman, 1960; Eysenck, 2004; Chung & Hyland, 2011). Critiques of Freud's analysis of the boy's phobia have therefore focussed on the validity and plausibility of his theory (Wolpe & Rachman, 1960; Eysenck, 2004; Chung & Hyland, 2011) often claiming that it was far-fetched and pre-scientific (Boring & Gardner, 1967). The main concerns centre on the how it is difficult to reproduce data when psychoanalysis relies on varying case studies and as such it is "rich in theorising but lacking in methodological rigour and deficient in facts" (Rachman, 2004: 246). In contention to the psychodynamic approach that was beginning to be developed in the early twentieth century with Freud's 1909 publication of Little Hans' experiences in *Analysis of a Phobia in a Five-year-old Boy,* John B. Watson (1878-1958) emerged with his own school of thought. Behaviourism, as it was termed, sought to displace the pre-scientific (Boring & Gardner, 1967) nature of Freud's psychoanalysis by introducing logical facts and methodological approaches to data collection within the field of psychology. The following section discusses the

introduction of behaviourism into mainstream psychology through its key thinkers and a famous experiment of similar standing to Little Hans. The famous Little Albert experiment was Watson's behaviourist version of exploring the development of fear in children. The results and conclusions of the experiment differ vastly from the present example of Little Hans and clearly highlight the differences between Freud's psychoanalytical approach and Watson's methodological behaviourism.

2.2 Methodological Behaviourism

Watson (1913) introduced his methodological behaviourism into mainstream psychology with the publication of the article *Psychology as the Behaviourist Views It*, which was latterly known as *The Behaviourist Manifesto*. In the beginning of this article, he extrapolates that psychology as the behaviourist views it is a purely objective experimental branch of natural science; with the central aim being the prediction and control of behaviour. Introspection and Freudian psychoanalysis, the mere observation of the mind, were not valid methods for this form of psychology. Instead, Watson encouraged the use of animals' response in experiments; claiming no dividing line between humans and beasts. Watson, clearly a fan of experiments involving animals is, however, mostly acknowledged for his famous experiment involving a human baby, his retort to Freud's Little Hans account. The *Little Albert* experiment, as it is commonly known, was Watson's proof that children can be conditioned from a young age.

The experiment involving Little Albert in the 1920s is often seen as the most controversial in the history of psychology (Beck, Levinson & Irons, 2009; Bartlett, 2012; Fridlund *et al.*, 2012). Watson, alongside his partner Rosalie Rayner, aimed to show how classical conditioning, a term that was newly introduced by Ivan Pavlov, could be applied to an 11-month-old boy and his conditioned fear of a white rat. Watson and Rayner conducted the experiment by placing a white rat in front of Little Albert; with the first presentation, Little Albert showed no fear but curiosity and intrigue. The second stage of the experiment involved placing the white rat in front of the boy whilst clanging an iron rod. Little Albert's response, as you could imagine, was one of fear; the child jumped suddenly, his breathing was short and sharpened, his lip started to tremble and he began to cry (Watson & Rayner, 1920: 2). This section of the experiment was repeated several times. In the final stage of the experiment, Watson and Rayner presented the white rat to the boy, without clanging the iron rod, and they discovered that the boy still showed fear. They also placed various other white furred objects such

as a Father Christmas mask, fur coat and white rabbit in front of the child and observed any reactions; he continued to show fear to the similar objects, which indicated that a conditioned response can be transferred to other stimulus.

Through this experiment, Watson displayed that emotions such as fear can be conditioned responses caused by direct and transferred stimuli and not from far-fetched complexes involving sexual interest in one's parents. This discovery was in contention to the Freud's psychodynamic approach, specifically his stages of development, where a child's behaviour is thought to develop from either nourishment or deprivation during key stages of growth, for example the oral and anal stages. Freud thought these stages were required to satisfy natural instincts and without satisfaction, the child would develop personality defects, however, Watson's experiment indicates that a child's behaviour is subject to conditioning and various environmental stimuli throughout development. Consequently, Watson and Raynor took their opportunity to disarm the Freudians with a quip that in future years psychoanalysts might be able to trace Albert's fear of a *seal skin coat* to an unresolved oedipal complex (Goodwin, 1999).

Regrettably for Watson's discovery, there has been a range of contention to this experiment; some arguing that it is morally wrong, others questioning the accuracy of the results. Beck, Levinson and Irons (2009) discovered that Little Albert had died from hydrocephalus, a condition of liquid in the brain, at the age of 6, which would have hindered his development, learning abilities and rate at which he responded to stimuli and conditioning. Bartlett (2012) later published a report suggesting that Watson was aware of such cognitive abnormalities in the infant but continued with the experiment despite this. If these arguments are true, they can invalidate the experiment and the birth of methodological behaviourism. However, even though the experiment is not a conclusive demonstration of the conditioning of infants, it still is an extremely important pivotal moment in the history of psychology. Watson's research gave behaviourism the publicity required to become a dominant force in American psychology (Goodwin, 1999).

After the Little Albert experiment, Watson was forced to resign from John Hopkins University due to the publicity of the affair he was having with Rayner, his research student (Chugh & Hyland, 2011). Following this dismissal, Watson chose to pursue marketing and apply his behavioural techniques to a consumer market. He joined the J. Walter Thompson advertising agency, which was based in New York and became vice president within a mere four years (Buckley, 1989). He used his time at J. Walter

Thompson to produce campaigns, which were based on his research surrounding the three central emotions: fear, rage and love and the impact that these had on the stimulation of desire (Fagerstrom & Arntzen, 2013). Emotional advertising techniques were not completely original within the field of consumer psychology as Watson adopted strategies that were pioneered previously by Walter Dill Scott. He did, however, introduce the idea of segmentation by using demographic data to target particular audiences (Coon, 1994). As with the Little Albert experiment, Watson's transition into advertising started to raise the profile of behaviourism again but this time within the field of consumer psychology.

To summarise Watson's attempt to initiate behaviourism one needs to comprehend that even though his arguments went far beyond the evidence he supplied to support them, the publicity he generated for the concept of behaviourism was paramount to its future success (Goodwin, 1999). In other words, Watson's data collection could not prove his excessive claims; e.g. one infant is not significant enough to represent an entire population, however, he did publicly discuss his strong beliefs, which originally created mixed views within academia but by 1935, his persistence and repeated arguments had installed a process that would eventually lead to behaviourism becoming the centre of experimental psychology in America. As a result, the origins of behaviourism are commonly thought to have begun with Watson in 1913 when he published *The Behaviourist Manifesto*; however, history is never that simple and one moment in time is often a lone chapter within a larger narrative (Goodwin, 1999). In other words there is no set moment in time when behaviourism was founded but prior and parallel to Watson, there were other psychologists who began to question the methods of introspection and consequently strove to discover a science of behaviour.

At the end of the nineteenth and beginning of the twentieth century, psychologists were already beginning to show dissatisfaction with Freud's introspective psychological methods and as a result, many improved the objectivity of their research methods. One example of this includes psychologists increasing the acceptance of evolutionary thinking and use of animals in the research process, which reduces the possibility of using of introspection and so in studying the relationship between human and animal consciousness a creation of objective and behavioural measures were adopted (Goodwin, 1999). One of the pioneers in objective animal psychology was the British psychologist Conwy Lloyd Morgan (1852-1936) who established that a dog's ability to open a gate is not due to intelligence and planning as previously

thought but down to trial and error. From this discovery comparative psychology was shifted from anecdotes to objective accounts of both stimuli and responses.

Thorndike's puzzle box from the 1890s is another example of the objectivity within animal psychology. His doctoral dissertation *Animal Intelligence: An experimental Study of the Associative Processes in Animals*, published in 1898, was the first psychological publication that involved the use of animals as opposed to humans. His central interest was whether these animals could learn tasks through either imitation or observation. Thorndike's experiment involved using puzzle boxes that were 20 inches long, 15 inches wide and 12 inches tall. Each puzzle box had a door, which was opened by a pulley system involving a piece of string and a weight. There was a lever or button inside the box that once pushed would start to operate the pulley system and open the door. The theory was that the animal inside the box would push the lever or button, which would cause the weight to lift and door to open. Boxes were used so that the animal was required to perform a response, which in this case was pushing a button or lever. He then measured the amount of time it took for the animal to escape. The final part of the experiment involved rewarding the animals that were "kept in a uniform state of hunger, which was practically utter hunger" (Thorndike, 1898; 96) for their behaviour by allowing them food if they were to escape.

Thorndike regularly recorded the behaviour of cats, dogs and chicks within his experiment; when they were first placed in the puzzle box, they would wander about; evidentially unaware of how to escape. Often the animals would accidentally stumble across the answer by pressing the lever with a limb and managing to escape. Thorndike attempted to test if his subjects would learn through observation by allowing one group of cats to observe another attempting to escape. He then compared the escape times of the voyeur cats to the control cats, who were not allowed any observation. The results were inconclusive and indicated that animals do not learn through observation. Just as Thorndike was becoming frustrated with his lack of findings, he discovered that after the animals accidentally stepped on the lever or button once, they would learn to press the lever faster in each successive trial they had in the puzzle box. Thorndike used this revelation and the escape times he had recorded to create a graph indicating a learning curve. In the learning curve, the animals often found it difficult at first, however, after they discovered how to escape, the escape times became increasingly shorter until they eventually reached the minimum escape time possible, creating a stable horizontal line. The escape rates resulted in an s-shape

learning curve. The curve was similar for different species; however, learning occurred at different speeds. From these puzzle boxes; Thorndike developed his theory, law of effect, which would later influence the work of the radical behaviourist B. F. Skinner.

Ivan Petrovich Pavlov (1849-1936) was also a major instigator in the behaviourist movement; he was a Russian physiologist who won the Nobel Prize for physiology in 1904. His most famous discovery, however, unknown to himself was within a discipline that will later be known as behavioural psychology. Whilst studying the salivation rates of dogs with his assistant Ivan Filippovitch Tolochinov, he had accidentally stumbled on the concept of conditioned reflexes. In Pavlov's physiological experiment on salivation rates he rang a bell prior to presenting the dogs with food. He discovered that the first couple of times he performed this sequence, the dogs would salivate when the food was presented in front of them, however, after several successive sequences, the dogs began to associate the mere ringing of the bell with food and as such they began salivate when the bell was rung, before the food had been presented.

Following this famous experiment, Pavlov's research from 1902 to 1936 turned towards his discovery of conditioned reflexes. He concluded that all nervous activity including *psychic activity* for highly organised animals such as dogs is based on a reflex action (Babkin & Babkin, 1949). Consequentially, even a highly complex behaviour can be classed as a response of an animal to a particular stimulus. The stimuli may influence the animal from both an internal or external source and can cause a response within the nervous system (Babkin & Babkin, 1949). His work also focused on two varying reflexes; conditioned and unconditioned. An unconditioned reflex is an inborn reaction to an internal or external stimulus by the organism; for example a human shivering when one is cold or a dog panting when it is warm. A conditioned reflex, on the other hand, is acquired during the organism's lifetime or in other words, a learnt response to a particular stimulus, which is what Pavlov revealed in the aforementioned canine experiment. The dogs began to associate the ringing of the bell with the offering of food. The natural inborn response or unconditioned reflex to being provided with food is to salivate and so when the dogs heard the ringing of the bell, they also started to respond by salivating. This is an example of a conditioned reflex and introduced classical conditioning into the psychology discipline and behaviourist school of thought.

Despite Pavlov's powerful discoveries, he was not widely known in America until 1920s, when much of his research was translated into English (Goodwin, 1999). There were also reports of Pavlov visiting the United States in 1925 and 1929, where he held a series of lectures at the Rockerfeller Institute in New York and at the Ninth International Congress of Psychology at Yale University, respectively. It was recorded that the audience was "spellbound" and showed their appreciation with a standing ovation and the occasional bow. From that moment on American psychologists and behaviourists such as J. B. Watson began to understand the relevance of Pavlov's research within their own concepts and principles of learning. It would be B. F. Skinner, however, who after reading Pavolv's *Conditioned Reflexes* (1927), would continue the Russian's research to create his own form of radical behaviourism.

Consequently, the main differences between the psychodynamic perspective and behaviourism lie in the way that data is collected. The psychodynamic approach, Freudian theories and Neo-Freudian thought focus on the unconscious mind and data collected from introspection. The private data of the unconscious mind forms the fundamental basis of psychodynamic thought and theories; however this private information is altered for public viewing and analysis, as in the case study of Little Hans. The ultimate problem with this approach lies in the dualities between the conscious and unconscious mind and public and private behaviour. These two dualities cause problems for data collection within psychology, as it is impossible to measure private unconscious behaviour without rendering it public at some point; a transformation, which if these dualities truly existed, would be not only be incredible but unfeasible. Consequentially, in the 1920s a new school of thought emerged from the US within the discipline of psychology. This was named the school of behaviourism and held the fundamental philosophy of realism; that a science of behaviour is possible and credible. Behaviourism rejected the private introspective data of previous theories as a viable scientific investigation by stating that any data which is recalled or private can be neither reliable nor objective (Baum, 2005). Alternatively, the school supported public data collection through observation of organisms, which introduced a science of psychology that could be observed, measured and documented. This methodological shift within psychology resulted in this school of thought becoming aptly named methodological behaviourism; key thinkers within this shift included the aforementioned psychologists J.B. Watson, Ivan Pavlov and Edward Thorndike.

2.3 Radical Behaviourism

The previous section explained that behaviourism become popular within American psychology in the 1930s, which was due to both Watson's talent at publicising his theories alongside the translation of Pavlov's publications into English. It was at this point that a post-Watsonian behaviourism emerged, with three psychologists at the forefront of the movement; Edward C. Tolman (1886-1959), Clark Hull (1884-1952) and B. F. Skinner (1904-1990). Whilst these three psychologists all supported different types of behaviourism, they embraced one label: neo-behaviourism. Tolman, Hull and Skinner were considered to be neobehaviourists because they had two common beliefs. Firstly, they thought that there was continuity between species; if a behavioural law applied to one species it was believed that it would also apply to another species. For instance, to understand human behaviour, non-human animals' behaviour could be examined and calibrated to that of human behaviour. Consequently, there was a substantial increase of animal subjects within experimental psychology between 1930 and 1960; generally being used for research into learning or conditioning. The second common belief between the neo-behaviourists was that behaviour is a learned state. In other words, it was thought that neo-behaviourists favoured the nurture side of the nature-nurture argument and to understand human behaviour, an in-depth analysis of how behaviours are learned was required (Goodwin, 1999; Baum, 2005; Chung & Hyland, 2011). Of the three different types of neo-behaviourism, the present thesis is concerned with the work of B. F. Skinner and what is termed *radical behaviourism*. Skinner differed from his fellow neo-behaviourists, Hull and Tolman by refuting their formal theories and creating a more inductive and descriptive behaviourism that searched for evidence of behaviours in three processes; the behaviour itself, the environment and the consequences of the behaviour. This evidence, according to Skinner, should be used in two ways; for prediction and control of behaviour. It was this approach to research that aided him to distinguish between Watson's and Pavlov's *classical conditioning* and his own *operant conditioning*.

B. F. Skinner's most famous invention was the operant conditioning chamber, which is more commonly known as the *Skinner Box.* He used this apparatus to develop his theory of operant conditioning through the intricate testing of a rat's responses to various visual and auditory stimuli. The success of the invention is portrayed by the extent to which it still dominates the experimental study of animal behaviour in psychology today (Pineno, 2013). The original and basic version included a lever and an entrance hole where food was released if the lever was pressed. The experiment

measured the response of the rat in relation to the lever; at first the rat would not be aware of the lever's function until trial and error led the animal to accidentally pressing the device and food to be released. After the positive reinforcement of food, the rat then associated the behaviour of pressing a lever with food, which heightened the rate at which the rat responded in future occurrences. Skinner used this equipment to experiment with responses and response rate by varying the reinforcement that was initiated after the lever was pressed; sometimes the rat received food (positive reinforcement), sometimes the removal of an electric shock was instigated (negative reinforcement), other times a shock was delivered (positive punishment) or there was a removal of food (negative punishment). The positive or negative reinforcements or punishments supplied to the rat, aided Skinner in both the control and prediction of behaviour, which gave birth to his most famous theory: *operant conditioning*.

Operant conditioning is when behaviour follows some consequence. The consequence determines the likelihood of the behaviour occurring in the future. If the consequence of the behaviour is positive, for example a rat receiving food, then the behaviour is likely to occur again. However, if the consequence of the behaviour is negative, for example the rat receiving an electric shock, then it is less likely to occur in future instances. Skinner labelled this theory operant conditioning because "the behaviour operates upon the environment to generate consequences" (Skinner, 1953: 65). To use operant conditioning as a prediction or to control behaviour, Skinner believed in an experimental analysis of behaviour; in other words, a full catalogue of behaviours such as lever pressing, the environment surrounding the organism e.g. the Skinner box and finally, the immediate consequences of performing the behaviour; positive reinforcement, negative reinforcement, positive punishment and negative punishment. He therefore focussed on how behaviours were shaped by the environment (Goodwin, 1999). *Classical or respondent conditioning*, on the other hand, is when a previously neutral stimulus (e.g. Pavlov's bell) is paired with an unconditioned stimulus (e.g. food) to produce behaviour (e.g. salivating); the neutral stimulus then instigates the behaviour without the presence of the unconditioned stimulus and hence becomes the conditioned stimulus. This theory accounts for some behaviour but it cannot explain behaviour where there appears to be no easily identifiable stimulus. Take the example of using a technology; one could not easily state what the sole stimulus would be that causes this response; there could be several with influence and other environmental and learning history factors that affect the response (Goodwin, 1999). On the other hand, understanding this behaviour in an operant manner, for instance what

consequences emerge from using technology, establishes the probability of the behaviour re-occurring, vital information when championing the benefits of continual technology use by people over the age of 65.

Operant behaviour can be expressed by the following equation, more commonly known as the three-term contingency:

$$\boldsymbol{S^d - R - S^r}$$

This concept focuses on the precedent and consequence of a behavioural response. R, being the response to S^d, the situational stimuli whilst S^r represents the reinforcing or punishing consequences. According to the three-term contingency, the S^r can either increase or decrease the probability of a future occurrence of the response in a similar situational environment. If the consequence of the response is positive, it becomes a reinforcing consequence and is therefore more likely to trigger further responses. Whereas if the consequence is punishing it is less likely to stimulate further responses. There is a balance between negative and positive reinforcers and punishers; Herrnstein's matching law (Herrnstein 1961; 1970) states that if the reinforcers outweigh the punishers then there will still be a high probability of a further occurrence, however, if the punishers equal more than the reinforcers then another occurrence is less likely to occur (Blackman, 1974). All these factors affect the rate at which the organism responds.

According to Skinner (1953; 1969; 1974) there are four different types of reinforcers/punishers that can engender operant learning. These are *positive reinforcement, positive punishment, negative punishment* and *negative reinforcement*. Whether the consequence (S^r) is labelled a *reinforcement* or a *punishment* depends on whether or not it reinforces the behaviour and encourages future instances. The labels of *positive* or *negative* describe the relationship between the behaviour (R) and the consequence (S^r); if the response (R) makes the consequence (S^r) more likely, then it is called *positive* but if it makes the consequence (S^r) less likely, it is called *negative* (Baum, 2005). For example a positive reinforcement would be the relationship between going to the library (R) and receiving good marks in an essay (S^r). Going to the library (R) increases the likelihood of receiving good marks (S^r) and at the same time receiving good marks increases the reinforcement to continue to go to the library. The relationship between setting a timer on the oven (R) and burning a cake (S^r) is an example of negative reinforcement; the burning of a cake reinforces the setting of a

timer (reinforcement), whilst the setting of a timer makes the burning of a cake less likely to occur (negative). An example of positive punishment would be the relationship between eating hot soup (R) and burning one's mouth (S^r). The relation is a punishment because burning one's mouth would decrease the likelihood of eating hot soup, it is also positive as eating hot soup makes it more likely that one would burn their mouth. Finally, an example of negative punishment is the relationship between talking in class (R) and receiving a good report (S^r). It is a punishment because if the child wanted to receive a good report they would have to stop talking in class; in other words receiving a good report would make talking in class less likely. The example is also negative because talking in class would make receiving a good report less likely (Baum, 2005).

Alongside classical and operant conditioning, another difference between Skinner's radical behaviourism and Watson's methodological behaviourism lies in the philosophical approach. Radical Behaviourists take a pragmatist rather than realist approach to avoid the dualistic view of a person's public and private events, which is incompatible with the ultimate philosophy that behaviourism is a science of behaviour (Baum, 2005).

> *"The part of behaviourism I rejected was the argument that science must confine itself to events accessible to at least two observers (the position of logical positivism) and that behaviourism was therefore destined to ignore private events"*(Skinner, 1984: 579)

This dualism is ineffective in science as it raises questions, which are impossible to answer without speculation; for instance, if this internal and external dualism was accepted, a science that measures only external behaviours would appear incomplete. Early behaviourists were therefore often criticised for excluding thoughts and feelings within their scientific research (Baum, 2005). Radical behaviourism consequently rejects this dualism by accepting private events as behaviours that, despite being accessible to only one person, are physical events and respond to similar environmental influences as the observable behaviours (Foxall, 1995). Consequently, radical behaviourism proposes that everything an organism does is behaviour including responses that were previously considered external such as eating, acting and speaking and responses that were previously considered internal such as thinking, sleeping and feeling. Skinner refutes the idea that thinking and feeling cause behaviour; instead arguing that they are behaviours themselves. As opposed to

thoughts and feelings instigating behaviour, he explains that all behaviour, private or public, is altered by environmental factors.

Consequently, another theory of behaviour analysis introduced into mainstream psychology by B. F. Skinner is *verbal behaviour*. Following a series of lectures at the University of Minnesota in the early 1940s, B. F. Skinner published his theoretical work on *Verbal Behaviour* in 1957. This book argues that verbal behaviour is similar to other operant behaviour and is consequently subject to antecedent and consequence events that evoke further responses, in this case a particular use of words. There is, however, a differentiation between verbal behaviour triggered by other people and verbal behaviour instigated by the environmental setting (Grow & Kodak, 2010). Within his publication, B. F. Skinner identified 7 different verbal operants.

Firstly, the *mand* is created from a motivating operation evoking the verbal behaviour, which is subsequently reinforced by a response-specific reinforcer (Michael, 1988). An example of which includes a child being hungry and asking his parent for "food"; the parent then provides the child with food. In this example, the hunger acts as a motivating operation whilst the food is the response-specific reinforcer. Secondly, the *tact* is verbal behaviour subject to discriminative control of a non-verbal, environmental stimulus, which evokes generalised reinforcement. In other words, if a child sees a plane and says "plane", the parent may praise the child which reinforces that specific verbal behaviour. Thirdly, an *echoic* response is a verbal behaviour that has point to point correspondence with a verbal stimulus. An example would be saying "dog" when somebody else had just said "dog". An *intraverbal* is also a response to other verbal behaviour but it is more of a reply and less of a repetition. For instance, if person A asks person B "Where is the train station?" and person B replies "Up the hill and around the corner", then person A reinforces this answer with a "Thank you", person B's reply is an example of an *intraverbal. Autoclitic* is a person's own verbal behaviour that modifies other forms of verbal behaviour, which directly effects reinforcement. In other words, using "I think" before a statement outlines the level of certainty of that statement and effects the subsequent reinforcement. For example, if a child says "I am really sick" they may be taken straight to see a doctor whereas if a child says "I think I am sick" the parent may just take a temperature or provide the child with another form of reinforcement. A *textual* is a verbal response which is influenced by nonauditory verbal stimuli; for example saying "cat" after seeing the letters C, A and T sequentially. Finally, *transcriptive* behaviour describes a response

that produces stimuli that have the same effects as verbal stimuli; for example writing C, A and T sequentially to produce "cat" as a response, which resembles the response of an *echoic* (Skinner, 1957; Frost & Bondy, 2006; Grow & Kodak, 2010; Dixon, Baker & Sadowski, 2011).

It has often been said that B. F. Skinner's *Verbal Behaviour* (1957) paved the way for the death of behaviourism following a scathing and undermining review by Noam Chomsky in 1959 (Smith, 1999). Chomsky (1959) stated that there were flaws in Skinner's theory stemming from the extrapolation of principals from non-human laboratory experiments to the human world of language. This view was adopted by many psychologists and initiated a cognitivist wave against *Verbal Behaviour* and behaviourism (Virues-Ortega, 2006). To say that this was the death of behaviourism, however, is a large exaggeration as behaviourism in the form of behaviour analysis and applied behaviour analysis is still very much alive today (Wyatt, Hawkins & Davis, 1986; Schlinger, 2008; Schlinger, 2010). Schlinger (2008) indicates the ever growing presence of behaviourism within modern psychology by providing figures of journal articles, university courses and book sales relating to the discipline. One such figure that truly encapsulates the Skinner versus Chomsky debate is that in 2007, the 50th anniversary of both academic's leading work, Skinner's *Verbal Behaviour* had double the book sales of Chomsky's *Syntactic Structures* (1957).

As indicated by Schlinger (2008), verbal behaviour is still used as a principle within modern psychology. A popular usage for the 7 verbal operants (Skinner, 1957) is to improve the verbal behaviour of children with developmental disabilities such as autism by providing a process that can facilitate the teaching of language (Sundberg & Partington, 1998; Sundberg & Michael, 2001; Grow & Kodak, 2010). This process has also been applied to older people suffering from Dementia who have already learnt a language but have difficulty recalling items, objects and names. The echoic operant is often the most effective in helping with language recall, especially aiding dementia patients in remembering the names of their loved ones and carers (Dixon, Baker & Sadowski, 2011). Consequently, despite the criticism that *Verbal Behaviour* has received across the 56 years after its publication, there is evidence that Skinner's theory can be applied to a variety of situations to improve both the verbal behaviour and quality of life of the participants.

There is also recent scholarship concerning Skinner's referral to Motivating Operations (MOs) within his publication of *Verbal Behaviour* (1957). Within the book, he identifies

problems with using the term motivation; however, he uses the word motivation and its derivatives 26 times in *Verbal Behaviour*. He also refers to motivation synonymously with other terminology such as deprivation, satiation and aversive stimuli (Skinner, 1957: 212). Additionally, according to Michael (2004: 59) "Skinner's concept of emotional predisposition identifies an operant aspect of emotion, as a form of motivating operation (although he did not use this term)". Skinner (1957) continues to mention emotion or operant emotion 154 times within the publication hence inadvertently referring to MOs on multiple occasions and throughout the book. From this evidence Sundberg (2013) presents 30 points about motivation that were outlined by Skinner in *Verbal Behaviour* but have later been extended by the continuous work of Jack Michael (Petursdottir, 2013). The present chapter will talk more of motivating operations in the following section but not before examining how Skinner's concepts are used in modern psychology.

3. The Application of Radical Behaviourism

3.1 Behavioural Analysis

The field of behaviour analysis involves applying Skinner's aforementioned theories to human behaviour. Behaviourist principles were originally applied to animals within a laboratory setting, for instance the Skinner box, but with the view that what was discovered in the laboratory with un-human subjects could also be generalised to humans outside this enclosed setting. A few courageous psychologists then decided to use human participants within a laboratory setting to discover strong support of the behaviourist principals. Experimentation on human behaviour later evolved into the outside world, again with successful supportive results of previous theories. From this history of behaviour analysis two separate methodological principals were created. The primary one involved the use of Skinner's theories within a laboratory setting, which is called Experimental Behaviour Analysis whilst the other technique is based in the exterior world and called Applied Behaviour Analysis (ABA; Sidman, 2011).

When behaviour analysis involves systematically studying variables that influence the behaviour within a real-world setting as opposed to a laboratory, it is called Applied Behaviour Analysis (ABA; Baer, Wolf & Risley, 1968). In 1968 Baer, Wolf & Risley outlined the dimensions and criteria of Applied Behaviour Analysis in the first publication of the *Journal of Applied Behavior Analysis*. According to this initial definition of ABA, there are seven different dimensions that the research must adhere to. Firstly,

the study must be *applied*, which means that it must be based in a real-world setting and focus on a behavioural issue that is socially significant. Secondly, it should be *behavioural*, which means it should measure behaviours from a pragmatic viewpoint; the research should not strive to alter a person's self-proclaimed behavioural habits but to alter what that person actually does. In other words "there is little applied value in the demonstration that an impotent man can be made to say that he no longer is impotent" (Baer *et al.*, 1968: 93). Thirdly, the applied research should be *analytical* by demonstrating that the independent variables actually influence the chosen behaviour. Fourthly, the empirical strategy should be developed to be "technological", which in this context means that "a typically trained reader could replicate that procedure well enough to produce the same results" (Baer *et al.*, 1968: 95). The final three dimensions were introduced to enhance the quality of ABA research and include using *conceptual systems* of behaviour analysis, being *effective* at improving behaviour and finally, having a *generality*, which means that the behaviour improvement continues over time (Baer *et al.*, 1968; Cooper, Heron & Heward, 2007).

In other words, according to Baer *et al.* (1968) if one were to proceed with an ABA study they should firstly choose a socially valid behaviour that requires altering for the good of the person or society (Baer & Schwartz, 1991). This behaviour should then be analysed in a real world setting; the researcher should strive to alter the actual behaviour by demonstrating that certain variables reliably increase or decrease the chosen behaviour. Secondly, the study should present a practical and effective change to the behaviour that continues over time and throughout different settings. Finally, during the research process, procedures should be adopted that are already established within behavioural sciences and these procedures should be replicable for further analysis (Carter, 2010).

It is commonly assumed that ABA research is used only for a particular type of problem amongst a specific set of people. This misconception has been produced from the success that ABA has had at treating and teaching people with autism and other mental health problems (Herbert, Sharp & Gaudiano, 2002; Kahng, Iwata & Lewin, 2002; Sturmey, 2002). The procedure, however, is not restricted to such issues and has been used successfully to implement operant psychology and other behavioural principles to study a plethora of behaviours from seat belt wearing (Van Houten, Malenfant, Austin & Lebbon, 2005), AIDS prevention (DeVries, Burnette & Redmon, 1991) and recycling (Brothers, Krantz & McClannahan, 1994) to decreasing problem

behaviour (Kuhn, Lerman & Vorndran, 2005) and teaching people with learning difficulties (Drasgow, Halle & Ostrosky, 1998). A few ABA studies that are relevant to this thesis include using communicative technology to decrease tardiness in college students through a system of text messages (Bicard *et al.*, 2012), using computer technology to improve skills such as braille reading (Scheithauer & Tiger, 2012) and understanding statistical interactions (Fields *et al.*, 2009). There is also a large scope of ABA research conducted using the older adult population but similar to the focus that ABA research has on Autism, these studies have mostly concentrated on dementia patients as opposed to the able minded older adults (Engelman *et al.*, 2003; Trahan *et al.*, 2011; Buchanan *et al.*, 2011; Ortega *et al.*, 2012).

3.2 Consumer Behaviour Analysis

Transferring the operant conditioning theory to real life events can be difficult due to the complexity and multitude of stimuli, behaviours and consequences within the environment. Consumer behaviour analysis, for example, is the application of behaviourism to the principles of real life consumer behaviour (Foxall *et al.*, 2006). One complexity of consumer behaviour analysis is that, unlike laboratory measured behaviours, the response is often both reinforced and punished by the consequences. In other words, purchasing a product can create the benefits of having the product or service whilst at the same time punishing the consumer for having to spend money, time and effort in the purchasing process (Alhadeff, 1982).

One model that was developed to manage the complexities of consumer behaviour is the Behavioural Perspective Model (BPM), which was initially introduced by Foxall in 1990 and subsequently revised in 1997 and 2007. The model has been applied to various consumer behaviours from Internet shopping (Fagerstrom, 2010) to environmental conservation (Foxall *et al.*, 2006). It is fundamentally an adaptation of Skinner's operant conditioning three-term contingency but using the context of consumer behaviour within a behaviour setting. The stimulus (S^d) is both the *consumer behaviour* and *learning history* of the consumer's previous purchases or consumptions, the response (R) is the *behaviour* of the consumer within the environmental setting of the *consumer situation.* Finally, the consequences (S^r) of the behaviour are split into four sections; *utilitarian reinforcement, utilitarian punishment, informational reinforcement* and *informational punishment*. A pictorial depiction of the Behavioural Perspective Model (BPM) can be seen in Figure 1.

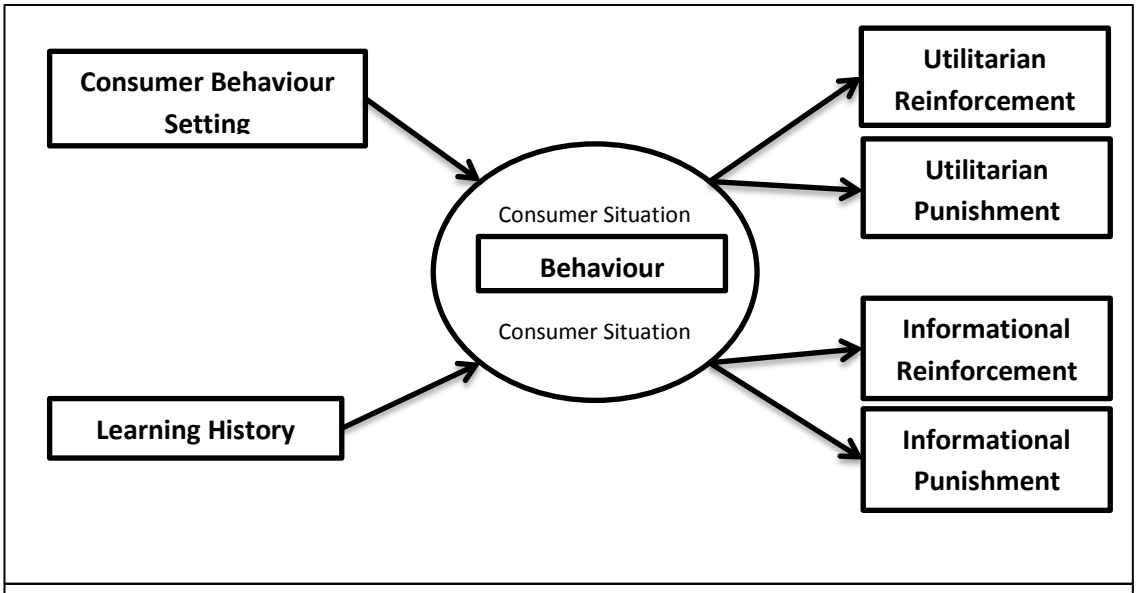

Figure 1: The Behavioural Perspective Model (BPM; Foxall, 2010a)

The *consumer situation* is comprised of the stimuli; *consumer behaviour setting* and *learning history* and these create the social and physical environment to the process described in Figure 1 (Barker, 1968). The *consumer behaviour setting* can be physical (shop environment, store branding and promotion), social (salesperson, friends and other customers), temporal (times of the year or week e.g. Christmas, shop opening hours) or regulatory (self-appointed regulations and rules of other organisations and governing bodies) (Foxall, 2005). It can also be described as either open or closed (Foxall, Oliveira-Castro, James, Schrezenmaier, 2011), which allows consumers to have varying levels of control over their behaviour. An example of an open setting would be a park or a festival where the consumer is provided with options of how to behave; wandering around, talking, eating, drinking or even leaving the area. Whereas, a closed setting is when a consumer is regimented by rules set by another person or organisation; they are less free and expected to conform to social regulations, for instance within a School environment.

Within the outlined *behaviour situation* is the consumer's *learning history;* this is his or her history of the behaviour within a comparable environmental setting. In other words, the consumer's previous behaviour in a similar setting creates either positive or negative reinforcements or punishers, which formulate the basis of the consumer's learning history and consequently their stimulus (S^d) for future behaviours within the behaviour setting. One example would be using free Wi-Fi in a café in a foreign country; if the experience was complicated or the connection was untrustworthy the

consumer would be less likely to use free Wi-Fi in an external setting again. However if the process was easy and enjoyable, the consumer would continue to use free Wi-Fi in various different external locations (Foxall, Oliveira-Castro, James, Schrezenmaier, 2011; Fagerstom, Foxall & Arntzen, 2010).

The *learning history* of the consumer provides the core section; *consumer situation* with context of previous behaviours within similar settings. The *consumer situation* is however more specific than a setting because it is not only defined by the stimulus from *learning history* but also by the *consumer setting* variables that indicate utilitarian and informational consequences of behaviour; these then create further stimulus for future behaviours. An example of a *consumer situation* would be if a consumer is in a neutral setting for the first time, then previous reinforcers and punishers of being in a similar situation will emerge in their *learning history* and consequently stimulus, which will evoke the behaviour they will perform in this novel environment (Fagerstom, Foxall & Arntzen, 2010). In other words, if this was the first time that somebody was in a cosmopolitan café they may draw on similar experiences of being in cafes or cosmopolitan environments to evoke a way of responding in this consumer situation.

The final section of the model involves the consequences of the consumer behaviour; these have been defined into four terms. Firstly, *utilitarian consequences* refer to the practical and functional results of purchasing and using a product or service. "They therefore reflect the value-in-use of a product or service, the economic, pragmatic or material consequences derived from acquiring, owning and using it" (Foxall, Oliveira-Castro & James, 2006: 103). These practical consequences can also involve feelings of enjoyment, arousal, amusement and sensory stimulation from the behaviour in question (Foxall, 2010a). For instance, the *utilitarian reinforcement* of buying a car may be easier and convenient travel, less time commuting to work, enjoyment from driving and a door-to-door service. Buying a car might also create *utilitarian punishment* such has having to spend a lot of money, having to buy car insurance and having to find a place to park the car. Secondly, *informational consequences* are related to social and symbolic influences on the behaviour. They are indicative of how the purchase or consumption of a product or service can make a consumer feel within a social setting. In other words, *informational consequences* are the evaluation of the behaviour in relation to the economic rationality alongside other social factors such as esteem and prestige (Foxall, 2010a). These consequences are often installed by other people and their opinions on the consumer's decision making. Continuing with the example of

purchasing a car; the *informational reinforcement* of such behaviour can include the opinion of value-for-money, social status of owning a particular car alongside admiration from others whilst *informational punishment* of owning a car could include envy from less fortune neighbours, which may install an element of embarrassment alongside feelings that the car will continue to depreciate in value.

The aforementioned consequences included in the BPM account for human consumer behaviour outside of laboratory or controlled settings. As a result, occasionally utilitarian but predominantly informational consequences can include the verbal behaviour attested to by Skinner in 1957, which influences the decisions that consumers make (Foxall, Oliveira-Castro, James & Schrezenmaier, 2011). It has been discovered that through the verbalisation of reinforcers, behaviour can be diverted from the patterns established in laboratory settings with non-human participants. Human participants' verbal behaviours create rule-governed behaviour that influences their operant performances (Horne & Lowe, 1993; Foxall, 1994; Foxall & Greenley, 2000). These rules may be introduced by advertisers or retailers in an attempt to control consumers within a particular open or closed setting. An example of which, includes the pretence that cinema-goers should eat popcorn as a snack during the film. Most consumers would not purchase popcorn independently of film watching but from advertisements and verbal behaviour, popcorn has been synonymously linked to cinema going. Alternatively, rules may be formulated by the consumer about their own purchase behaviour through contact with advertising, personal experience or behaviour instructed by others (Foxall, 1992). For instance, if a consumer is told that a certain brand of sportswear is reliable and comfortable they might always purchase this particular brand independent of what type of product they require e.g. socks, boots, shorts, vest etc. This rule-governed behaviour is especially prominent in purchasing situations where people are unfamiliar; if said consumer had never purchased sportswear before, they are likely to acts on rules developed from other people's instructions or advertising campaigns (Foxall, 1999).

Depending on what utilitarian or informational consequences the consumer behaviour produces, there are varying schedules of reinforcement, which can operate on four different types of consumer behaviour that Foxall (1992; 1993; 1994; 2010a) identified as maintenance, accumulation, hedonism and accomplishment:

	High utilitarian reinforcement	Low utilitarian reinforcement
High informational reinforcement	ACCOMPLISHMENT	ACCUMULATION
Low informational reinforcement	HEDONISM	MAINTENANCE

Table 1: Operant class of consumer behaviour (Foxall, 2010a)

Firstly, as depicted in Table 1, *maintenance* is controlled by low levels of both utilitarian and informational reinforcement on a *fixed interval* (FI) schedule. *Maintenance*, therefore, refers to a routine behaviour that is necessary for the consumer to maintain their life and well-being. For instance, *maintenance* could refer to eating food, drinking water, buying prescriptions and paying taxes. With reference to paying taxes and buying prescriptions, *maintenance* behaviour can often be controlled by a threat; the removal of this threat can negatively impact the occurrence of the behaviour. Secondly, *accumulation* is controlled by low levels of utilitarian reinforcement and high levels of informational reinforcement on a *fixed ratio* schedule (FR). *Accumulation*, therefore, involves a series of planned acquisitions that, due to the promise of further reinforcement, continue in a repetitive fashion to acquire a further reward. One example of accumulation involves continuously going to a particular supermarket to use a 'storecard' to gain future discounts and credit within the store. Thirdly, *hedonism* is behaviour that is influenced by high levels of utilitarian reinforcement and lower levels of informational reinforcement on a *variable interval* (VI) schedule; for instance hedonistic behaviour is often reinforced by entertainment. An example of pleasure driven behaviour involves buying and using a Laptop for entertainment purposes; the temporal use of the Laptop depends on the specific entertainment reinforcement that it produces. Finally, *accomplishment* is controlled by high levels of both utilitarian and informational reinforcement on a variable ratio (VR) schedule; it, therefore, involves a sense of social or economic achievement, which often produces regular responses at a high response rate. For instance, accomplishment could include the pre-purchase search for luxury goods and the consumption of said luxurious products (Foxall, 1992; 1993; 1994).

These classes of consumer behaviour all occur within the consumer behaviour setting along a scale from open to closed; an open setting can control different behaviour to a

closed setting (Foxall, 1992; 2010a). Table 2 indicates 8 different categories of accomplishment, hedonism, accumulation and maintenance in both closed and open settings. Each of these *contingency categories* within the *behaviour setting scope* have been previously tested using Mehrabian and Russell's (1974) *Approach to Environmental Psychology*, which measures the emotional reactions to environmental stimuli using three different categories entitled *pleasure*, *arousal* and *dominance.* As was predicted by the BPM, these attitude responses vary across a range of consumption contexts, which indicates that situation factors, consumer setting scope and consumption history can indicate likely responses within particular contexts (Foxall, 1998; 1999). This research has also been transferable across different languages and cultures (Foxall & Yani-de-Soriano, 2005).

	Closed	**Open**
Accomplishment	Fulfilment (CC2)	Status consumption (CC1)
Hedonism	Inescapable entertainment (CC4)	Popular entertainment (CC3)
Accumulation	Token-based consumption (CC6)	Saving and collecting (CC5)
Maintenance	Mandatory consumption (CC8)	Routine purchasing (CC7)

Table 2: Contingency Categories as Situational Outcomes (Foxall, 2010a)

The BPM has been used in various consumer behaviour contexts; it interprets behaviour through the analysis of a person's learning history and environmental setting in which the behaviour is enacted. It can be put to practise by marketers in two different ways; firstly, managing the scope of the consumer behaviour setting can improve consumer behaviour responses; secondly; utilitarian and informational consequences can be managed in the way they are made available to the consumer (Foxall, 1999). Various scholars have used the model to generate empirical research that clarifies the practise and theory of behaviour by both the aforementioned marketer and the consumer (Foxall & Greenley, 2000; Foxall & Yani-de-Soriano, 2005; Nicholson, 2005; Foxall *et al.*, 2006; Xiao, 2006; Yermekbayeva, 2011). There is an argument, however, that the concept of motivation has been ignored within the framework and requires further analysis (Fagerstrom, Foxall & Arntzen, 2010). The following section

therefore explores the concept of motivation in order to combine it with the BMP to form a more comprehensive analysis of a complex behaviour, which in this instance is technology use by older adults.

3.3 Motivating Operations and the Behavioural Perspective Model

An establishing operation is what B.F. Skinner first referred to as a 'third variable'. He stated that "one needed to refer not only to the stimulus and the response but to conditions which changed the relation between them. I called these conditions 'third variables'" (Skinner, 1980: 194). The term Establishing Operation (EO) was first used by Keller and Schoenfeld in 1950 and later by Millenson in 1967. It was reintroduced into behavioural psychology in the early eighties through a series of papers by Michael (1982a; 1988; 1993; 2000) who provided the definition:

> *"An EO is an environmental event, operation, or stimulus condition that affects an organism by momentarily altering (a) the reinforcing effectiveness of other events and (b) the frequency of occurrence of that part of the organism's repertoire relevant to those events as consequences"* (Michael, 1993: 192).

Therefore an EO is likely to affect both the consequences (S^r) of an initial response and subsequently the stimulus (S^d) of future behavioural responses, which in turn affects the probability of repetition of the behaviour (Laraway, Snycerski, Michael & Poling, 2003; Edrisinha *et al.*, 2006). A typical example of an EO is hunger. If somebody is hungry they are more likely to want to buy a chocolate bar; the higher the hunger level, the higher the desire to purchase the chocolate. The act of buying the chocolate bar is the response to the EO and the stimuli, which in this case could be a previous experience of purchasing the chocolate bar, alongside the available options of chocolate. The consequences of buying the chocolate bar are both positive and negative; the chocolate bar may taste good and influence further purchase, however, it does cost money to buy, which can in turn be a negative reinforcement. When an EO such as hunger is involved, the consequences as well as the stimulus are affected; in this case, the hungrier the consumer is, the more satisfying the chocolate bar becomes and this can influence future purchase of the same chocolate bar. The memory of satisfying hunger increases the positive reinforcement of the purchase and increases the likelihood of a repeat purchase. Moreover, the hunger also affects the negative reinforcement by reducing its impact; in other words, if somebody were hungry, they would be more likely to buy a chocolate bar despite the amount of money it may cost them.

There are two different types of Establishing Operations (EOs); unconditioned establishing operations (UEO) and conditioned establishing operations (CEO). An UEO is when the reinforcer-establishing effects of a stimulus condition are unlearned. This means that they were dependent on the evolutionary history of the organism; which may vary from one species to another. An EO is categorised as 'unconditioned' when the reinforced establishing effect is unlearned (Michael, 1993). An example of this would be the feeling of being too warm. Knowing when one's body is too warm or too cold is evolutionary and unlearned, it does, however, increase the value of cooling down. Therefore if somebody was sat in a warm room, wearing a jumper; their environment and previous learning history would indicate that they should remove their jumper to produce the effect of cooling down. The feeling of being too warm as an EO, adds extra value to the removal of the jumper. The person's response is therefore to remove their jumper, which in turn reduces the feeling of being warm, creating positive reinforcement and encouraging future behavioural occurrences. In other occasions there are variables learned from the organism's history that may alter the reinforcing effectiveness of an event. These are called conditioned establishing operations and these are developed after birth and throughout the lifetime of the organism. The CEOs, similar to the UEOs, can alter the frequency of the behaviour that has been either reinforced or punished by preceding events and behaviours (Michael, 1993). An example of a CEO is an almost empty petrol tank when driving; this increases the positive consequences of finding a petrol station and refuelling the car whilst abolishing the negative reinforcement of having to spend money. In other words, an empty tank increase the value of filling up the tank and decreases any negative feelings of having to spend money.

In 2003, it was suggested by Laraway, Snycerski, Michael and Poling that the term Establishing Operations (EO) be part of a larger term, Motivating Operations (MO), which refer to "an environmental event that first establishes (or abolishes) the reinforcing or punishing effect of another event and second, evokes (or abates) behaviours related with that event" (Laraway *et al.*, 2003: 412). Establishing Operations (EOs) are environmental events that increase the reinforcing or punishing consequences of the behaviour, whilst the term Abolishing Operation (AO) refers to an environmental event that reduces the effectiveness of reinforcing or punishing consequences. Both EOs and AOs belong under the umbrella term, Motivating Operations (MO).

The most difficult challenge of applying MOs to behaviour is deciphering between discriminative variables and motivative variables. Michael (1993) describes the distinction as follows:

> *"Discriminative variables are related to the differential availability of an effective form of reinforcement given a particular type of behavior; motivative variables are related to the differential reinforcing effectiveness of environmental events"* (p. 193)

Consequently, if we refer the concept of the MO to a consumer setting; it changes how much a consumer wants something whilst the stimulus (S^d) alters the chances of the consumer getting what they want (Fagerstrom *et al*., 2010). For instance, the price of a car determines whether or not the consumer can afford to purchase the vehicle; this acts as a stimulus (S^d) to the behaviour of buying a car. A Motivating Operation (MO) such as the high esteemed branding of the car can operate on the negative effects of the cost. In other words a consumer may be willing to spend more on a car than they can reasonably afford because the car is an esteemed brand that people will admire. According to Michael (1982; 1993) it is imperative to make an explicit distinction between S^d and MO in applied behaviour analysis and the consumer behaviour setting so that there is a discrepancy between antecedent events that produce motivational functions and the stimulus that evoke an operant response.

The complex setting of consumer behaviour could never be independently measured using the three term contingency (Skinner, 1953); this is because the environment could not be realistically simplified and controlled , which is why Foxall (1992; 1993; 1994; 1995) first introduced the Behavioural Perspective Model (BPM). Just as the three-term contingency has been adapted into the MO inclusive four-term contingency (Skinner, 1957; Michael, 2004; Sundberg, 2013), Fagerstrom, Foxall & Arntzen (2010) and Fagerstrom & Arntzen (2013) now argue for the incorporation of MOs into the BPM framework to distinguish between learning history within a consumer behaviour setting and the motivating operations influencing response:

> *"MO explicitly identifies antecedent motivating events that previously have been underemphasized in the BPM. The concept of MO helps to distinguish between discriminative and motivational functions of antecedents in the consumer behaviour setting."* (Fagerstrom, Foxall & Arntzen, 2010: 122)

According to Fagerstrom *et al.* (2010), MOs have two effects, which are important when considering the inclusion of motivating functions into the BPM. These are value-

altering effects and behaviour altering effects both of which occur simultaneously yet independently (Michael, 2000). The first effect (value-altering) is related to the consequences of responding and either increases or decreases the value of responding. For instance, if somebody were thirsty this would increase the value of water and may result in somebody paying more for a bottle of water than would usually be regarded as reasonable. The second effect (behaviour-altering) is the effect of responses related to the consequences. This effect either evokes or abates the consumer behaviour. For instance being thirsty increases the likelihood that somebody will buy a bottle of water and hence 'evokes' this behaviour whist, on the other hand, if somebody had a quenched thirst they would be less likely to buy a bottle of water, which 'abates' the behaviour (Laraway *et al.*, 2003). Fagerstom, Foxall & Arntzen (2010) indicate 8 categories where Establishing Operations (EOs) and Abolishing Operations (AOs) act on utilitarian and informational consequences within a value-altering context in an attempt to conceptualise the introduction of MOs in the BPM. The subsequent section uses Fagerstrom *et al.*'s (2010) eight categories as a basis to create example scenarios within technology consumption that indicate the effects of EOs and AOs on informational and utilitarian reinforcement and punishment.

Table 3 indicates conditioned AOs and EOs on informational and utilitarian punishment. According to Michael (1993) there are three types of conditioned establishing operations (CEOs), which were re-termed as conditioned motivating operations (CMOs) by Laraway *et al.* in 2003. The three different CMOs that act on *utilitarian and informational reinforcement and punishment* are as follows (a) surrogate, (b) reflexive, and (c) transitive (Michael, 1993). Firstly, *surrogate conditioned motivating operations* (CMO-S) take effect on behaviour by being paired with either a UMO or already established CMO; the CMO-S then has the same effect on the behaviour (R) and its consequences (S^r) as the original MO. A consumer behaviour example of a CMO-S would be if hunger (UMO) and various learning history stimulus (S^d) originally prompted the purchase of a cheese sandwich (R) on an aeroplane (CMO-S). The hunger (UMO) increased the positive reinforcement (S^r) of purchasing the cheese sandwich (R) and so in future when the consumer travels on an aeroplane (CMO-S) they, despite being hungry or not, may have the inclination (S^d) to buy a cheese sandwich (R). The situation of being on aeroplane consequently becomes the CMO-S for the behaviour of purchasing the sandwich.

	Establishing Operations	Abolishing Operations
Utilitarian Reinforcement	An emergency where somebody requires an ambulance has an establishing effect on the reinforcing consequence of using a mobile phone.	Being somewhere without mobile phone signal has an abolishing effect on the reinforcing consequence of owning and using a mobile phone
Utilitarian Punishment	Leading a hectic life and being in a hurry may have an establishing effect on the punishing consequence of waiting for a computer to start up.	Being retired and leading a relaxing life may have an abolishing effect on the punishing consequence of waiting for a computer to boot up.
Informational Reinforcement	Having a relative in another country might have an establishing effect on the reinforcing consequences of using the Internet to connect with people.	When a company such as Apple bring out a new iPad it may have abolishing effects on the reinforcing consequences of using the older iPad.
Informational Punishment	The effects of the recession may have an establishing effect on the punishing consequences of buying and using an expensive piece of technology, which could create resentment and jealousy.	An increase in popularity of the kindle may have an abolishing effect on the punishing consequences of a predominantly traditional book group member using a kindle.

Table 3: The value altering effect of AOs and EOs on utilitarian and informational reinforcement and punishment (Originated from Fagerstrom *et al*., 2010)

Secondly, *reflexive conditioned motivating operations* (CMO-Rs) are originally neutral stimuli (S^d) that become establishing operations by being correlated with either the "worsening" or "improvement" (Michael, 1993) of somebody's condition. If the CMO-R is correlated to "worsening", its removal acts as a reinforcer and evokes responses related to the removal. However, if the CMO-R is correlated with "improvement", its removal is established as a punisher and therefore it suppresses responses related to its removal. The concept of the CMO-R can be easily applied to teaching a child; for example the neutral stimulus of a slip of paper can become a CMO-R for a child. If a child is misbehaving and receives a 'black mark', in the form of a piece of paper, at school; this stimuli is correlated with other aversive stimulus, such as being sent to the head teacher or having detention, therefore the child's condition is "worsened". The

presence of the black mark is associated with the negative reinforcement of misbehaving. Consequently, the removal of the 'black mark' can be used as reinforcement to abate bad behaviour and it is the motivation of the black mark's removal, which makes it a reflexive conditional establishing operation (CMO-R).

CMO-Rs may also influence a child's performance at school. For instance, if a child behaves and performs well, they may be rewarded with a prefect's badge. The neutral stimulus of a badge becomes a reinforcement of good behaviour by being correlated with other types of reinforcement such as privileges and peer respect, which is an "improvement" of the child's condition. The prefect's badge becomes a CMO-R when its removal from the child acts as an effective type of punisher for misbehaviour. In other words, if a child in possession of a prefect's badge misbehaves at school, a punishment for that child could be removal of the badge or a threat of removal. The potential for the removal of the badge evokes good behaviour in the child and therefore the continued ownership of the badge.

A CMO-R within a consumer behaviour setting involves the presence of red sale stickers on a food item; when shopping in the supermarket, the large amount of products available results in consumers relying heavily on the consumer setting and their learning history. The neutral stimulus of a red sticker indicating a sale item acts as a CMO-R on the purchase of that product. The presence of the sticker indicates further positive reinforcement of purchasing the product such as a lower price or a higher value-for-money, which "improves" the consumer's situation. The removal of the sticker creates punishing effects of purchasing the product; as the item is removed from the sale and the price is increased. The knowledge that this could happen motivates the buyer to purchase the product whilst it is in the sale; a red sticker therefore acts as a CMO-R by motivating purchase with the threat of its own removal.

Finally, *transitive conditioned motivating operations* (CMO-T) are neutral stimuli, which alter the reinforcing or punishing consequences of another stimulus and motivate responses that evoke or abate that stimulus (Michael, 1993). Within a consumer setting, an example of a CMO-T would be the purchase of a smart phone in relation to the purchasing of a Scrabble application for the new technology. The purchase of the smart phone alters the reinforcing effectiveness of the supplementary applications for that particular technology, which therefore evokes the purchase of a Scrabble application. The purchase of the Scrabble application is motivated by the neutral stimulus of purchasing a smart phone; this is an example of a CMO-T. In the present thesis, both

CMO-Rs and CMO-Ss are proposed as motivating technology use. CMO-Ts have been omitted from the propositions as these would spread the focus of the thesis away from technology use as an operant behaviour towards other behaviours that are connected with technology, for example buying applications. This would complicate the analysis of the behaviour and prevent logical and applicable recommendations concerning policy and charity.

Previous literature on MOs often focusses on challenging behaviour (Edrisinha *et al.*, 2006; O'Reilly *et al.,* 2006), problem behaviour (Call, Wacker, Ringdahl and Boelter, 2005; McGill, 1999) and aberrant behaviour (O'Reilly, 1999). There appears to be a neglect of motivation within consumer behaviour literature, with the exception of Fagerstrom, Foxall and Arntzen (2010) who argue for the inclusion of MOs into the BPM framework, and Fagerstrom (2010) who measures the influence of CMO-Rs on online consumer shopping. His work focuses on the behaviour of purchasing products online and the motivating impact of antecedent stimuli on this behaviour. Such stimuli include; in-stock status, price, other customers' reviews, order confirmation procedures and donation to charity. Although Fagerstrom's (2010) work introduces motivational operations in online consumer behaviour, there is definitely scope for further research into the impact of MOs on technology consumption. The present thesis, consequently, concerns itself with the impact of CMOs on the usage of technology after the purchase phase.

Foxall (2010a) identifies five different overlapping temporal phases of the BPM research within the past 33 years, none of which he believes are complete. The first phase, predominantly between 1980 and 1990 was the *conceptual* phase, which involves critical analysis of the cognitive paradigm from a behavioural perspective. Secondly, the *theoretical* development of the BPM occurred mostly between 1989 and 2000 and involved the development of the model to produce a radical behaviourist methodology that could be utilised in the analysis of economic behaviour and interpretation. The third phase is the *empirical* stage from 1997 onwards, which involves using the model to predict consumer behaviour within particular consumption contexts. From 2000 onwards, the BPM has been used to develop behavioural economic approaches in what is termed the *behavioural economic* phase. Finally, the *philosophical* phase emerged from 2003 to present and has resulted in the development of post-behaviourists models of consumption, which include intentional behaviourism (Foxall, 2007a; 2007b; Foxall & Oliveira-Castro, 2009). By identifying and incorporating MOs into the BPM, the present

research will be targeting the *philosophical* development of the model, alongside advancing the *empirical* stage by applying this theory to a situation of technology usage.

3.4 Technology and Consumer Behaviour

The present thesis is concerned with the motivating operations of the post-purchase consumer behaviour of technology use. The previous section has discussed the inclusion of MOs into the consumer behaviour model BPM; the following section will discuss present models of technology use and create an argument for the inclusion and application of MOs into the technology acceptance research. Present models of the acceptance of information technology include intention based models such as the theory of reasoned action (TRA; Ajzen & Fishbein, 1980; Davis *et al.*, 1989), the theory of planned behaviour (TPB; Ajzen, 1991) and the technology acceptance model (TAM; Davis *et al.*, 1989). Another widespread theory includes the diffusion of innovation theory (Rogers, 2003), which has subsequently been analysed using the behaviourist principles of the BPM (Foxall, 1994). The following section will discuss TAM, the mostly widely used technology acceptance model before proposing a theoretical shift towards consumer behaviour principles.

The preferred model used to test technology acceptance and adoption is the Technology Acceptance Model (TAM), which accounts for 10% of all publications relating to Information Systems (Holden and Karsh, 2010). With such a large influence and application, it is important to not only understand the background behind the model but to discover its strengths and limitations. TAM was first developed by Davis, Bagozzi and Warshaw in 1989 to monitor technology acceptance in the workplace. The theoretical hypothesis of the TAM is that technology acceptance can be established by the internal beliefs, attitudes and intentions of the users. Consequently, TAM is used to predict the technology use of a new piece of software or hardware that may be introduced to a workplace. If the TAM questionnaire was given to a company's employees at the time of the new technology introduction, the results of the survey should indicate if the technology is to be used sufficiently (Turner *et al.*, 2010).

The model was developed from an extension of Ajzen and Fishbein's (1980) Theory of Reasoned Action (TRA) with the additional factors *perceived usefulness* and *perceived ease-of-use* attached. These factors were previously developed by Davis in 1989. *Perceived usefulness* (PU) is "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davies, 1989: 320) and

perceived ease-of-use (PEOU) is "the degree to which a person believes that using a particular system would be free from effort" (Davis, 1989: 320). The original TAM (Figure 2) therefore has the following internal variables: perceived ease of use (PEU), perceived usefulness (PU), attitude toward use (A) and behavioural intention to use (BI); all of which indicate the actual use of the technology.

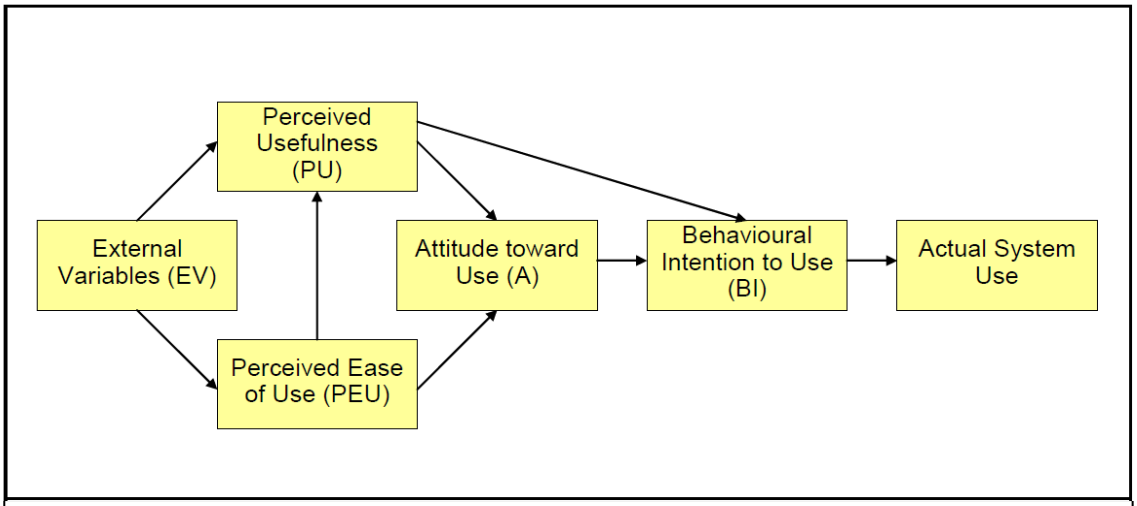

Figure 2: Technology Acceptance Model (TAM). Source: Renaud & Van Biljon (2008)

Figure 2 pictorially displays the original TAM, with the components of the TRA model on the right (A, BI and actual use) and the components of Davis, Bagozzi & Warshaw's (1989) extension on the left. The external variables (EV) are variables, which are likely to influence perceived usefulness and perceived ease of use. Many academics have explored what these variables could be and which ones are important when applying the model. Pavlou (2003), for example, demonstrates the importance of integrating trust and risk into the model, especially in correspondence with e-commerce and internet transactions; therefore applying the model to situations not based in the work environment. Both Venkatesh (2000) and Van der Heijden (2004) intend to integrate computer playfulness and perceived enjoyment of usage into the TAM. In addition, Morris and Venkatesh (2000) investigate the implications of age on the technology adoption process and the TAM. They discovered that age has important influences on technology adoption and sustained usage decisions. For instance, younger people had increased positive attitudes towards using new technologies whilst older people responded to subjective norms and perceived behavioural control more strongly, which according to Morris and Venkatesh (2000) hindered their likelihood of accepting

the technology. Other external variables tested as influencing technology acceptance include subjective norm (Schepers & Wetzels, 2007), control, intrinsic motivation and emotion (Venkatesh, 2000). Extending TAM can have its advantages in that it attempts to rethink a model that is simplified and lacking in elements.

Consequently, Venkatesh & Davis (2000) proposed a revised version of TAM, which is referred to as TAM2. This updated model excludes attitude towards use as a variable and includes supplementary variables, for example experience and subjective norm. Although the model has been altered, the theory behind the model remains unchanged. Consequently, the limitations that apply to TAM's theoretical basis continue to apply to TAM2. In attempts to improve the TAM, additional variables have been introduced and the model has become broadened and complicated. One example of this includes Venkatesh *et al.*'s (2003) proposed unified theory of acceptance and use of technology (UTAUT), which is a well thought-trough model with good intentions, however, what is produced is a framework with 41 independent variables for predicting intentions and at least eight for predicting behaviour (Bagozzi, 2007). Another adaptation and extension is Venkatesh and Bala's (2008) TAM3, which appears to have 16 variables and even more relationships between the variables. These adaptions of TAM are extremely complex and would be difficult to apply to a technology acceptance situation.

There have been arguments against the dominance of TAM and its revisions within the technology acceptance literature. This has been due to the questionable accuracy of the variables within the model (Turner *et al.*, 2010) and the failure to successfully apply TAM to other contexts outside the original workplace (Holden & Karsh, 2010). In a systematic review, Turner *et al.* (2010) discovered that few papers using TAM actually measured the use of technology objectively. Many studies relied on subjective accounts of usage as opposed to objective computer recorded usage or system logs of information. Alongside this, the studies indicated a questionable reliability of PU and PEU as variables of usage; they were worse predictors of actual usage than the original TRA variable 'Behavioural Intention to Use' (BI). The central reason for this is that PU and PEU were defined based on the values and attitudes of the test population (Davis, Bagozzi & Warshaw's, 1989); this sample of people was comprised of employees at a time when technology was novel and as such attitudes and values have changed alongside the context in which technology is being adopted. As Holden and Karsh (2010) indicate PU was defined in accordance with improvements to personal

productivity; this may not therefore be transferrable to other organisations, such as within the healthcare sector, as usefulness can refer to patient outcomes and not just employee experiences. In addition, the model bares little predictive value to an individual's acceptance of a technology outside of an organisational setting.

Bagozzi (2007) also points to several gaps in the model and takes issue with previous attempts at rectifying said gaps (Venkatesh & Davis, 2000; Venkatesh *et al.*, 2003). The majority of research in accordance to TAM leads to a broadening of the model by introducing additional predictors for PU or intentions. In previous literature, there has been little deepening of the model by explaining PU and PEU or reconceptualising existing variables. As a result the gaps that Bagozzi (2007) indicates are between intentions and behaviour, PU and PEU. As a solution to these gaps, he suggests a paradigm shift by outlining that adoption, acceptance or rejection of technology is a process that is established by goal striving. Unfortunately, the goal striving model that Bagozzi (2007) presents as an alternative to TAM is still not ideal for the present thesis as it remains focused on the acceptance of technology in the workplace, it assumes that use is a decision based on attitudes and intentions and it still concludes with *intention to act*, which according to the behaviourist literature does not always evoke actual usage. With both TAM, extensions of TAM and Bagozzi's (2007) goal striving model, there is no reference to how often the technology is used, which is vital in determining the level of technology acceptance. There is also little reference to the environment in which the technology is being adopted; be this a workplace, a public or a private location. Wells, Campbell, Valacich & Featherman (2010) also strive towards a paradigm shift away from TAM by introducing innovation literature and perceived novelty (Rogers, 2003) as an alternative predictor of adoption. Their results indicate a strong influence of perceived novelty on intention to use, unfortunately, the chosen theoretical basis still lies within intentions, attitudes and the TRA model, and does not solve the flawed relationship between intention to use and behaviour. A paradigm shift, on the other hand, of predicting and controlling technology usage can be installed by applying a model based on operant conditioning such as the BPM, which would account for individual responses (technology usages), alongside any antecedent environmental stimuli of behaviour.

Venkatesh & Brown (2001) propose a model of technology adoption within households (MATH) and use the proposed reinforcers within the BPM; utilitarian and informational consequences but posing under the terminology utilitarian outcomes,

hedonic outcomes and social outcomes. Although the model is a refreshing variation to TAM and is developed to measure technology adoption within a household as opposed to a workplace, its psychological basis still remains within cognitive psychology as Venkatesh and Brown (2001) decided to base their model on the Theory of Planned Behaviour (TPB), an improvement to the TRA developed by Ajzen (1985, 1991). There is, therefore, a distinct lack of technology and innovation literature that has used behavioural principles. This is with exception to Foxall (1994) who utilised Roger's (2010a) diffusion of innovation theory to test and incorporate the BPM in innovation literature.

Diffusion of innovation was first published by Everett Rogers in 1962; it is now in its fifth edition (2003). It conceptualises innovation adoption as being moulded by a process of communication and social influence. In other words, a network of innovation users report the benefits of the using the device in an attempt to encourage others to join the behaviour. As expressed by the following quote, an innovation or technology requires social networks of adoption for it to be successful:

> *"With each additional adopter, the utility of an interactive communication technology increases for all adopters. An illustration is provided by the very first individual to adopt a telephone in the 1870s. This interactive technology had no utility until a second individual adopted."* Rogers, 2003: 343

The theory continues to outline why certain innovations are adopted rapidly whilst others suffer or are used only minimally over time. The most valuable factors that contribute towards the innovation are as follows: relative advantage, compatibility, complexity, trialability and observability (Rogers, 2003). According to Rogers (2003) these factors have different effects on people who adopt innovations at varying speeds; from the innovators who will purchase and use a new technology in its very earliest stages to the laggards who only purchase when the innovation is a low cost household name. For each of these adopters, there are five main stages to the adoption process, which include the consumer becoming aware of the innovation (knowledge phase), the consumer being persuaded that they need the product (persuasion phase), the decision phase leading to a purchase, the product being used (implementation phase) and finally evaluated in the confirmation phase (Renaud & Van Biljon, 2008). Foxall (1994) applied the BPM to Roger's bell curve of adopters (see Figure 3) and assigned a behaviour setting scope to each of the adoption categories. This application of accomplishment, pleasure, accumulation and maintenance to the diffusion of

innovation adopter categories is the first example of behavioural principles being linked to the innovation literature and as such it holds strong importance on the remainder of the present thesis and will be revisited in later sections.

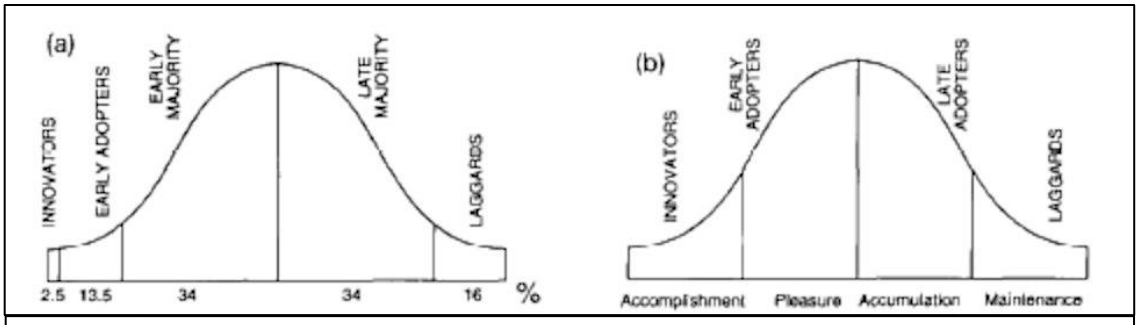

Figure 3: (a) Adopter categories determined by degree of innovation (after Rogers, 1983). (b) BPM categorization of adopter categories according to the pattern of reinforcement contingencies. Source: Foxall (1994).

In the preceding section, the incorporation of MOs into the BMP framework has been discussed in relation to consumer behaviour. If technology acceptance is considered to be the consumer behaviour under observation, the primary understanding should be the difference between discriminative stimulus (S^d) and MOs within post-purchase technology usage (Fagerstrom, Foxall & Arntzen, 2010). An S^d signals the availability of the behaviour, therefore indicating the physical presence of the technology, whether it works and is compatible within a particular setting; for example connecting to the internet in an external environment or having mobile phone signal. An MO, on the other hand, determines how much the consumer wants to use the technology; this motivation can be anything from the design of the technology to how using portrays the consumer's affluence. It can therefore be argued that when incorporating MOs in the BMP and applying the framework to consumer behaviour after the purchase procedure, there will be more MOs evoking response than S^d s. This is because in the temporal context of consumer behaviour, the post-purchase or evaluation phase is when the consumer has already acquired the product; therefore the availability of using the product (S^d) generally remains constant, whereas there are varying numbers of MOs within the complex situation that can influence usage. To implement a paradigm shift of TAM the following literature review combines technology acceptance literature with research on the chosen population to develop MOs that can be applied to the after purchase process of technology use.

4. The 'Third Variables'

4.1 An Ageing Population

The recent March 2011 census data for the UK indicates that the percentage of people over the age of 65 has increased; it was logged at 16.4 per cent, which is the highest recorded by any census. This means that in 2011 one-in-six people in the UK were aged 65 and over (Office of National Statistics, 2012a). Figure 4 portrays a breakdown of the older adult population into more specific age categories; as one would expect the UK population within each per age group decreases as age increases. What is interesting about the graph are the trends over time; the 65-69 and 70-74 age categories are the largest and contribute over half the number of people within this population. Alongside this, these categories are continuing to increase over the years; in 2001 the 65-69 age group was at 2,604,000 and the 70-74 age group was at 2,344,000, following an increase of 15% and 4% respectively; the 65-69 age group had reached 3,005,000 and 70-74 category, extended to 2,429,000 people by 2011. With more people living longer, it is predicted that the percentage of the population aged over 65 will continue to increase.

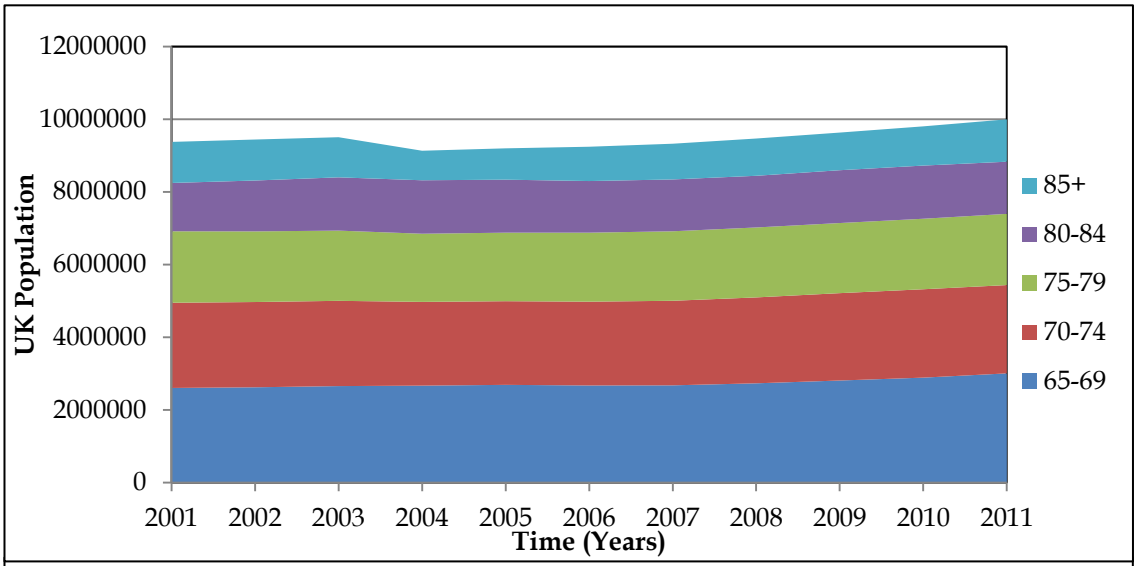

Figure 4: Breakdown of older adults (65+) into further age-groups; UK population of age-groups from 2001-2011. Source: OECD (2013)

From recent UK demographics, it is evident that the ageing population is continuing to expand. With the population surge in the 1950s, this group of people are starting to reach 65 years old, which means that there will be an even more diverse composition of

people within the older adult category. Consequently, a larger proportion of the older adults are now highly educated, physically and mentally healthy and still contributing to the UK's workforce (Warburton, Ng & Shardlow, 2013). With the diversity and growth of this population, it is essential for academic research to focus on the implications of the changing population; their current characteristics and needs. The following section, therefore, uses recent ageing literature from a few key journals such as *Ageing & Society, Journal of Advanced Nursing* and *Geriatrics & Gerontology International* to examine this generally under-researched population of people. The first section focusses on both the disengagement (Cumming *et al.*, 1960; Carstensen 1992; 1995,; Fung, Carstensen & Lang 2001) and the activity theory (Moody, 2006), alongside the effects that loneliness can have on the older population. The second section explores the care system and both the positive and negative effects of caring for an older person. The final section introduces positive ageing, which can be beneficial to current and future generations of older adults.

Academic literature surrounding older people often focuses on both physical health and cognitive functioning, which are extremely important topics; however, this can detract from the social aspects of ageing, which are also of extreme importance (Warburton, Ng & Shardlow, 2013). Neglect of social characteristics and the quality of life as people age can result in a stereotyping of older adults into one homogeneous group (Mechanic, 1999; Vitell *et al.*, 1991; Sherman, Schiffman & Mathur, 2001). With the aforementioned demographic changes to the population it is vital for the varying social situations within this age group to be examined through previous literature and experimentation.

One of the primary theoretical perspectives on the social side of the ageing process is the disengagement theory (Heylen, 2010). This theory states that as ageing occurs, self-awareness of eminent approaching death leads a person to disengage from society and accordingly reduce their social interaction. As a result, this person experiences a decrease in social contacts, both concrete and desired, which means that ageing does not directly create social loneliness but instead isolation is a conscious decision (Cumming *et al.* 1960; Carstensen 1992; 1995; Fung, Carstensen & Lang 2001). The central criticism to the disengagement theory lies in the overall assumption that withdrawal from social contact during old age is a voluntary behaviour. This supposition implies that policy makers or charities are not required to support the social integration of older people (Adams, 2004). According to Cattan, White, Bond &

Learmouth's (2005) systematic review, social integration in a group scenario is the most effective method of preventing social isolation and loneliness amongst older people. Consequently, by assuming the disengagement theory to be correct this could produce inactivity in an area of policy and behaviour change, which would otherwise help the life satisfaction of many older people.

There are other theories which contest the disengagement theory, namely the activity theory and continuity theory (Moody, 2006). The activity theory states that an older person's life satisfaction is proportional to the activity of the individual; in other words, the more active the person, the higher their satisfaction of life. This has led academics to focus on the barriers of ageing which can prevent social interactions (Fung, Carstensen & Lang, 2001) alongside the deterrence of such physical and social obstacles (Heylen, 2010). The continuity theory is noticeably similar but also claims that as people age they continue to hold the same habits and roles as that they attained earlier in life (Moody, 2006). Both of the theories focus on the importance of social connections in the ageing process and suggest that as one ages, one should continue to maintain friendships and group interactions to improve quality of life. In contention to the disengagement theories, the activity theory and the continuity theory actual imply that a reduced social circle can result in a lower wellbeing and consequently an increased risk of social loneliness (Merz & Huxhold, 2010).

Although the previously mentioned theories of the social ageing process vary in concepts and consistency, there is one central theme combining them all, which focusses on the relationships of the older population and consequential potential social loneliness. Whichever theory is adopted, loneliness is a vital element of ageing that must be researched and prevented, where possible. According to Weiss (1973) loneliness is a subjective and frequently painful and troubling feeling of being emotionally and/or socially isolated. Often literature uses the term loneliness in conjunction with other concepts such as "living alone", "being alone" and "social isolation" (Victor *et al.*, 2005: 358). However, being physically alone does not necessarily mean that somebody is lonely and being with somebody does not always prevent loneliness (Kirkvold *et al.*, 2012). Consequently, to use terminology of being on one's own interchangeably with the term loneliness, is often incorrect and can lead to confusion within the topic of social ageing.

Academic research surrounding loneliness in older people equates that approximately 40% of people over the age of 65 will admit to being lonely (Savikko *et al.* 2005, Victor

et al. 2005, Steed *et al.* 2007). The percentage of people suffering from loneliness is higher in people aged 80 or older (Jylha 2004, Dykstra *et al.* 2005, Savikko *et al.* 2005) and people living on their own (Kharicha *et al.* 2007). It is believed that health degradation is one of the most prominent causes of a reduction in an elderly person's social network; as poor health increases with age it leads to a higher risk of social loneliness (Weiss, 1973). This is especially true when health reasons prevent people from partaking in social and leisure activities (Scherger, Nazroo & Higgs, 2010). Health status can be both a predictor and consequence of loneliness, in that, mobility problems and physical disabilities can cause people to interact less hence increasing their loneliness whilst an increased loneliness can cause depression, alter sleep patterns and appetite (Drennan, *et al.*, 2008), which in turn creates further health degradation.

By focussing on the social problems associated with ageing, this thesis is attempting to treat the population aged 65 and over as an age group with varying characteristics, needs and desires. Recent research by Kirkvold *et al.* (2012) is therefore extremely prominent as it explains that although 40% of people over the age of 65 admit to being lonely, there are 60% of people who do not have these feelings. Another prominent cause of loneliness is losses in later life; Kirvold at al. (2012) discovered that there are two different patterns of coping with loss. One pattern involves managing well coping with living alone and experiencing loss (Nygren *et al.* 2007, Schnittker 2007, Tiikkainen *et al.* 2008) whilst the other pattern indicates people without the ability to cope with accumulating losses; this pattern of people are more likely to experience loneliness.

There are many suggested solutions to avoiding loneliness and its effects, from how to improve social (Heylen, 2010) and cultural (Lizardo, 2006) interactions to what factors can improve life satisfaction (Gaymu and Springer 2010) and the meaning of life (Reker, 1997) in old age. Gaymu and Springer (2010) conclude that engaging in social activities should be encouraged everywhere in Europe for both men and women, as in their results this social interaction always correlated positively with life satisfaction. Heylen (2010) concurs and suggests that people should attach great importance to both quality and quantity of their social relationships. One way to do this would be to improve connections between the elderly and their social network, despite geographical and health obstacles (Drennan, *et al.*, 2008). Another way in which people can make connections with each other is through similar cultural interests (Lizardo, 2006). Unfortunately, cultural-capital theory first developed by Bourdieu (1986), suggests that as one gets older their cultural tastes narrow (Harrison and Ryan, 2010).

It is therefore important that the older adult has a way of maintaining social connections through stabilising levels of health and improving independence.

Although developing effective interventions to alleviate loneliness can be challenging (Findlay, 2003; Cattan *et al.* 2005) there are some suggestions that highlight the importance of bringing people into a group environment. Cattan *et al.* (2005) systematically review previous loneliness interventions and conclude that the most effective solution is to introduce group activities with an educational and supportive purpose for people within the older adult population. Continuing on this perspective are other suggestions that group meetings, not directly related to loneliness, can be effective in alleviating negative emotions. An example of this is a recent study by Savikko *et al*. (2010) which indicates that group activities in art, exercise, therapeutic writing and group therapy have positive effects on reducing feelings of loneliness amongst people aged 75 and over.

Alternative solutions to loneliness include one-to-one support such as befriending, home visits and carer support (Dean & Goodlad 1998; Cattan 2002). Although these options are not as effective as group activities, they can still help the older adult improve feelings of social belonging and self-esteem. For many people who struggle to leave their homes, carer support can reduce feelings of loneliness, alongside helping with everyday tasks. Caring can therefore have extremely positive effects on the lives of the older population (Cohen *et al*., 2002). Unfortunately, according to the literature, there is also a downside to the caring process.

Throughout Europe the majority of care provided for older people is informal in nature (Suanet, Van Groenou & Van Tilburg, 2011); an informal caregiver is an unpaid person who helps somebody with physical care or coping with disease (Hileman, Lackey & Hassanein, 1992). Consequently, a large proportion of older people are cared for by their children, spouses, friends or neighbours. As mentioned above, this can alleviate loneliness and aid in everyday tasks for the older people receiving care; however, for the informal carers the negative implications behind caring are vast. According to the literature, these can include economic burdens such as loss of income and benefits as a caregiver has to give up work or reduce their hours (Arno, Levine & Memmott, 1999); non-economic burdens include a damaged social life, a damaged family life, and feelings of loneliness, stress, anxiety and depression (Jones and Peters, 1992; Arai *et al*., 2004) alongside an increase in poor health (Walker & Luszcz, 2009), which can lead to premature mortality (Schultz & Beach, 1992). On top of these problems, are concerns of

the older adult caring for another older adult; in either in a spousal, neighbourly or friendly relationship and the implications that this can have on the lives of the ageing population.

In 2010 the NHS Information Centre published the results of a 2009/10 survey of carers within households in the UK. This information clearly indicates the extent to which older adults are caring for other older people and the effects that this has on health and social connections. This survey discovered that 25% of all carers in the UK are aged 65 or over. The following section will use the statistics from the NHS survey to produce a profile of carers within this age group. 54% of carers aged 65 or over are the sole carers for the cared for person; this percentage is far higher than any other age group, with only 29% of 45-54 year old carers being the solitary support person. In addition, older adults are spending longer hours caring for the cared for person; 30% of carers who spend 20 hours or more caring are aged 65 or older; this is in comparison to other age groups for example, 45 - 54 year olds comprise only 19% of carers who spend over 20 hours a week caring. Of all the age groups within the statistics, people aged 65 and over are the only category to have a higher percentage of people caring for over 20 hours a week rather than caring for less than 20 hours a week. In addition, of the 65 and over age group caring for over 20 hours a week, 40% are caring for 35 hours or more per week, which can produce huge strains on health, well-being and social connections. For example the groups of people who are most likely to admit to not having had a break from caring for 2 days or more were people over the age of 65 (60%), retired (57%) and in bad or only fair health (56% and 50% respectively). The relationship between carer and main cared for person is also interesting with 58% of carers aged over 65 looking after somebody within in a spousal relationship or as a partner to the main cared for person.

Not only does the NHS survey produce statistics on carers but also on the primary person cared for. The following section uses these statistics to outline a basic profile of a person over the age of 65 who is in need of care. 50% of carers in the UK were looking after somebody who was aged 75 or older, 61% were caring for females, whilst 39% were caring for males. Of people being cared for in the same household, 31% were aged over 75 whilst 14% were aged between 65 and 74. Of people being cared for in another household, 69% were aged over 75 and 12% were aged between 65 and 74. This indicates that there is a skew in the data towards the older generation; people over the age of 65 are being cared for by somebody both in the same household and in

another household more than any other age group. The statistics indicate that a high proportion of informal caring in the UK is for people over the age of 65. With an increase in the size of this population, the demand for informal and formal caring is only going to increase. There are also a large majority of older people caring for a spouse or partner, supporting this person for long hours with not many rests or breaks. Although many find caring rewarding, it would help reduce the strain placed on older adults if there were alternative methods to improving standards of living, reducing loneliness, increasing social connections, perceptions of self-worth and social belonging.

Current literature on ageing can often be negative by focussing on the problems associated with the ageing process such as illness, loss and dependency; alongside negative effects on society and the healthcare system of a county. Much of the literature highlights these problems and offers solutions to an ever expanding ageing population. Ageing, however, can also be seen in a positive light; as an opportunity for this population to benefit from their free time, competences and material goods. This process is called successful ageing and originated from a theory by Rowe and Kahn in 1987. Rowe and Khan (1987, 1998) created definitions for three different types of ageing: Firstly, pathological ageing which is when severe illnesses and disabilities affect the ageing process. Secondly, usual ageing which is ageing without the severe illnesses but where there is still a high probability of suffering from them. Thirdly and finally, successful ageing which is deemed a "good way" (Villar, 2012) to age and is created by three criteria: (a) a low risk of diseases, illnesses and disabilities (b) a high functional level both mentally and physically (c) an active engagement with life by maintaining close relationships and continuing involvement in valued activities. Criticisms of Rowe and Khan's (1987, 1998) definition of successful ageing centre mostly on fact that for a positive message, the definition still uses a plethora of negative language. Points (a) and (b) of the successful ageing description, rely on the absence of negative attributes within older age, for example illness, disability, mental and physical depreciation. Whereas point (c) begins to look towards positive actions, that can be taken to enhance the possibility of successful ageing. These include upholding close relationships with family and friends, alongside actively engaging with productive activities such as joining community societies and partaking in voluntary work (Villar, 2012).

Although there are discrepancies to Rowe and Khan's (1987, 1998) definition of successful ageing, it has opened up opportunities for further thought into a positive ageing experience. One theory, which has proven influential within the ageing literature, is the SOC model of selection, optimisation and compensation (Baltes & Baltes, 1990; Freund, 2008). It proposes that successful ageing can occur if three key processes are adopted by the individual. These processes enable said individual to capitalise on their available resources, namely time, competences or material goods, which according to the literature can be limited. The three processes within the SOC model are as follows: (a) selection of specific goals and developmental courses by the individual in an attempt to focus on more important tasks and ignore the lesser, medial but time-consuming responsibilities; (b) optimisation of available resources or the acquisition of further resources required for a higher level of mental or physical functioning; and (c) compensation when formerly accessible resources have been lost, through effort by the individual to sustain functioning at a particular level (Villar, 2012; Baltes & Baltes, 1990; Freund, 2008).

The previous model introduces some key processes that should be involved to achieve successful ageing, alongside suggesting positive actions to improve the ageing experience. It does, however, appear extremely theoretical and consequentially needs to be placed in the context of the modern ageing society. In other words, the theory gives a list of what the individual *should* do in order to achieve successful ageing but as discussed earlier in relation to intention based technology models, what we *should* do and what we *actually* do are two very different pathways. Villar (2012) therefore provides the SOC model with further context by suggesting positive ways in which these theoretical behaviours can be achieved. The ultimate conclusion is that "successful ageing is not something older people can achieve by themselves" (Villar, 2012: 1099). As a result Hill (2011) highlights the importance of behavioural change strategies that can be applied to the older generation by maintaining and attempting to improve health and optimal function (Gallagher-Thompson, Steffen & Thompson, 2008). Previous strategies have involved evoking regular exercise, improving nutrition and discouraging smoking and alcohol abuse. Hill (2011) suggests further research into aiding older adults with accepting loss and the transitions of old age whilst encouraging prevention of disease and function maximisation.

As suggested in section (c) of Rowe and Khan's (1987, 1998) definition of successful ageing, relationships with individuals and community groups should be upheld to

enhance the ageing experience. As a result, the more that older people communicate with their family and friends and actively involve themselves with volunteering and community groups, the more likely it is for those older people to age in a successful and positive way. Obviously it is difficult to establish whether the ability to communicate and be active is a more influential factor of successful ageing, or if through these activities mental and physical health is maintained, which in-turn leads to positive ageing. Whichever the cause, one cannot underestimate the importance of communication, relationships and purpose within the ageing process. Kirkvold *et al.* (2012) therefore suggest that social relationships within the older community should be maintained with the use of technical devices such as the telephone and other communicative technologies. The importance of this communication is stressed as being highly functional as a relief to feelings of loneliness. Unfortunately, not all participants in the Kirkvold *et al.* (2012) study were comfortable using a telephone to ring friends and family when feeling lonely. It is therefore important to understand the relationship between the older person and technology so that usage can be increased. Another study on older adults using Internet as a befriending mechanism (Ballantyne *et al.*, 2010) indicated that a reduction in loneliness and an increase in pleasure occurred in the participants who successfully learnt how to use a computer, set up a profile and chat to people online. The following section will therefore outline proposed CMOs acting on the operant behaviour of technology use in an attempt to predict and control this behaviour so that it can be related to the process of successful ageing.

4.2 Technology and Ageing

Having established the importance of technology adoption for the chosen population, this thesis will now use academic literature and statistics to indicate the present relationship between older people and technology. The following section will begin by discussing recent statistics on technology usage by older adults and conclude by presenting the proposed motivating influences on this behaviour. Table 4 demonstrates a detailed household expenditure by age of the household reference person from 2010 (Office of National Statistics, 2011). People aged 65 to 74 spend an average of £54.90 per week on *Recreation and Culture*; 9.2% of this budget is spent on audio-visual, photographic and information processing equipment. This population also spends 6.6% of their *Recreation and Culture* expenditure specifically on televisions, video equipment and computers. The population aged 75 or over, in contrast, only spend £27.50 a week on average on *Recreation and Culture*, however, a higher percentage of 16% is spent on audio-visual, photographic and information processing equipment.

More specifically, 14.5% of the expenditure is spent on televisions, video equipment and computers; the highest percentage of all the age groups. These figures imply that the older generation are spending a good part of their wealth on technology.

	Less than 30	**30 to 49**	**50 to 64**	**65 to 74**	**75 or over**	**All house holds**
Commodity or service			Average weekly household expenditure (£)			
9 Recreation & Culture	**40.60**	**65.50**	**72.00**	**54.90**	**27.50**	**58.10**
9.1 Audio-visual, photographic and information processing equipment	5.60	7.90	9.30	5.10	4.40	7.20
9.1.1 Audio equipment & accessories, CD Players	0.80	2.00	1.70	1.10	0.30	1.40
9.1.2 TV, video and computers	4.70	5.10	7.00	3.60	4.00	5.20
9.1.3 Photographic, cine and optical equipment	[0.10}	0.80	0.60	[0.40]	[0.20]	0.50

Table 4: Household expenditure by age of household. Source: Office of National Statistics (2011)

Table 5 compares data of computer use from 2006 and 2012 by age group (Office for National Statistics, 2012b). In the 65 or over age category, it is evident that computer use over the past 6 years has dramatically increased. In 2006 only 23% of people aged 65 or over had used a computer in the last 3 months, whilst 65% of this population had never used a computer. In contrast, in 2012 46% of older adults had used a computer in the last 3 months and only 44% had never used a computer. This decrease from 65% to 44% in 6 years, illustrates that this generation are not only beginning to purchase ICT but also beginning to use it. Research into their use of this equipment has become extremely poignant and useful in understanding what may motivate further usage of technologies in an attempt to improve quality of life.

Age	**Last 3 months**		**3-12 months**		**Over a year ago**		**Never used**	
	2006	**2012**	**2006**	**2012**	**2006**	**2012**	**2006**	**2012**
16-24	88	96	5	2	5	1	2	1
25-44	84	96	3	1	5	1	7	2
45-54	76	88	3	1	5	2	15	9
55-64	61	79	4	3	7	3	28	15
65+	23	46	2	3	9	7	65	44
All	67	82	3	2	6	3	24	14

Table 5: Last computer use by adults by age group, 2006 and 2012 by percentage. Base: Adults (aged 16+) in Great Britain. Percentages may not sum to 100% due to independently rounded components. Source: Office for National Statistics (2012b)

As the use of technology increases amongst older adults, so have the number of publications focussing on technology use by people over the age of 65 (Wagner, Hassanein & Head, 2010). The main themes running through this literature include using age as a variable to measure technological performance (Arning & Ziefle, 2007; 2008; 2009) and technical usage (Eastman & Iyer, 2005; Thayer & Ray, 2006; Czaja *et al.*, 2006; Peacock & Kunemund, 2007), which often conclude that older people are using technology less than younger people and in a more inefficient manner. It has been suggested that this is due to a lack of motivation to use technological devices within this population (Morris *et al.*, 2007; Peacock & Kunemund, 2007), however, recent scholarship has heavily contested this assumption (Zaphiris, Kurniawan & Ghiawadwala, 2007; Mitzner *et al.*, 2010). This opinion reflects, that the majority of research in this area, has used attitude and intention based models to collect data (McClosky, 2006; Morris & Venkatesh, 2000; Nagle & Schmidt, 2012), and as such plenty of scholarship is available on older adults' opinions towards technology. In contrast, however, few studies have measured the actual use of technology by this age group and what may instigate such behaviour (Selwyn, 2004; Ng, 2008), which is where the theory that technology use is an operant behaviour and can become imperative to the present research.

Another important area of research stresses the benefits that using technology has on older adults, the care system and the health service. For instance, Hsu *et al*. (2011) highlight the current underuse of NHS direct online by older adults but imply that if this service is used, strains on many NHS A&E departments would be reduced. Moreover, the use of assistive technologies by older adults could help informal carers by reducing the levels of emotional and physical care required (Morenson *et al.*, 2012). In terms of the loneliness felt by older people, alongside the physical and mental health problems, which are not always but can often be an issue, communicative technology can improve the lives of people within these situations (Karavidas, Lim & Katsikas, 2005; Ballantyne *et al*, 2010; Cattan, Kime & Bagnall, 2011; Kirkvold *et al*, 2012). The following section, consequently, uses previous literature on older adults and technology use to develop potential CMOs that may impact upon the post-purchase use of technology by people over the age of 65.

4.2.1 Utility

An older person may consider buying a technology for many different reasons; it is believed that an older adult does not purchase a technology for the same reason that a

person of a younger generation would (Leventhal, 1997; Lunsford and Burnett, 1992). Leventhal (1997) argues that technology obtained for people over the age of 65 is based less on curiosity of a novel item and more on the specific personal need of the customer. In other words, the younger generation would purchase the new iPad because it is a sign of social status whereas an older person may merely purchase the iPad to help with writing emails to their friends and family. The needs of the older person can vary according to lifestyle, socio-economic status, health and geography. All these different factors can influence a person's desire to acquire a technology and the type of technology that they wish to purchase. For example, a Kindle might be bought by someone with poor eyesight to help him or her read in large font, whereas, somebody who struggles to walk might need an assistive technology to help with the stairs. The reasons why an older adult may purchase a technology are vast and reflect the variation within the population but generally it is agreed that the technology is more appealing to this market if it appears useful (Lunsford & Burnett, 1992) and useable (Laukkanen *et al.*, 2007), often by being reminiscent of previous technologies that the older person may have acquired (Sledgers *et al.*, 2009; Buse, 2010).

After the purchase of a technology, one example of usage by people over the age of 65 is an older person's adoption of an assistive technology (Meister *et al.*, 2002). Often the older adult is required to have an assistive technology in their home to aid with everyday tasks and physical mobility. Previous studies have explored this generation's adoption of technology by measuring the age group's willingness to use a technological device (McCreadie & Tinker, 2005). McCreadie & Tinker (2005) outline various different factors that influence a willingness to use a technology and place these factors within a framework. The first of these factors is the user's perceived needs; in this case what the older person believes that he or she needs assistance with. The most common conclusion is safety; people need help in feeling secure in their own homes (Zimmer & Chappell 1999; Wielandt & Strong 2000). The second factor is a desire to use assistive technology, which comes from a perceived usefulness of the device (Czaja & Barr 1989; Hartke, Prohaska & Furner 1998; Chamberlain *et al.* 2001). Using the example of assistive technology, this desire to use the equipment could stem from somebody believing that it will perform the tasks it was intended for; for example to help them up the stairs.

Consequently, the first CMO-R that this thesis aims to incorporate into the BPM model for post-purchase technology use by the older adult is *utility*. After using a type of

technology, CMO-Rs related to utility can be established. When the technology is correlated with "worsening", it establishes its own termination as a reinforcer and evokes behaviors related with their termination. However, when technology is correlated with "improvement", it establishes its own termination as a punisher and suppresses behaviors related with their termination. When the utility of a technology is high, the use of a technology is correlated with "improvement" which evokes further usage and establishes the removal of utility as a punisher, which would suppress usage. Utility is as an umbrella term for several functions that, according to the literature, technology for the older adult should possess; firstly, usability (Sledgers *et al.*, 2009; Buse, 2010), which refers to how easy the technology is to use and adapt to; secondly, usefulness (Czaja & Barr 1989; Hartke, Prohaska & Furner 1998; Chamberlain *et al.* 2001), which refers to how useful the technology is to the older adult within their everyday lives; and thirdly, functionality (Zimmer & Chappell 1999; Wielandt & Strong 2000; Heylen, 2010; Gaymu & Springer, 2010), which refers to how the technology fulfils the needs of the market audience. By introducing utility as a CMO-R of technology usage, the two main factors in TAM; perceived usefulness and perceived ease of use are effectively being incorporated into a behaviourist based model. Consequently their influences on technology use are being considered, however, not as a part of an intention or attitude based model but as a motivation on the operant behaviour of usage.

When obtaining a technical device the older adult expects the device to fulfil its utility on three fronts; by being useful, usable and functional. After the purchase, the technology is used and either found to fulfil this criteria or to be lacking in certain fundamental elements. The level of expectation that the device meets affects the amount of usage that it receives. In this respect utility acts as a CMO-R on the usage of technology in the post-purchase period. The promise that the technology will fulfil the desired utility, acts as motivation to use the device. After the initial use, the behaviour will either have increased *utilitarian reinforcement* by being correlated with high levels of utility and or increased *utilitarian punishment* by being correlated with low levels of utility. If utility levels are perceived to be high during use, they can affect the value of reinforcements such as access to information and communication which consequently leads to an "improvement" of the user's condition. The utility of the device therefore establishes its continued presence as an effective type of reinforcement and evokes behaviours that have led to this utility in the past such as using the device for particular purposes. The presence of utility as increasing the value of reinforcement,

also inaugurates the absence of utility as a punisher. In other words, if the device ceases to fulfil the expectations of utility this will create a punishment, which abates the behaviour of using the technology.

For instance, if an older person purchases an iPad and has an expectation that it will be easy to use, useful for sending emails whilst on the train and works effectively as an addition to a Laptop; when it comes to using the device whether the iPad fulfils these functions will affect the likelihood of he or she continuing to use the technology. When the older person first uses their brand new iPad, they discover that it is as useful, usable and functional as they were hoping, which means that any activity they intend to partake in whilst using the iPad is successful; this is an "improvement" to that person's condition. They therefore continue the behaviour of using the device to maintain this level of utility acting as positive reinforcement. If the iPad then starts to either become complicated to use, refuses connect to the internet on the train or is discovered to not be a useful addition to a Laptop, its level of utility drops, which acts as a punishing consequence of the use of the device. As such, the older person may cease to use their iPad.

Consequently, the perceived utility of a device; why an older adult may purchase or receive a technological product can impact the usage after the purchase procedure. In other words, if somebody is expecting a device to work in a particular way and provide a specific utility, the presence or absence of this utility can either evoke or abate usage of the technology. As such, utility acts as a CMO-R on the use of technology as an operant behaviour. It is from this discussion that the first proposition is formulated:

P1: The utility of a technological device acts as a CMO-R on technology use as an operant behaviour.

4.2.2 Enjoyment

Alongside the utility of a device producing usage, enjoyment is another factor that can either abate or evoke behaviour related to technology use. According to the literature, the enjoyment involved in using technology encourages repeated and regular use (Young, Hawkins, Sharlin & Igarashi, 2009). Heerink, Krose, Evers & Wielinga (2006; 2008a; 2008b) demonstrate this through their published work on testing robotic technology by using elderly people as participants. Being a completely novel technology, it is an excellent modem to indicate factors that influence technology use

within the chosen population as very few participants using the robot would previously have experience of similar technology. Consequently their responses are uninfluenced by much learning history and as such; it is easier to decipher what present motivations are evoking or abating technology use and can be transferred to other emerging technologies. The iCat, designed by Philips is the robot that Heerink *et al*. (2006; 2008a; 2008b) were testing; it is a 38 cm tall immobile robot with moveable lips, eyes, eyelids and eyebrows to display different facial expressions and simulate emotional behaviour. It has a camera and microphone to recognise people and their speech. It was discovered that the main concerns that participants had with the robot were feelings of embarrassment whilst talking to it and admitting to using the device. The authors discovered that the participants who continually used the iCat were responding to the robot as if it were human whilst showing high levels of enjoyment. They therefore conclude that one needs to account for perceived enjoyment when creating an acceptance model for technology use by the older adult.

Enjoyment as a CMO-R, therefore, acts in a similar manner to utility as a CMO-R; if the consumer is expecting to enjoy using the technological device that they have obtained then the actual level of enjoyment created through use can either evoke or abate future occurrences. Consequently if an older adult obtains a technological device and is expecting to enjoy using it, the actual level of enjoyment can influence whether that person continues to use the device. If the level of enjoyment from use is high, this can correlate with other positive reinforcement such as connecting with friends and family or a higher perception of self-worth, which is an "improvement" to the user's condition and as such, the user continues to partake in behaviour that creates this enjoyment. The absence of enjoyment acts as a negative punishment, which indicates that if the use of the technological device ceases to create enjoyment this will abate the behaviour of technology use.

Imagine an older person had purchased a new smart phone and they were expecting to enjoy various elements of the device such as communicating with friends and relatives, alongside using applications to co-inside with their interests. If after the initial use, the smart phone installs this expected element of enjoyment, then the consumer will be encouraged to continue to use their phone. This enjoyment will be directly correlated with the sense of belonging that the older person may feel from easily communicating with friends and relatives, which is an "improvement" to their condition. However, if the phone lacks signal or a similar problem arises, the consumer may no longer be able

to enjoy communicating with people or downloading their favourite applications; this lack of enjoyment could therefore abate technology use. Consequently, the following proposal indicates the effect that enjoyment can have on the process of technology use by the older adult.

P2: The enjoyment associated with using a technological device acts as a CMO-R on technology use as an operant behaviour.

4.2.3 Emotional Attachment

Emotional attachment is the third MO that the present thesis proposes has an influence on technology use by people aged over 65. Attachment theory (Ainsworth, 1979; Bowlby, 1969) was initially developed to comprehend the relationship between infant and caregiver. It conceptualises attachment as an infant's inherent, goal corrected control system that regulates his/her behaviours to create or maintain closeness to a particular caregiver or attachment figure. Through this, the infant secures their protection from psychological and physical threats whilst discovering emotion regulation and healthy exploration (Bowlby, 1969). Recent psychology and marketing literature has indicated that attachments go beyond relationships between people to relationships between people and retailers (Vlachos, Theotokis, Pramatari & Vrechopoulos, 2010), brands (Carroll & Ahuvia, 2006), firms (Yim, Tse & Chan, 2008), places (Morgan, 2010) and material possessions (Kleine & Baker, 2004). By creating an attachment to a possession such as a technology, it is predicted that over time this technology becomes irreplaceable. For example, a young child can become attached to a special object such as a teddy bear over continual repeated uses and positive reinforcement. This can also be true of adult possessions such as a wristwatch, which through continual use and dependency can be assigned a personal meaning. This thesis proposes that the same attachment can occur towards a technology, through the positive reinforcement created from using a device.

From a behavioural perspective, Skinner's referral to emotional predisposition within *Verbal Behaviour* (1957) implies that emotion acts on operant behaviour in the same manner as a motivating operation, although at the time he was unaware of the terminology (Michael, 2004). As such, within this publication he refers to emotion or some variation of the term 154 times; from his references to emotion it becomes evident that operant emotions are complex in nature, containing multiple controls and private events, however, they do resemble the characteristics of Michael's (2004) definition of

MOs (Sunberg, 2013). As such, it makes sense that a formulated emotional attachment towards a device can act in the same manner as a CMO on the rate of technology use.

Literature centering on people's dependence on a technology through an emotional connection to the device is a progressive academic area. Recent studies have included emotional attachments to portable devices (Gomez, Popovic., & Blackler, 2008), especially mobile phones (Vincent 2006; Stelmaszewska *et al.*, 2004; 2006; 2008). The primary findings indicate that people interact with portable devices in an emotional way; at a personal and social level (Stelmaszewska *et al.*, 2004; 2006; 2008). Consumers have an attachment to both the device and the information stored on it; indicating at times an overdependence on the technology (Vincent, 2006). In particular reference to the older adult and emotional attachment to technology, the literature is limited, however, a study on electric mobility-scooters by May, Garrett & Ballantyne (2010) touches on the idea that an increase usage of the device is due to a form of emotional attachment.

Electric mobilty-scooters are a recent phenomena that have become popular and fashionable amongst the older population (May, Garrett & Ballantyne, 2010). The use of scooters by the elderly is increasing in Europe so that people can maintain social contacts and carry out activities in the community (Marcellini *et al.,* 2000). This is also the case in other developed countries such as Australia (Muir, 2004) and the United States of America (LaPlante & Kaye, 2010). The literature indicates that older people are developing an emotional attachment towards their scooters and as such, they become less embarrased about using an assistive technology. The current social status of scooter ownership is acting as an *informational reinforcement* for continual usage and encouraging emotional attachment to the technology. This attachment is on two fronts; firstly the attachment to the device itself and secondly to the freedom and independence that it provides.

Continuing with the example of the scooter; after the purchase of the device, if *utilitarian and informational reinforcement* encourage repeated scooter uses, an emotional attachment to the device can develop, which creates feelings of protection and esteem. Emotional attachment towards to scooter is a CMO-S, established by other CMO-Rs such as utility and enjoyment; the initial uses of the scooter indicate whether it fulfils expectations of utility and enjoyment. If these expectations are met then utility and enjoyment become CMO-Rs of the use of the scooter. Emotional attachment, which is initally a neutral stimulus, becomes associated the CMO-Rs of utility and enjoyment,

and evokes further scooter usage. By being a CMO-S of technology use, emotional attachment then creates the same impact on the behaviour as the initial CMO-Rs.

In other words, the utility and enjoyment of a technology can create an emotional attachment to the device. This emotional attachment is established as a CMO-S for technology use as an operant behaviour. It has the same influence on usage as the previous CMO-Rs of utility and enjoyment, which means that the onset of emotional attachment encourages further behaviour to increase the reinforcement of emotional attachment, in this case further usage, whilst the offset of emotional attachment acts as a punishment and reduces the likelihood of further usage. Consequently this discussion of the impact of emotional attachment on technology use has led to the third proposition within the present thesis:

P3: Emotional attachment is coupled with other CMO-Rs to become a CMO-S of technology use and consequently a CMO-R on the repeated use of technology as an operant behaviour.

4.2.4 Social Belonging

Even though the older generation should not be seen as a homogeneous group, stereotyped by academics (Mechanic, 1999; Vitell *et al.*, 1991; Sherman, Schiffman & Mathur, 2001); it is clear that as the ageing process increases, people develop both physical and social problems. For example, a reduction in social connections (Cumming *et al.*, 1960; Carstensen 1995; Fung, Carstensen & Lang 2001; Gray, 2009), an increase in health problems (Scherger, Nazroo & Higgs, 2010; Drennan *et al.,* 2008), and a lack of independence (Carstensen, 1992) can all lead to loneliness (Weiss, 1973), which in turn can worsen the initial difficulties. Whether the disengagement theory (Cumming *et al.*, 1960; Castensen 1995; Fung, Carstensen & Lang 2001), the activity theory (Moody, 2006), or the theory of socio-emotional selectivity (Carstensen, 1992) are used to describe the process of ageing, it becomes apparent that with age there is a tendency to reduce one's social circle, which can decrease the feeling of social belonging.

With the problems that arise from the socio-emotional selectivity theory developed by Laura Carstensen in 1987 and 1991, it is important for older people, if they wish to achieve successful ageing, to maintain their social connections. There are two ways to do this, one is through improving communications despite geographical and health obstacles (Drennan, *et al.,* 2008) and the other is through sharing cultural interests (Lizardo, 2006). Technology allows the older adult to communicate with friends and

relatives despite any physical limitations, which can increase feelings of social belonging. Alongside this, a technological device can act as a common interest, in the sense that people can relate to each other if they share similar devices or attitudes. For instance, one group of people may be Apple fans and bond over their admiration of anything Apple, whilst the other group may be PC fans and connect over their resentment of anything Apple. Previous studies that have focused on technology use by older people as a method of improving sense of belonging indicate that when technology is used, it results in a reduction in loneliness and increase in belonging, however, not all people accept technology as an option to reducing negative feelings and as such there is scope for research into the relationship between technology use and a sense of belonging (Kirkvold *et al.*, 2012; Ballantyne *et al.*, 2010). Consequently, the successive section proposes a sense of belonging as a CMO-S on technology use.

Imagine an older person has recently acquired a new Laptop: This thesis proposes that initial utility and enjoyment of using the Laptop encourages further operant behaviour, which aids the consumer in communicating with friends and family. This communication creates a reinforcement of a sense of social belonging, which correlates with further technology usage alongside other positive reinforcement such as confidence and independence, hence evoking an "improvement" of the consumer's condition. The older person will therefore continue with any behaviour that leads to this sense of belonging, which in this case is usage of the device. Just as the onset of a sense of belonging evokes further usage, the offset of sense of belonging can abate further technology usage. For instance, if the Laptop is difficult to use to communicate with people, the sense of belonging may decrease and the likelihood of Laptop usage could reduce. In addition, if a fashionable device creates common interest with people within a social setting and suddenly a new version of the device is released; the sense of belonging will decrease and the likelihood of Laptop usage may also decrease.

By being associated with the utility and enjoyment of a device, a sense of belonging acts as a CMO-S on the technology use of people over the age of 65. A sense of belonging is initially an independent stimulus but when correlated with utility, enjoyment and other positive reinforcement, which improves the condition of the consumer, it becomes a CMO-R on technology use. As such, the removal of a sense of belonging in correlation with technology use can act as a negative punishment on the behaviour and abate technology use. Consequently, the fourth proposition has been developed as follows:

P4: Sense of belonging is coupled with other CMO-Rs to become a CMO-S of technology use and consequently a CMO-R on the repeated use of technology as an operant behaviour.

4.2.5 Perceptions of Self-Worth

The final CMO-S that the present thesis is proposing as having an influence on technology use by people over the age of 65 is perceptions of self-worth. In the previous section on ageing, a discussion was formulated centring on the high levels of loneliness amongst older people, the necessity of informal carers and the potential for successful ageing. The literature indicated that if loneliness is high, perceptions of self-worth may be low; solutions to such negative feelings can include improving social connections through such medium as technology use, which in turn produces perceptions of self-worth. Although technology may reduce these negative feelings, there is also a risk of a device creating further negative perceptions of self-worth; for example if it is difficult to use or easily creates opportunities of failure, a person may begin to doubt their ability in relation to technology and learning. The balance of the final factor both influencing usage and being influenced by usage is therefore important to understand so that technology use can be used to improve perception of self-worth instead of creating feelings of failure and doubt.

If an older person is continually using technology as a functional communicative device or a sign of social status and it is easy to use, it can increase their perceptions of self-worth. Self-worth can be enhanced by reducing loneliness, increasing independence, improving social connections and enhancing learning; all of which can be achieved through the use of technology. From previous literature on assistive technologies, devices must 'raise functional ability and enhance elder's perceptions of self-worth' (Hirsch, Forlizzi, Hyder, Goetz, Stroback & Kurtz, 2000; 77) in order to improve the older adult's physical and social wellbeing. In other words, the utility of a device can evoke perceptions of self-worth, which become directly related to the use of that technology. The perceptions of self-worth, consequently act as a reinforcer for behaviour and improvement of the consumer's condition. The following section will use an iPad as an example to indicate the value of perceptions of self-worth as a CMO-S and consequently CMO-R on technology use.

Imagine that a 78 year old woman has recently acquired an iPad from her children as a birthday present. Before the use of the iPad she has an expectation of its utility and enjoyment; these expectations act as CMO-Rs on the use of the device; if they are

fulfilled, the use of the iPad continues, whereas if they are not met the use of the iPad may decrease or even terminate. For the purpose of this example, the 78 year old woman finds that the iPad fulfils expectations of utility by being both easy to use and useful for applications such as Skype. It also reaches expectations of enjoyment by being fun and stress-free to use. When the 78 year old continues to use the technology, the CMO-Rs of utility and enjoyment stimulate an increase perception of self-worth, which encourages the user to continue to use her iPad. A person's perception of self-worth is initially a neutral stimulus not related to the use of technology, however, if the technology improves communication, independence and learning by being functional, easy to use (P1) and enjoyable (P2) then this can influence an increased perception of self-worth, which then starts to act as an MO on technology use. As such, it becomes a CMO-S and can further stimulate the operant behaviour.

Perceptions of self-worth then act as a CMO-R on the behaviour of technology use, in that if the 78 year old woman discovered that whilst using her iPad, she developed higher levels of self-worth due to the fact it is easy to use, enjoyable and provides communication, this then encourages further use. The presence of self-worth, acting on continual technology use evokes other positive reinforcement such as confidence with using the iPad, more communication and independence, which is an "improvement" to the consumer's condition. The 78 year old woman therefore continues the behaviour that is going to result in improving her perceptions of self-worth, which in this case is using the easy but rewarding functions of her iPad; perhaps emailing or 'Skyping' family or ordering food shopping online. The removal of perceptions of self-worth can also act as a punishment; for example if something on the iPad is too complex to understand, this may reduce the consumer's perceived self-worth, which in-turn reduces technology use.

In other words, the CMO-Rs of perceived utility and enjoyment act on the use of technology, which influence the consumer's perceptions of self-worth. Somebody's perceived self-worth is originally a neutral stimulus, not correlated with the use of technology, however, by being coupled with the CMO-Rs of utility and enjoyment it becomes a CMO-S and stimulates further responses of technology use. In addition, self-worth then acts as a CMO-R itself, by improving conditions, triggering continual use and an increased perception of self-worth; its onset also establishes its offset as punishment. The aforementioned relationship can be more eloquently described in the following proposition:

P5: Perceptions of self-worth are coupled with other CMO-Rs to become a CMO-S of technology use and consequently a CMO-R on the repeated use of technology as an operant behaviour.

4.3 Diffusion of innovation and operant classes of consumer behaviour

In 1994 Foxall applied the BPM and his proposed operant classes of consumer behaviour (accomplishment, accumulation, hedonism and maintenance) to Rogers' (2003) adopter categories determined by degree of innovation (innovators, early adopters, early majority, late majority and laggards). The result produced four categories of adopter behaviour, still relating to Rogers bell curve format; innovators (16%), early adopters (34%), late adopters (34%) and laggards (16%). Each category was assigned an operant class of consumer behaviour that was related to the behaviour of the initiator; for instance the innovators seek accomplishment, the early adopters seek hedonism, the late adopters are subject to accumulation whilst the laggards merely adopt for maintenance reasons. Successive research on the quality of these adaptive groups has attempted to assign personality traits to each level of adoption, often with the use of the Kirton Adaption-Innovation Inventory (Kirton, 1976). However, an examination of these studies by Foxall (1995) reveals weak correlations between personality traits and innovation and concludes that the behaviour of consumer initiators cannot be explained by a type of innovative personality (Foxall, 1995; Foxall & James, 2009). Alternatively, the present study suggests that the adoption of an innovation depends upon the MOs influencing the consumer behaviour of each group of adopters. Based on Fagerstrom *et al.*'s (2010) argument that MOs should be incorporated into the BPM, the present thesis aims to incorporate MOs into Foxall's application of the BPM to Rogers (2003) adoption categories. The succeeding section will discuss the rationale behind each of these categories and apply the aforementioned MOs to Foxall's (1994) application and interpretation.

The first category is that of the innovator, which Foxall (1994) assigned the operant class accomplishment. The characteristics of this group of adopters suggest that they do not abide by previous rules but are heavily influenced by the performance and symbolism of the innovation, from which they create their own rules regarding the technology. The initial adopters within the group create rules for themselves as their adoption of the innovation maintains their self-esteem from the knowledge that they are succeeding within society. The innovators who adopt the innovation slightly later within the present category are more concerned with setting the trend and creating

rules for the adopters who follow them. As such, accomplishment with high utilitarian and informational reinforcement applies to this category of adopter. In reference to the MOs proposed previously, the motivating factors of adoption for the innovators are firstly perceived utility, which creates utilitarian reinforcement; an innovator creates their own rules regarding a technology based on the relationship between the perceived utility and actual utility of the device; the higher the perceived utility, the more likely an innovative consumer is to adopt and use the technology. Secondly, the self-esteem that being the first to adopt the technology creates suggests that perceptions of self-worth are a strong motivating influence of adoption for the innovators. Finally, social belonging motivates these innovators as they strive to appear successful within society and want to set trends for their technical followers. These MOs have been outlined in Table 6.

The early adopters, according to Foxall (1994) display characteristics of hedonistic consumerism; in other words their utilitarian reinforcement is high whilst their informational reinforcement is low. These adopters are more conservative than the innovators and hence they wait to perceive the functional and economic benefits of the innovation. Consequently, they are concerned with the reported performance of the device alongside the perceived complexity of its use. These consumers have lifestyles driven by pleasure as they strive for an innovation with proven utility; the social standing that owning such a technology provides is not a strong motivator of ownership. In terms of the MOs impacting upon the behaviour of the early adopters, perceived utility and perceived enjoyment would evoke the purchase and use of an innovation by this category of adopters.

The third group of initiators, the late adopters, are concerned more with informational reinforcement than with utilitarian reinforcement. In other words, although there may be a motivation to replace an existing technology this group of consumers are less concerned with the utility function of the innovation and more concerned with the low status associated with owning out-of-date products. As such, they adopt the innovation due to social pressures to conform and social rules made by previous adopters; this group of adopters practise accumulation behaviour. The motivating factors influencing the late adopters are the CMO-Ss proposed in the present thesis; firstly, social belonging or a desire to adhere to social rules motivates the adoption and usage of an innovation. Secondly, the desire to avoid the ridicule of being out-of-date implies that perceptions of self-worth also motivate adoption. Finally, with less of a

utilitarian reinforcement of acquiring the innovation and more symbolism and informational reinforcement connected to its purchase and usage, more of an emotional attachment develops between user and device, which establishes itself as a motivator of further uses.

Finally, the laggards are the group of adopters whose purchase and use of a device depends less on MOs and more on S^ds. They adopt an innovation when the product is ubiquitous and the usage is a matter of economic necessity, social conformity and escape from ridicule. The consumer behaviour associated with this group of adopters is maintenance (Foxall, 1994). Consequently the motivating influence to adopt the innovation and use the technology is lower within this group. If motivating variables were present there would be low levels of perceived utility and social belonging from previous accounts of the innovation and the social pressure on adopting it. Generally, however, laggards adopt due to limited choice; they rely more the availability of the technology rather than the want or desire to own and use it. For instance, with the television digital switchover in the UK, the laggards would be the people who only adopted digital TV directly after the switchover because they had no choice; their analogue television ceased to work. Table 6 demonstrates how the proposed MOs in the present thesis coincide with Foxall's (1994) application of operant classes of consumer behaviour to Rogers' (2003) adopter categories.

	High utilitarian reinforcement	**Low utilitarian reinforcement**
High informational reinforcement	ACCOMPLISHMENT (innovators) P1 (Perceived utility) P4 (Social belonging) P5 (Perceptions of self-worth)	ACCUMULATION (late adopters) P3 (Emotional attachment) P4 (Social belonging) P5 (Perceptions of self-worth)
Low informational reinforcement	HEDONISM (early adopters) P1 (Perceived utility) P2 (Perceived enjoyment)	MAINTENANCE (laggards) Low P1 (Perceived utility) Low P4 (Social belonging)

Table 6: Proposed MOs within Foxall's (1994) operant classes of consumer behaviour

In brief the final proposition that this thesis proposes is that varying MOs impact differently on the different adoption categories that Rogers' (2003) first introduced in his theory of innovation. Foxall's (1994) interpretation of these categories applies the fundamentals of the BPM to the consumer choice of adopting an innovation at

particular stages. The research presented in this study aims to extend Foxall's (1994) interpretation by testing different motivating factors on the stages of adoption. Consequently, the following and final proposition has been developed:

P6: There is a significant difference between the MOs influencing the operant interpretation of adopter classes.

In summation, this chapter has drawn on literature from psychology, applied behaviour analysis, consumer psychology, gerontology, innovation and technology acceptance, to develop 6 propositions intending to test the motivations of post-purchase technology use by older adults. Propositions 1-5 introduce 5 potential MOs, which may impact upon the operant behaviour of technology use. The final proposition (P6) endeavours to combine these MOs into the BPM and innovation literature by proposing that they adequately fit into Foxall's (1994) amalgamation of the operant classes of consumer behaviour with the innovation adoption categories. Through this proposition, the thesis intends to begin the process of including MOs into the BPM as presented in Figure 5. The remaining chapters have set out to empirically validate propositions 1-5, before using the empirical data to apply these validated MOs to the BPM, in the process of validating the final proposition (P6).

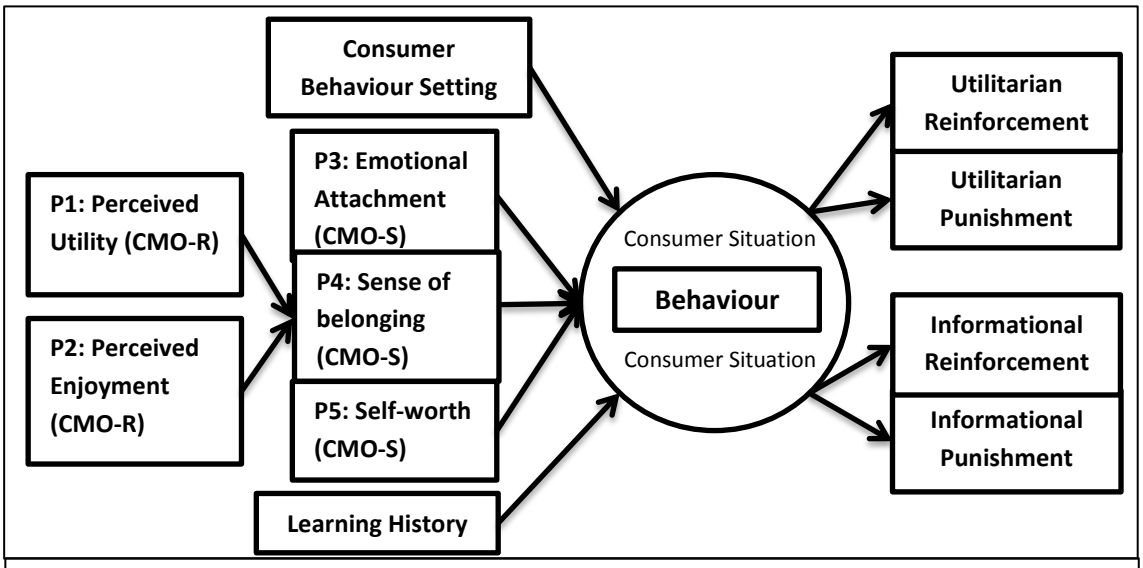

Figure 5: Combining the proposed MOs into the BPM

CHAPTER THREE

FUNCTIONAL ANALYSIS

1. Introduction

Thus far this thesis has drawn on previous academic research from applied behaviour analysis, consumer psychology, gerontology, innovation and technology acceptance to develop six propositions. The intention of the aforementioned propositions is to develop an understanding of post-purchase technology use by older adults. The theoretical basis to this understanding stems from motivational operations (MOs) within the applied behaviour analysis literature and the Behavioural Perspective Model (BPM) prevalent within the consumer behaviour publications. Consequently, propositions 1-5 present five different CMO-Rs and CMO-Ss that either evoke or abate the chosen behaviour, whilst proposition 6 intends to incorporate these proposed MOs into the BPM by applying each MO to Foxall's (1994) operant classes of consumer behaviour.

The present chapter therefore presents an empirical strategy to measure each MO, before validating the independent variables and developing reliable scales to quantitatively measure each one. The chapter begins with a discussion on the philosophy of radical behaviourism and nature of applied behaviourist methodology, especially in the context of testing MOs on participants. The second part involves using qualitative self-report diary data as a form of functional analysis to establish the presence of the proposed MOs within post-purchase technology use by older adults. The final section of this chapter uses a preliminary quantitative survey to develop psychological scales that can be used to measure the MOs before reaffirming the empirical strategy used to collate the quantitative data analysed in *Chapter Four*.

2. Research Design

2.1 Pragmatic-Positivism

Prior to electing a particular empirical strategy, it is vital to discuss the philosophical stance previously taken by radical behaviourists. Considering that the present study is based on principles of applied behaviour analysis and consumer behaviour, this philosophical stance must be explored and understood as it has strong implications

upon the research process of how data is collected (Burrell & Morgan, 1994; Holden & Lynch, 2004; Remenyi, Williams, Money & Swartz, 2005; Moller, Pels & Saren, 2009). According to Guba & Lincoln (1994) questions of paradigm should be answered before questions of methodology and so the following section will discuss the previous and present philosophical position of behaviourism prior to presenting the empirical strategy of the thesis.

It is commonly believed that behaviourism, during the early twentieth century, emerged as a psychological school of thought that adopted logical positivism as its overarching philosophy of science (O'Donohue & Ferguson, 2001; Baum, 2005; Moore, 2011). According to this stance, the central aim of science is to cultivate theories that can create predictions; these hypotheses are then tested against the truths generated from experience. The stance was popularised in 1920 Europe by a group of scientists, mathematicians and logicians, most of who were members of the Vienna Circle. They argued for statements to be analytical and verified by observation or else they were seen to be meaningless (Moore, 2010; O'Donohue, 2013). With the similar transition in psychology from introspective methods to methodological behaviourism, it made sense for logical positivism and behaviourism to philosophically walk hand in hand (Smith, 1986).

Early behaviourists believed in theory development, which resulted in the use of the aforementioned hypthetico-deductive method (Skinner, 1974; Watson, 1913). This method involved proposing a feasible theoretical justification for the behaviour then creating a hypothesis from this explanation of behaviour, and finally using a quantitative metric to either support or discount the hypothesis and its explanation of the behaviour. The assumption is, however, that the underlying theory behind the hypothesis is correct, when it could in fact be false (Skinner, 1974). In other words, the hypthetico-deductive method is not accepted by the radical behaviourists because the repetition of hypothesis proving results can be strengthening a theory that may be based on untruths (Baum, 2005; Moore, 2011).

When neo-behaviourism was born from the key thinkers Edward C. Tolman, Clark L. Hull and B. F. Skinner this school of thought still held parallels with logical positivism (Goodwin, 1999); however, each neo-behaviourist developed their own epistemology that slightly altered the original logical positivism developed by the Vienna Circle (Smith, 1986). B. F. Skinner, for example, was heavily influenced during his education at Harvard by Ernst Mach's *Science of Mechanics* (1883), which created the theoretical

basis of Skinner's doctoral thesis alongside honing his own positivistic opinions of science. Machian positivism is therefore the foundation of Skinner's radical behaviourism (Smith, 1986; Foxall, 1995; Moore, 2010), the primary philosophy of the present thesis; consequently, the subsequent section will discuss the key characteristics of Machian positivism and its influences on the present empirical strategy.

During Skinner's doctoral thesis, he acknowledged the Machian view that history can be used as a tool to clarify the origin and basis of concepts; a principle which would later correlate with the radical behaviourist theory of an organism's learning history influencing behaviour. In addition, Mach developed four primary beliefs that would profoundly influence Skinner's radical behaviourism (Topper, 2013). Firstly, the acquisition of knowledge by organisms is more a tribute to accidental encounters through trial-and-error than due to careful logic. Secondly, Machian positivism supports all scientific propositions as these are based on the historical experiences of the theorists. Thirdly, due to the importance of historical events on scientific thought, epistemology should account for previous examples of scientific enquiry whilst taking caution not to generalise the previous theory. Finally, due to the emphasis on the historical and temporal aspects of science, it is evident that fluctuations, alterations and refinement are imperative to advancements. Therefore, any current theories can be viewed as being provisional and incomplete (Smith, 1986; Morris et al., 1990). Overall, the aforementioned Machian concepts can be summarised as outlining a science that cannot be explained by a single formula or determined by specific methodological rules and regulations. By adopting this approach, Skinner was refuting the previous hypothetico-deductive methods of logical positivism and paving the way for a pragmatic positivist approach.

Pragmatism, deriving from Charles Peirce (1839 – 1914) and William James (1842 – 1910), is what could be used to describe the central philosophy that radical behaviourism adopts as both its scientific stance and approach to interpretation (Foxall, 1995). It is through this ontological position that radical behaviourists base all their experimentation and complex behaviours upon. Rather than taking a realist approach that searches for the ultimate truth of how the objective universe works (Baum, 2005), Skinner chose pragmatism, which is concerned with what the universe allows the researcher to accomplish (Foxall, 1995). There is a complex, varied and theoretical account of pragmatism (Leigland, 2010); however, for the purpose of this chapter it is important to outline the key components that are influential on radical behaviourism.

Firstly, behaviour is an outcome of environmental characteristics, which can occur naturally or be accomplished through experimentation. Secondly, prediction and control should be the main objective of experimentation involving behaviour. Thirdly, there is no place for absolute truth; truth is relative to historical and current content. In other words, one truth may replace another if it explains more of nature and the universe; what is currently believed to be true might be replaced at any time by a novel truer theory (Foxall, 1995; Moore, 2011).

The implications that pragmatic-positivism have on methodology is that it liberates behaviour analysis from the traditional agenda of philosophy (Leigland, 2010). In other words, the methodology involved in radical behaviourism is not burdened by previous philosophical issues and debates. These are, however, not ignored by radical behaviourists but addressed as verbal behaviours that require interpretation, reconfiguration and engagement (Skinner, 1957). The only regulations that influence a radical behaviourist methodology are those of pragmatic-positivism. For instance the central aim of the research process should be to predict and control behaviour; the empirical strategy is descriptive as opposed to being abstract and heavily theoretical; it involves a practical analysis of behaviour by relating the dependent variables (the behaviours) to the independent variables (the environment), which influence the rate of response. As such, the methodology should require searching for laws that indicate the relationship between behaviour and environmental factors (Foxall, 1995). These general laws, however, are not the central aim of behaviour analysis but may emerge through replication of the research (Skinner, 1957).

In the early 1990s Foxall (1992; 1993; 1994; 1995) argued for the inclusion of radical behaviourism and its philosophical stance into consumer behaviour by introducing the BPM as a framework that can be utilised and adapted by academics within the field. At the time, this was mainly because of the discipline's dispute between positivist methodologies and hermeneutic analysis. The philosophical origins of consumer behaviour lay with logical positivist ontology, however, at the time of Foxall's publication, there was a sway towards interpretivist approaches such as phenomenology, ethnography and hermeneutics. Foxall was not suggesting that either approach was "right" or "wrong" but that the dispute between positivism and anti-positivism and the reluctance to combine methodologies was jeopardising the ultimate goal of consumer research, which is the understanding of consumer behaviour. As a solution, Foxall suggests the inclusion of radical behaviourism into the practise of

consumer research because it cannot be considered purely objective or solely quantitative. Instead, through pragmatic-positivism it supports a mixed methods approach; positivism strives for the collection of quantitative data where possible whilst pragmatism allows the interpretation of verbal behaviour where necessary; as long as the data adheres to the three-term contingency.

In summary, radical behaviourists adhere to pragmatic-positivism as opposed to the hypo-deductive methods of logical positivism. The subtle differences between these two perceptions of science are important as they decipher two different methods to conducting research. The early behaviourist method involves testing hypotheses by using a quantitative approach whereas radical behaviourism has more modest intentions for research. The aim is purely to understand behaviour by observing and measuring it objectively (Skinner, 1957, 1969, 1974, 1980). If a general law of behaviour emerges, it is simply from a series of successive replications; it is not the central aim of the research. Radical behaviourism still favours quantitative methods as they allow observations and measurements to be made objectively; however, the theory also encourages qualitative methods where quantitative measurements prove impractical or impossible. These qualitative methods do, however, have to generate an explanation of behaviour that is independent from the results of the quantitative research, be interpreted by an independent observer whilst remaining consistent with the three-term contingency (Foxall, 1995, 1998).

2.2 General Strategy

By using Skinner's (1957) and Michael's (1982; 1988; 1993; 2000; 2004) principles as a basis to understand the MOs evoking and abating the repetitive use of technology by people over the age of 65, this thesis is using the aforementioned radical behaviourist view of science. Consequently, the empirical strategy adopted a mixed-methods approach using primarily quantitative measures and statistical testing to analyse the acquired data. However, where quantitative measures were impractical, qualitative methods were alternatively embraced; for example, in the preliminary research phase diaries have been used to enhance knowledge of the participants' learning history and environment. In accordance with radical behaviourism, although data collection of this phase was qualitative, it has been analysed quantitatively.

Most studies that include the analysis of MOs on behaviour are placed within a controlled setting where participants are observed and monitored. This research often focusses on problem behaviour (Call *et al.*, 2005), behaviour disorders (Smith and

Iwata, 1997) and self-injury (Smith *et al.*, 1995) in an attempt to reduce or even terminate the harmful behaviours. Prior to a series of papers from O'Reilly and colleagues (O'Reilly *et al.,* 2006a; O'Reilly *et al*., 2006b; O'Reilly *et al*., 2007a; O'Reilly *et al.*, 2007b) there was a two-step process that was typically employed by researchers. The first phase involved isolating the antecedent variables that were causing the problem behaviour, often by using a functional analysis, which is a methodology previously developed by Iwata *et al*. in 1982 and revised in 1994. The second phase involved holding the participant and behaviour constant whilst applying the different MOs to establish the effect that each one had on operant responding. Recently, however, O'Reilly and colleagues (2006a; 2006b; 2007a; 2007b) have extended the above methodology into a three-phase process. The first phase is the aforementioned functional analysis whilst the second and third phases differ from the original method. Phase two involves introducing the putative MOs to the participant by controlling the pre-session access to reinforcement. The subjects are exposed to two conditions; one in which they have contact with the abolishing operation and the other in which they do not (establishing operation). The final phase involves systematically subjecting participants to the MOs in an attempt to terminate target behaviours (Edrishinha *et al*., 2011).

The closest application of the O'Reilly *et al.* (2006a; 2006b; 2007a; 2007b) three-phase methodology to consumer behaviour was by Fagerstrom (2010) who applied the MO concept to behaviour within the context of the online webshop but as a substitute to using a functional analysis he used a conjoint analysis, which requires a rating system to indicate the influence that certain factors may have on webshop usage. Fagerstrom also applied MOs in the context of extinction; to decipher what factors encourage users to leave the webshop. The two fundamental differences between his methodology and the present thesis ideology is that firstly instead of attempting to terminate a behaviour, this thesis aims to explore the behaviour of using technology through the measurement of five proposed MOs. Secondly, as opposed to testing MOs within a controlled environment, the present study intends to indicate the effect of MOs on the technology use of participants within their normal surroundings. Consequently, the following section adapts the methodology introduced by O'Reilly *et al.* (2006a; 2006b; 2007a; 2007b) to formulate an empirical strategy appropriate for exploring consumer behaviour within a consumer behaviour setting (Foxall, 1995).

The first phase that O'Reilly *et al.* (2006a; 2006b; 2007a; 2007b) suggest as a methodology involves a functional analysis to decipher which MOs impact upon the behaviour. This strategy was first introduced into behavioural psychology by Iwata *et al*. in 1982 to discover multiple effects of the environment on the repetitive behaviour of self-injury (Iwata *et al*., 1994). Functional analysis was developed for applied behaviour analysis where participants are placed within controlled settings and subjected to different environmental factors. In contrast, this thesis is exploring post-purchase consumer behaviour, which is heavily influenced by the learning history and consumer behaviour setting of the chosen population (see Foxall, 1995). The preliminary research phase therefore involved participants completing a self-report diary (Alaszewski, 2006; Zarantonello & Luomala, 2011) over a temporal dimension of 6 months (Sung *et al.,* 2009); they have been used to explore which MOs are evoking or abating technology use in order to test these MOs later in the research phase.

The second and third phases within O'Reilly *et al.*'s (2006a; 2006b; 2007a; 2007b) empirical strategy involve subjecting the participants to the MOs discovered in the functional analysis; both the abolishing operations and the establishing operations and observing subsequent behaviour in a controlled environment. The only difference with the final phase is that O'Reilly *et al.'s* (2006a; 2006b; 2007a; 2007b) application of the MOs is in an attempt to terminate the aberrant behaviour. Within a natural and uncontrolled setting, this strategy must be altered to account for the influences of learning history and the consumer behaviour setting within the BPM. As such, the present research design is built to account for the effect of different MOs on the behaviour of technology use within a consumer behaviour setting. A variation within two elements of the setting provides a range of results across the different participants, which can account for the suggested MOs presented in the preliminary phase. These two elements are time and the technology being used, which will be validated later in this chapter.

Consequently, the central empirical strategy adopted a longitudinal quantitative approach to measure the technology use of the participants over a 6 month period (Gomez et al., 2008; Holden & Karsh, 2010; Lee, Trimi & Kim, 2013). A self-report questionnaire (Hedman *et al*., 2010; Ramanau, Hosein & Jones, 2010; Huitink, Embregts, Veerman & Verhoeven, 2011; Hankin & Abela, 2011; Gobbens & van Assen, 2012; d'Autume *et al*., 2012) containing 6 different scales was developed for each participant to take once a month for the aforementioned time period. The chosen time

period allowed for a progression of technology acceptance to occur, which indicated different MOs evoking or abating technology use across the time frame (Sung *et al.*, 2009). Moreover, the technologies varied between participants, which altered the levels of functionality alongside the MOs influencing usage. For instance a device with the ability to improve communication may create a high influence of the social belonging MO whereas a device that is difficult use may have a low level of utility, which can act as an abolishing operation on technology use. With a 6 month time period and different technologies being used, the research design intended to measure the abating or evoking effect of MOs on technology. Moreover, even though the research design does not explicitly intend to terminate the target behaviour, as is expected from previous MO studies (Edrisinha *et al.*, 2011), the variation of participants, technology and time have produced extinction results that can be analysed to determine the MOs at play.

This technique is similar to an applied behaviour analysis multielement design (Bailey & Burch 2002; Thompson, Iwata, Conners & Roscoe, 1999) which has been used previously by Iwata and colleagues (1982; 1994) to demonstrate a functional analysis of self-injury. This method involves inflicting different discriminative stimuli on the same behaviour to discover the effects that each stimuli have on the behaviour (Bailey & Burch, 2002). The method has been used previously in MO studies examining the establishing operations of problem behaviour (Worsdell, Iwata, Conners, Kahng & Thompson, 2000). The key difference between previous multielement designs and the present empirical strategy is that as opposed to physically and unnaturally inflicting the different discriminative stimuli on participants, the present study measured the different independent variables in relation to behaviour within a natural setting. This was achieved through developing psychological scales to measure each proposed MO, which have been collated into one accessible questionnaire. The variation in participants, technologies and time period was designed so that a disparity of data could be collected, which isolated the different MOs and aids in the interpretation of their impact upon technology usage. The details of both the preliminary and central research phases will be discussed thoroughly in the remainder of the present chapter.

3. Preliminary Research Phase

3.1 Instrument

The preliminary phase of the empirical study involved voluntary participants completing a technology log over a 6-month period based on their use of the technological device. The diary is an instrument of self-report that is used to record everyday behaviours (Alaszewski, 2006; Zarantonello & Luomala, 2011). It creates valuable pseudo-ethnographic data, which can be analysed by qualitative and quantitative methods (Nicholson, 2005). In other words, a diary is a personal account of the participants' experiences of technology use. The mechanism also records the temporal aspects of people's lives; indicating their thoughts and actions at a specific moment in time (Bolger *et al.*, 2003). Whether the format of a diary is structured or unstructured, they have begun to be seen by social scientists as a highly useful means of collecting in-depth personal data contextualised within the environment surrounding of the diarist (Patterson, 2005). However, the researcher must be careful in their analysis and interpretation of the data as the text within a diary is often highly subjective and edited by the author; excluding material that they do not wish to share (Bolger *et al.* 2003; Alaszewski, 2006; Zarantonello & Luomala, 2011).

The reason that diaries have been chosen as the instrument to gather data for the preliminary research phase is that they have the ability explore which MOs may be influencing technology use, similar to a functional analysis (O'Reilly *et al.* 2006a; 2006b; 2007a; 2007b). As a personal report this method can express participant's usage, environmental influences and learning history of technology use, which is generally individual and personal to the participant. Previous research indicated that diaries can be an extremely useful mechanism for collecting data on private behaviours of a potentially sensitive nature such as suffering (Alaszewski, 2006), sexuality (Kenten, 2010) and secret consumption habits (Zarantonello & Luomala, 2011). As technology use by older adults is a new academic area, still lacking in longitudinal data (Holden & Karsh, 2010; Wagner, Hassanein & Head, 2010) it is safer to assume that technology usage by the older adult is a sensitive and private matter (Heerink *et al.*, 2006; 2008a; 2008b) and therefore not a topic that people wish to discuss in a group environment. As such, focus groups, which are often thought of as the most suitable method for exploratory purposes (Wilkinson, 2004; Farnsworth & Boon, 2010) would be less appropriate. Moreover, focus groups tend to encourage a collective opinion on subject matter causing participants to be susceptible to group-think (Bazerman & Moore,

2008). Diaries, on the other hand, are "an innovative way to capture rich insights into processes, relationships, settings, products and consumers" (Patterson, 2005; 142).

The format of the preliminary study was over a 6 month period (Sung *et al.,* 2009), participants were encouraged to write in their diary regarding usage of their technology and asked to note down any influences there may be that either increase or decrease technology use. These are often called event-based diaries (Bolger *et al.*, 3003) or event-contingent protocols (Wheeler & Reis, 1991) and have been used in previous post-purchase consumption studies (Zarantonello & Luomala, 2011). Participants were given the freedom to use any format of diary that they felt comfortable with, which produces data that is open and expansive. The majority of people, however, chose to type their diaries in a word document, which in itself reflects a competence and use of technology (Bolger *et al.*, 2003). Due to a level autonomy with the format, the diaries varied in length from 5 pages to 50 pages, creating a rich set of data that can be analysed using content analysis (Alaszewski, 2006).

3.2 Participants

Participants were acquired for the preliminary study in the same way that they were acquired for the central quantitative research phase. As the present thesis is focusing on technology use by people over the age of 65, several organisations working with this age group were approached. The University of the Third-Age was the most responsive to the aims of this research and consequently their local contingencies were willing to provide participants. As an organisation that encourages learning for all members, it seemed apt that they were willing to assist in the research process. Advertisements were placed in local U3A newsletters, on websites and sent through emails asking for people who fit the outlined criteria and were willing to participate in a 6 month study. There were 3 criteria that a participant must adhere to; they must be 65 years of age or older, predominantly live in the UK and have acquired a technology within 12 months of beginning the longitudinal study.

These criteria were selected to produce a set of data that was indicative of the aims of the research project; to measure the influence of MOs on technology use by the older adult. Participants were required to be 65 years old or older as this is the traditional age at which people retire (Dixon *et al*., 2010); as such, the majority of secondary data on older people uses this age as a milestone. Consequently, for functions of comparison between secondary and primary data, 65 years has been decided as the starting age for

the participants. The present thesis is not, however, concluding that all people within this age group have similar characteristics and abilities (Vitell *et al.*, 1991; Mechanic, 1999;Sherman, Schiffman & Mathur, 2001) but that each person has an individual learning history and environmental setting influencing their technology use. Age will be considered as factor within the consumer behaviour setting but not assumed to be a direct influence on usage. Therefore, the participants of both the preliminary and central research phases vary in age from 65 to 88 years of age.

The second criterion outlined that the participant must be predominantly living within the UK; this is for several reasons. Firstly, for the ability to compare the primary data collected for this thesis with secondary data on people aged 65 or over living in the UK. Secondly, the UK is currently heavily influenced by an ageing population (Warburton, Ng and Shardlow, 2013) and increasing number of informal carers (NHS Information Centre, 2010). The use of technology within the country is therefore an important topic that needs attention (Mortenson et. al, 2012). Thirdly, the research design was developed in English and so to avoid complications with language barriers and translation of qualitative diaries and quantitative scales, participants were required to live in the UK and have a good level of English.

The final criterion required the participants to have acquired a new technology in the past 12 months. Previous academics have discovered that it took at least two months for stable interactions between technology and users to emerge and six months for stable routines to be established (Sung *et al.,* 2009). However the typical user of technology in the study by Sung *et al.* (2009) was young with a high level of education and technical knowledge. Considering that the age category of the older adult has a wider range of technical experience, from never using a computer to accessing the Internet daily (Office for National Statistics 2012b), it is imperative to extend the post-purchase evaluation phase of technology use to 12 months. The technology that the older adult had acquired could be anything that is in everyday life (Mortenson *et al.*, 2012). This thesis is not aimed at analysing different technologies but technology use as an operant behaviour; the researcher is therefore expecting varying results for different technologies but is more interested in the variation of MOs that different technologies produce on the usage patterns. As such, the majority of subject technologies were Portable Interactive Devices (PIDs) but a few, such as the smart TV and brain trainer, fell under a different technological category. Considering that the majority of

participants had iPads, Laptops, Kindles and Smart Phones; these devices became the primary concern of the preliminary and central research analysis.

Overall, for the preliminary qualitative research phase, there were 12 people who volunteered to participate and adhered to the criteria; out of these 12 participants, 8 people completed the task. For this phase of the research, the age of the participants ranged from 65 to 83 years old, creating an average of 73 years. All participants were currently living in the UK. The highest qualification that each participant owed varied from school examinations to postgraduate education. The technology being used by the 8 diarists included 3 tablets, 2 smart phones, 2 kindles and a Laptop, which provides a rich variation of data; all these items had been acquired by the participants within the previous 12 months leading to the start of the study period.

3.3 Procedure

Once the participants had volunteered to write a diary for 6 months, the researcher checked that each participant matched the aforementioned criteria. Each diarist was then given the same instructions as to how to complete the diary, which included logging technology usages, dates, likes and dislikes of the technology alongside any changes to lifestyle. As per event-based diaries, the instructions given, clearly outlined what to include but left the participant free-reign of the content, examples and stories that they chose to record (Zarantonello & Luomala, 2011; Bolger *et al.*, 2003; Wheeler & Reis, 1991). The format and length of the diaries were also dependent on the participants and how willing they were to complete the task alongside how often they used their technology. The reason that the diarists were given the freedom to write the diaries in any chosen format was because this qualitative research was a preliminary, exploratory study to indicate which MOs evoke or abate technology usage. By allowing the participants freedom and comfort in their expression, multiple influences have emerged that would otherwise be undiscovered. In other words, by representing the functional analysis phase of previous MO methodologies (O'Reilly *et al.*, 2006a; 2006b; 2007a; 2007b), the diaries are acting as an explorative study to establish the presence of the proposed MOs evoking technology usage.

Consequently, the participants were asked to write diaries about the use of their newly acquired technology for a period of 6 months. To confirm the occurrences of entries made, the diarists were contacted once a month within the aforementioned time frame and gently probed about how the process was going. Most responses were positive and

reassuring that entries were being made and technology usages being logged. After the 6 month time period had come to a close, participants were asked to submit their diaries. Despite being provided with options as to how to write and submit the technology logs, all were written in a word document and submitted via email. This process consequently facilitated the analysis phase of the preliminary research study.

3.3 Analysis

Since the diaries were submitted in a word document format, no transcriptions were required, which aided in the process of coding and content analysis (Brewer, 2003). It was also imperative to decide whether to analyse the data quantitatively or qualitatively (Aleszewski, 2006). Although the data collection for the preliminary research phase was qualitative, the analysis of this data adhered to the behavioural philosophy of methodology. It consequently, has been analysed quantitatively in all occurrences and only qualitatively when quantitative measures are neither possible nor appropriate. As such, each technology usage noted in the diaries was regarded as an observation of behaviour and analysed using statistical methods.

Prior to analysing the data, it is important for the researcher to decide what it is that they require quantifying (Millward, 2006; Wilkinson, 2004). Considering that this project intends to identify and measure the influence of the proposed MOs on technology use, it is these that have been interpreted and coded using content analysis. Rather than counting particular word occurrences, the texts have been analysed by coding specific interpreted influences on technology use. In other words, people's accounts of their technology use have been coded thematically based on the interpretation of the influences on behaviour (Nicholson, 2005; Yermekbayeva, 2011). Consequently a coding guide was established, which allowed the diary data to be analysed in a systematic manner (Millward, 2006). This coding guide was developed based on the central aim of the research project; to analyse the effect of MOs on technology usage.

As has been discussed in previous research, MOs can have both an abolishing and establishing effect on behaviour (Laraway *et al.*, 2003). Consequently, the following coding guide accounts for all the proposed MOs in the previous chapter. Their presence acts as an establishing affect whilst their absence acts as an abolishing effect. Therefore, the MOs interpreted in the texts have been sub-coded into having either positive (establishing) or negative (abolishing) effects on technology usage. For instance, a device that is easy and fun to use creates feelings of enjoyment; these

feelings establish further usage of the technology, however, if the device suddenly develops technical difficulties, the enjoyment factor is lost and usage ceases to occur; this abolishes the behaviour. The coding guide in Table 7 indicates each of the proposed MOs and their abolishing or establishing effects on technology usage. There are 10 different clusters of the thematic content analysis that the coding of the diaries adhered to:

Proposed MO	**Examples of EO (positive)**	**Examples of AO (negative)**
Utility	Ease of use, usefulness, functional for required purposes, practical, logical framework etc.	Difficult to use, not useful, does not fulfil required purposes, not practical or logical to use, unpredictable, unreliable etc.
Enjoyment	Has an element of fun or interest, can be used as a hobby.	Not fun to use and is not a point of interest, creates negative emotions such as frustration and anger
Emotional attachment	The user creates a bond with the device, positive emotions towards the device such as love and esteem, the user feels protective over the technology.	User has no connection to the device, only negative emotions associated with it e.g. resentment, user would not care if the technology was stolen or lost.
Sense of belonging	Device is used to connect with family and friends, communicative device, the user establishes a common interest with somebody through the device, and device acts as a common interest.	The device prevents communication, owning/using the technology isolates the user and the user's friends/family disagree with the ownership/use of the device.
Perceptions of self-worth	Device enhances esteem through increasing independence, a sense of achievement and improving quality of life.	The device is difficult to use and therefore reduces feelings of competency and the user feels embarrassed to use the technology.
Table 7: Self-report diary coding guide		

The suggested thematic coding process was based on the literature review in chapter two and the propositions that were established. From previous studies on technology use by people over the age of 65, it became apparent that there are several motivating factors that either evoke or abate usage. These factors were identified into 5 different MOs and consequently, thesis propositions. The table above indicates each of the influencing factors and the establishing or abolishing effects that they may have. The diaries have been coding using the 10 presented clusters. The establishing effects of the MOs are predicted to increase technology usage whilst the abolishing effects reduce or even terminate the behaviour.

So that the coding process can be considered reliable, the diary data was primarily coded by the researcher using the aforementioned coding guide. The data was then subsequently re-coded by another social scientist whose field differs from the present research. This is because; to identify the different influences on technology use no prior knowledge of behaviourism or older people's relationship with technology was required and as such the second coder would not be hindered by over-analysis or hopeful interpretation. The diaries were also coded by the second analyser completely blindly; in other words she was not aware of the researcher's previous coding but was given the coding guide as a premise (Schreier, 2012). After this procedure, there was an agreement percentage of 89.91% across the 1034 different observations. Alongside this measurement, a Cohen's kappa (Cohen, 1960) was used to indicate the reliability of the coding. The equation is as follows:

$$\boldsymbol{k = \frac{P(a) - P(e)}{1 - P(e)}}$$

P(a) is the agreement of observations between the two coders whilst P(e) is the probability of chance agreement. The calculated Kappa of the coded data was 0.693, which indicates that the reliability of the data observations is substantial for a preliminary research phase (Landis & Koch, 1977). There are debates about the magnitude guidelines and the significance of the Kappa value but considering that any value over 0.75 is classed as excellent and over 0.81 as near perfect agreement (Landis and Koch, 1977), the present example stands as adequately statistically significant.

3.4 Results and Discussion

The fundamental aim of the following discussion is to validate the empirical strategy of the central quantitative research phase. The coded data has therefore been statistically analysed to establish the significance of the two proposed variables, time and type of technology, on the proposed MOs. Consequently, two contingency tables have been produced indicating the cross-tabulated observations between the AOs and EOs of proposed the MOs with a) months 1-6 of the diary projects and b) the different technologies (see Table 8a and Table 8b). These cross-tabulations were equated using Pearson's Chi-square equation; the expected count indicates the count that should have been recorded if the association between the two variables is null whilst the Pearson Chi-Square indicates the strength of significance. Each table also contains a percentage of the EO or AO impacting within a time period or on a type of technology.

Table 8a explores the relationship between the MOs proposed in the literature review and the time (in months) that the diary completion took place. The MOs are presented as both establishing (positive on technology use) and abolishing (negative on technology use) whilst time is presented in months, from 1-6. The Chi-Square value for the aforementioned relationship has been calculated as 79.925 with 45 degrees of freedom and a significance probability of 0.001. Considering that the significance probability should be less than 0.05 to indicate association, this figure demonstrates an adequately high result. From the data, it can be concluded that there are significant differences in the frequency of MOs between the months 1-6 during the technology adoption phase, which provides validation of using time as a variable to measure different levels of the proposed MOs within the central research phase.

			Time						
			Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	**Total**
MO	Utility AO	Count	12	14	14	18	21	15	94
		Expected Count	26.0	10.1	12.1	11.7	13.7	20.5	94.0
		% within Time	6.6%	19.7%	16.5%	22.0%	21.9%	10.4%	14.2%
	Utility EO	Count	43	11	20	16	9	25	124
		Expected Count	34.3	13.3	15.9	15.4	18.0	27.0	124.0
		% within Time	23.5%	15.5%	23.5%	19.5%	9.4%	17.4%	18.8%
	Enjoyment AO	Count	6	2	0	4	6	7	25
		Expected Count	6.9	2.7	3.2	3.1	3.6	5.4	25.0
		% within Time	3.3%	2.8%	0.0%	4.9%	6.3%	4.9%	3.8%
	Enjoyment EO	Count	31	5	12	6	12	18	84
		Expected Count	23.3	9.0	10.8	10.4	12.2	18.3	84.0
		% within Time	16.9%	7.0%	14.1%	7.3%	12.5%	12.5%	12.7%
	Emotional Attachment AO	Count	8	5	4	3	7	8	35
		Expected Count	9.7	3.8	4.5	4.3	5.1	7.6	35.0
		% within Time	4.4%	7.0%	4.7%	3.7%	7.3%	5.6%	5.3%
	Emotional Attachment EO	Count	11	5	7	12	13	15	63
		Expected Count	17.4	6.8	8.1	7.8	9.1	13.7	63.0
		% within Time	6.0%	7.0%	8.2%	14.6%	13.5%	10.4%	9.5%
	Sense of belonging AO	Count	7	6	4	4	4	9	34
		Expected Count	9.4	3.7	4.4	4.2	4.9	7.4	34.0
		% within Time	3.8%	8.5%	4.7%	4.9%	4.2%	6.3%	5.1%
	Sense of belonging EO	Count	46	14	9	13	10	18	110
		Expected Count	30.5	11.8	14.1	13.6	16.0	24.0	110.0
		% within Time	25.1%	19.7%	10.6%	15.9%	10.4%	12.5%	16.6%
	Perceptions of self-worth AO	Count	7	5	4	1	9	13	39
		Expected Count	10.8	4.2	5.0	4.8	5.7	8.5	39.0
		% within Time	3.8%	7.0%	4.7%	1.2%	9.4%	9.0%	5.9%
	Perceptions of self-worth EO	Count	12	4	11	5	5	16	53
		Expected Count	14.7	5.7	6.8	6.6	7.7	11.5	53.0
		% within Time	6.6%	5.6%	12.9%	6.1%	5.2%	11.1%	8.0%
Total		Count	183	71	85	82	96	144	661
		Expected Count	183.0	71.0	85.0	82.0	96.0	144.0	661.0
		% within Time	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 8a: Pearson's Chi-Square analysis of MOs against Time (in months)

			Technology				Total
			iPad	Kindle	Laptop	Smart Phone	
MO	Utility AO	Count	60	3	1	41	105
		Expected Count	54.1	7.0	4.0	39.9	105.0
		% within Technology	16.4%	6.4%	3.7%	15.2%	14.8%
	Utility EO	Count	67	12	8	46	133
		Expected Count	68.6	8.8	5.1	50.5	133.0
		% within Technology	18.4%	25.5%	29.6%	17.1%	18.8%
	Enjoyment AO	Count	15	0	0	13	28
		Expected Count	14.4	1.9	1.1	10.6	28.0
		% within Technology	4.1%	0.0%	0.0%	4.8%	4.0%
	Enjoyment EO	Count	41	8	6	33	88
		Expected Count	45.4	5.8	3.4	33.4	88.0
		% within Technology	11.2%	17.0%	22.2%	12.3%	12.4%
	Emotional Attachment AO	Count	17	6	0	16	39
		Expected Count	20.1	2.6	1.5	14.8	39.0
		% within Technology	4.7%	12.8%	0.0%	5.9%	5.5%
	Emotional Attachment EO	Count	23	8	2	34	67
		Expected Count	34.5	4.4	2.6	25.5	67.0
		% within Technology	6.3%	17.0%	7.4%	12.6%	9.5%
	Sense of belonging AO	Count	17	2	2	16	37
		Expected Count	19.1	2.5	1.4	14.1	37.0
		% within Technology	4.7%	4.3%	7.4%	5.9%	5.2%
	Sense of belonging EO	Count	66	5	6	38	115
		Expected Count	59.3	7.6	4.4	43.7	115.0
		% within Technology	18.1%	10.6%	22.2%	14.1%	16.2%
	Perceptions of self-worth AO	Count	27	0	0	13	40
		Expected Count	20.6	2.7	1.5	15.2	40.0
		% within Technology	7.4%	0.0%	0.0%	4.8%	5.6%
	Perceptions of self-worth EO	Count	32	3	2	19	56
		Expected Count	28.9	3.7	2.1	21.3	56.0
		% within Technology	8.8%	6.4%	7.4%	7.1%	7.9%
Total		Count	365	47	27	269	708
		Expected Count	365.0	47.0	27.0	269.0	708.0
		% within Technology	100.0%	100.0%	100.0%	100.0%	100.0 %

Table 8b: Pearson's Chi-Square analysis of MOs against Technology

Table 8b also explores the relationship of the proposed MOs but with the different technologies that the participants were using. As before, the MOs are presented as both EOs and AOs whilst the technologies are presented in four different categories (iPad,

Kindle, Laptop and Smart Phone). One limitation to diary data collected is the frequency of observations spread across the different variables. As the length of the diaries depended on the participants, some technologies had a much higher frequency than others. As such, the 'Minimum Expected Frequency' calculated during the Chi-Square test must be accounted for. For the first table, 13 cells had an expected count of less than 5, which is only 21.7% of the 60 cells presented. The threshold for expected frequency is 25% and as such this figure adheres to the required value and the statistical test stands as indicating significance. The second table, on the other hand, has a much higher percentage of cells with an expected count of less than 5; 15 cells have this below threshold count amounting to a total of 37.5%. As a result, the second Chi-Square equation is void at indicating significance (Field, 2013).

Although the present diary data cannot prove the significant difference between the varying MOs impacting the different technologies, the statistical test indicates that with more in-depth data across the different technologies this significance could be proven. The problem lies with the aforementioned limitation that some diary data is more detailed for certain technologies such as the iPad and Smart Phone, than for others such as the Kindle and Laptop. The central research phase therefore collected rich quantitative data from participants using different technologies, whilst ensuring that each technology was adequately represented. This data will be used in the succeeding chapter to continue the technology significance tests completed within the present preliminary research phase.

The following discussion will further validate the empirical strategy for the central research phase by discussing each proposition in relation to the preliminary phase research. The previous tables will be used to demonstrate the strength of each individual MO. In addition, observation graphs from two participants will be used to compare and contrast the data recorded within the present preliminary study.

3.4.1 Cross Factor Analysis

To calculate the occurrences of MOs in relation to technology use, the second table will be used as a reference. This is mostly because the first table only includes 6 from the 8 completed diaries, as 2 diaries failed to log sufficient entry dates to analyse the data by month. Whereas the second table includes all the coded observations as all 8 diarists clearly indicated which technology they were using. From these observations, it is clear that Utility features the most with 238 counts; it is by far the most heavily recorded MO with 86 more counts than Sense of Belonging (n=152). The remaining three MOs have

very similar observation counts with Enjoyment reaching 116, Emotional Attachment recorded as 106 and Perceptions of Self-Worth at 96.

Interestingly across the present data set, all the proposed MOs have more establishing occurrences than abolishing occurrences; indicating a higher strength of positive rather than negative motivation on technology use. Sense of belonging as a motivation of technology use has the highest establishing count (n=115) in relation to abolishing count (n=37) at a ratio of 3:1. Perceptions of self-worth, on the other hand, have the least high establishing count (n=56) in relation to abolishing count (n=40) at a ratio of only 7:5. The reason behind these differences will be explored further in the following section, which will analyse in depth the preliminary data on each MO.

Referring to Table 8a, it is evident that there are fluctuations in the observation of MOs across the 6 month time period. There appears to be two different trends between the MOs that were proposed as CMO-Rs and the MOs proposed as CMO-Ss. The CMO-Rs are subject to a high EO value within the early months of adoption whilst the CMO-Ss are subject to a gradual increase in the EO value across months 1-3. For the surrogate MOs (CMO-Ss), it seems that the period of 1-3 months is the time it takes for emotional attachment and perceptions of self-worth to establishing themselves as MOs, whilst for CMO-Rs (utility and enjoyment) there appears to be a 'honeymoon' period of acceptance (Fichman & Kemerer, 1993; Mukherjee & Hoyer, 2001; Wells *et al.*, 2010). These patterns of acceptance require further analysis and validation in the central quantitative research phase but for now they will be used as exploratory data within the present preliminary study.

3.4.2 Utility

P1: The utility of a technological device acts as a CMO-R on technology use as an operant behaviour.

This section provides a more specific analysis of the preliminary data by exploring the impact of the proposed MOs on technology use and highlighting any key and additional themes that emerged throughout the diaries. Proposition 1 indicates that the level of utility a device provides impacts the use of the technology. If the perceived utility is positive, it acts as an establishing operation on technology use whilst if utility levels are low, this acts as an abolishing operation on usage.

Figure 6 demonstrates utility as both an AO and EO across a 6 month period; utility (AO & EO) is presented as a percentage of MOs counted within a one month period,

which is also expressed numerically in Table 8a. Each AO or EO is presented as a percentage of the MOs influencing usage in that particular month to avoid any visual misrepresentation of data within months where diary entries were limited. As is the nature of quantitative data, not all entries were equal for each month, therefore to establish the influence of MOs on the behaviour; they have been explored in relation to each other rather than as absolute frequencies. By using graphs demonstrating relative frequencies, it becomes more evident which MOs have more impact on the behaviour within that particular month.

The mirrored lines on the graph indicate an inverse relationship between utility as an EO and utility as an AO; for instance if positive utility levels are high, negative utility levels will be low. Across the 6 month period there is a clear fluctuation in utility levels. It appears that the initial perceived utility of a device is high in the first month, indicating a 'honeymoon period' (Fichman & Kemerer, 1993) of usage; when a device is new and exciting (Mukherjee & Hoyer, 2001; Wells *et al.*, 2010). However, as time and usages continue, perceived utility fluctuates; the more a device is used the more is required of a technology and as such further practical discoveries are made (Mallenius *et al.*, 2010; Xie *et al.*, 2012). These discoveries, as indicated by the graph, may be positive or negative causing a fluctuating utility. Month 6 depicts an increase in utility as an EO and decrease in utility as an AO, which could imply the beginning of complete adoption of the technology (Sung *et al.*, 2009).

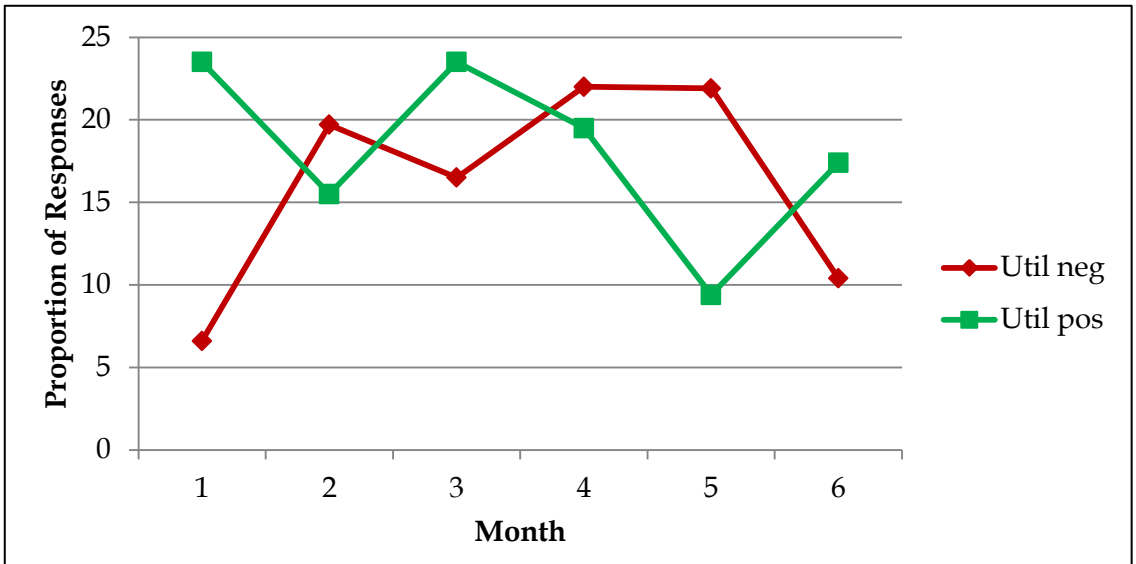

Figure 6: Utility rates (n=218) across the 6 month period.

Although it is difficult to decipher actual technology usage from this exploratory diary data, it is evident that the level of utility a device holds influences the usage of said device. One participant indicates how a low level of utility can decrease usage:

> **Participant A**: "*My problems when trying to write at length on the iPad touch screen made me abandon the effort.*"

The same participant, however, also indicates that a device with a high level of utility will increase the usage of the technology:

> **Participant A:** "*I will also shortly be using the iPad for scheduling sessions of a colloquium I will be running in my college. It will be very useful to have the iPad with diary in college with me at all times when talking to potential speakers. It will receive much more use than before.*"

As technology increases in functions, the analysis of its use becomes more complex; this is because one device can be used for several different reasons and occasions. Consequently, it is not as simple as a high level of utility increases use whilst a low level of utility decreases use. There may be certain functions of a device that fulfil the expected utility whilst other functions are a disappointment. In this situation the device has still been used for the functions that it fulfils, despite having low levels of utility in other areas. For instance:

> **Participant S:** "*Overall, I find iJack a fiddly, time-wasting device that's not nearly as intuitively designed as our PC – but perhaps that's because I'm used to the PC's foibles. However, iJack will still serve well for its main purpose: to take travelling to keep abreast of bank and credit card accounts, pay bills, check email and listen to news in English.*"

The preliminary study has deciphered two different types of utility; the usability of a device and the functionality of the technology. In other words, one type of utility is how easy to use and user friendly the device is whilst the other is how the technology fulfils its function. Examples of these two categories of utility are expressed below:

> **Participant G (Usability):** "*I would like more space to hold the frame; she thought that the forward and reverse buttons should be the other way round*"

> **Participant C (Functionality):** "*Away towards the end of the week, found it very useful to be able to access e mails whilst away from home.*"

Participants often mentioned positive functionality of the device but low levels of usability, which is why Figure 6 indicates such high AOs of utility in comparison to the other MOs presented in this discussion. Additional research within the quantitative research phase is required to explore the influence that utility has on the rate of technology use, however these preliminary results indicate that utility is definitely a prominent characteristic.

3.4.3 Enjoyment

P2: The enjoyment associated with using a technological device acts as a CMO-R on technology use as an operant behaviour.

The second proposition, that high levels of enjoyment increase usage but low levels of enjoyment decrease usage (Venkatesh, 2000; van der Heijden, 2004), has been explored in this preliminary study. Figure 7 presents the enjoyment levels reported in participant diaries. As is evident from the graph, there is a substantial difference between reported enjoyment (n=84) and reported low levels of enjoyment or dislike (n=25) with a difference of 59 and ratio 10:3. Similar to the utility EO, the enjoyment EO portrays an initial awe of a technological device in month 1 (Fichman & Kemerer, 1993; Mukherjee & Hoyer, 2001; Wells *et al.*, 2010), before fluctuating enjoyment levels across months 2-5 due to arising difficulties and discoveries of new functions and finally a levelling of enjoyment as stable technology use begins in months 5-6 (Sung *et al.*, 2009).

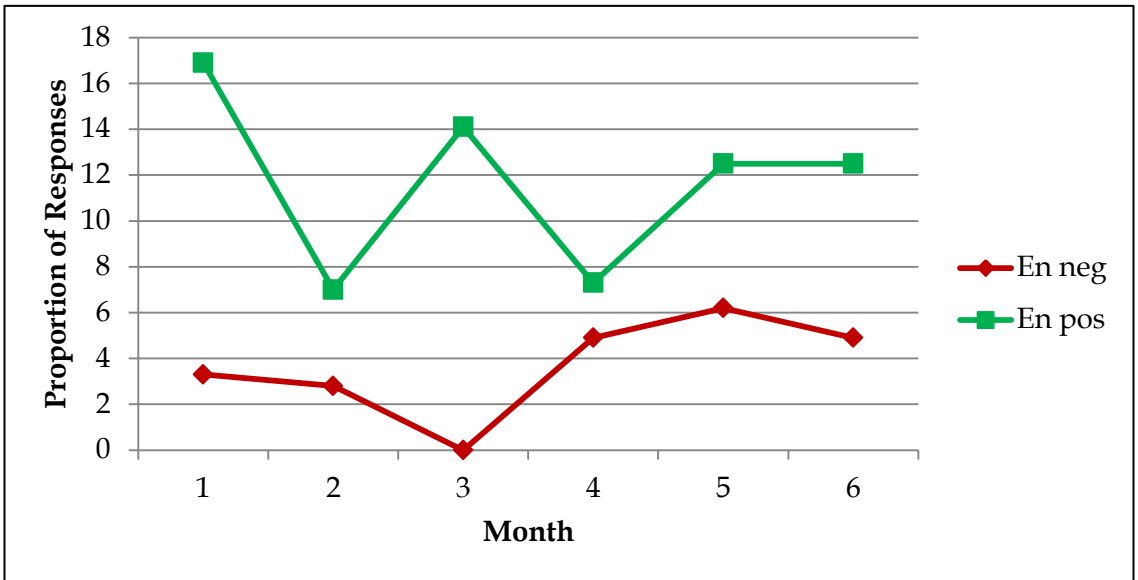

Figure 7: Enjoyment rates (n=109) across the 6 month period

The exploratory research highlighted key causes behind the enjoyment of technology use, which ranged from playing games, watching television programmes, reading the news, reading books, taking photographs, communicating with friends and family and listening to music. A majority of technology usage by this age group is for recreational purposes and as such enjoyment levels appear to be high, which induces further usage.

> **Participant G:** *"Yes it's nice to feel a page turning…but not that nice – nicer to have the promise of another book always there to be read."*

Although the AO levels of enjoyment are low within the present study, if there is no enjoyment associated with using a device, usage will reduce. As such it is important to understand what particular factors cause a lack of enjoyment as an AO of technology usage; these include complex systems, unnecessary functions, small screens and failure of the technology to work as expected:

> **Participant I: "***But on the iPhone everything was so tiny it made my eyes hurt - even sideways - that I shut them off. The games and the eyes. I also deleted the games. Several other things are really too small to be of use; icons are there I don't need, and I'm not into Facebook or Twitter."*

One prominent theme that emerged from the exploratory research is the enjoyment behind the personalisation of technology. Participant G mentions the individuality of her device and the enjoyment that this can bring from using it:

> **Participant G**: *"How useful it is, people say, to have a Kindle, so no one can see what you're reading – you can even be ready to switch to an innocuous book if an inquisitive teenage daughter looks over your shoulder...I completely don't want to read Fifty Shades (and haven't got a teenage daughter), but I'm interested in this additional reason for using a Kindle. It takes individualism one stage further…a Kindle is absolutely private."*

Other mentions of personalisation and enjoyment include uploading music onto a device, uploading books, downloading specific apps, storing photos, poems and checking emails and social media sites. The individualisation that participants write about is in correspondence with enjoyment, indicating that this theme is linked to enjoyment, which in turn increases technology usage. Further investigation into personalisation is required to discover the degree to which it evokes usage of a device by people over the age of 65.

3.4.4 Emotional Attachment

P3: Emotional attachment is coupled with other CMO-Rs to become a CMO-S of technology use and consequently a CMO-R on the repeated use of technology as an operant behaviour.

Figure 8 portrays the pattern of emotional attachment within the present preliminary study across a 6 month period. It is proposed that the presence of emotional attachment acts as an EO on technology use whilst the absence of emotional attachment acts as an AO on usage (Gomez, Popovic & Blackler, 2008; Vincent, 2006; Stelmaszewska *et al.*, 2004; 2006; May, Garrett & Ballantyne, 2010). Emotional attachment EO, as seen in Figure 8, increases slowly from months 1-3 as one would expect of a CMO-S of technology use. In month 4 positive emotional attachment peaks to 15% of the recorded MOs for that month before tapering off in months 4-6; whether the levelling of this EO is due to the beginning stages of acceptance remains to be seen and therefore requires further analysis. Negative emotional attachment acts as an AO on technology use; the aforementioned figure indicates lower levels of emotional attachment as an AO than as an EO, wavering between 4 and 7 per cent.

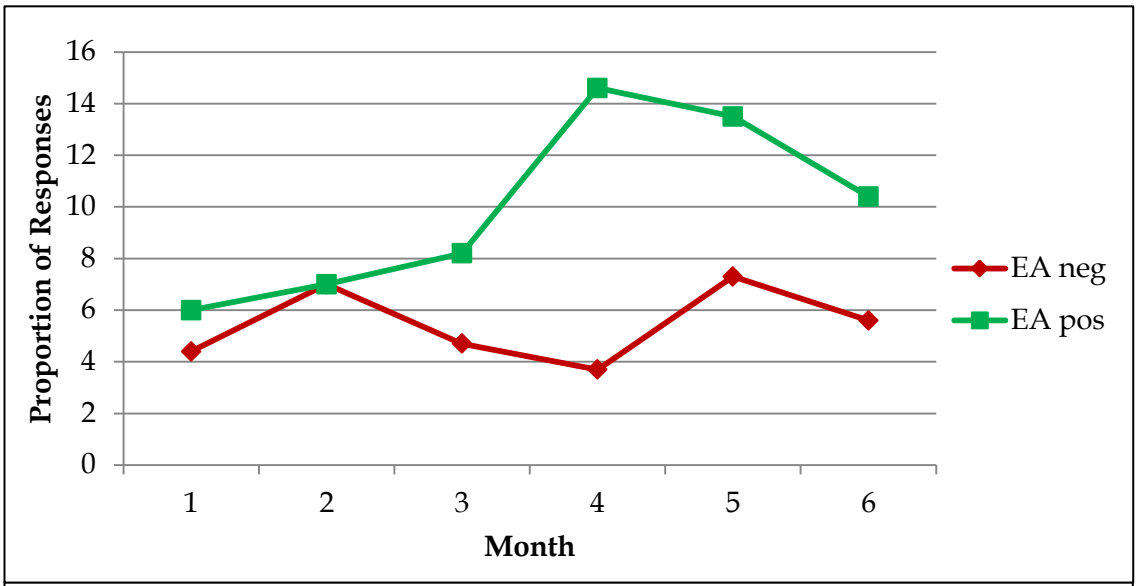

Figure 8: Emotional attachment rates (n=98) across the 6 month period

According to the diary data, positive emotional attachment takes a few different forms. Firstly, participants are emotionally attached to the device itself and produce evidence of protecting the device and relating to the device. For instance one participant took to naming her iPad:

> **Participant S**: *"Niece's boyfriend, a techie by profession, set up my iPad, which I've christened **iJack**."*

Whilst another participant refers to how he would feel if he were to lose or misplace his technology:

> **Participant I:** *"But there's another thing about technology as true as about life: once you have it you don't want to let go of it."*

Other recordings of emotional attachment towards devices are produced by the information that the technology holds. This links in with the aforementioned individualisation of technology; the higher the personalisation level of the device to the owner, the more emotional attached the user becomes. The following participant mentions how invaluable her technology is due to the personalisation of the device:

> **Participant P:** *"Just got back from a great holiday where my kindle was invaluable…used it every single day to read my latest novel. Even better, just before we left Spain I had finished my book and was able to immediately buy a new one to read on the plane home – fantastic"*

Emotional attachment acting as an AO occurs when there are few positive feelings towards the technology. These can either be feelings of apathy towards the device:

> **Participant A**: *"Partly I am sure this is an issue of familiarity, but I have lacked the motivation to spend much time getting used to Pages on the iPad"*

Or strong negative feelings such as frustration, disappointment and fear that abate people from using their technology:

> **Participant S:** *"Received iPad and left it in its packaging. I wondered if it might bite."*

Interestingly, for some participants negative experiences with technology can actually increase positive emotional attachment towards their device. These people enjoy problem solving and the challenges that technology provides and actually relish in working through the difficulties:

> **Participant I:** *"She was experiencing problems with her iPad, and compared to her I'm a guru. They are just user problems, and being a boy at heart I play with mine like I used to play with my Meccano."*

This recollection has been expressed within the preliminary data, it does however, require justification in the following stages to analyse. Consequently, data collected in the central quantitative research phase can be used to further explore and validate these discoveries. It is apparent, however, from the qualitative data, that emotional attachment impacts upon technology usage by the present participants.

3.4.5 Sense of Belonging

P4: Sense of belonging is coupled with other CMO-Rs to become a CMO-S of technology use and consequently a CMO-R on the repeated use of technology as an operant behaviour.

Sense of belonging as a CMO-S indicates that a sense of belonging is associated with other CMO-Rs such as utility and enjoyment to influence technology use, which after time evokes further usages (EO). If the level of sense of belonging drops then it is proposed that technology use will also decrease (AO) (Kirkvold *et al.*, 2012; Ballantyne *et al.*, 2010). Figure 9 indicates sense of belonging as both an EO and an AO; unlike the other proposed CMO-Ss, the EO line on the graph portrays a 'honeymoon' period of usage within the first 1-2 months in a similar pattern to the other CMO-Rs. Between months 2-5 the sense of belonging fluctuates and peaks around month 4 before levelling off during the stabilisation period between months 5-6. This EO pattern is similar of other proposed CMO-Rs such as utility and enjoyment, suggesting that sense of belonging couples with the CMO-Rs earlier on in the process than emotional attachment and perceptions of self-worth. The AO pattern presented in Figure 9 displays low levels of sense of belonging acting as an AO, which is partly because of the communicative nature of many of the technologies used by the participants.

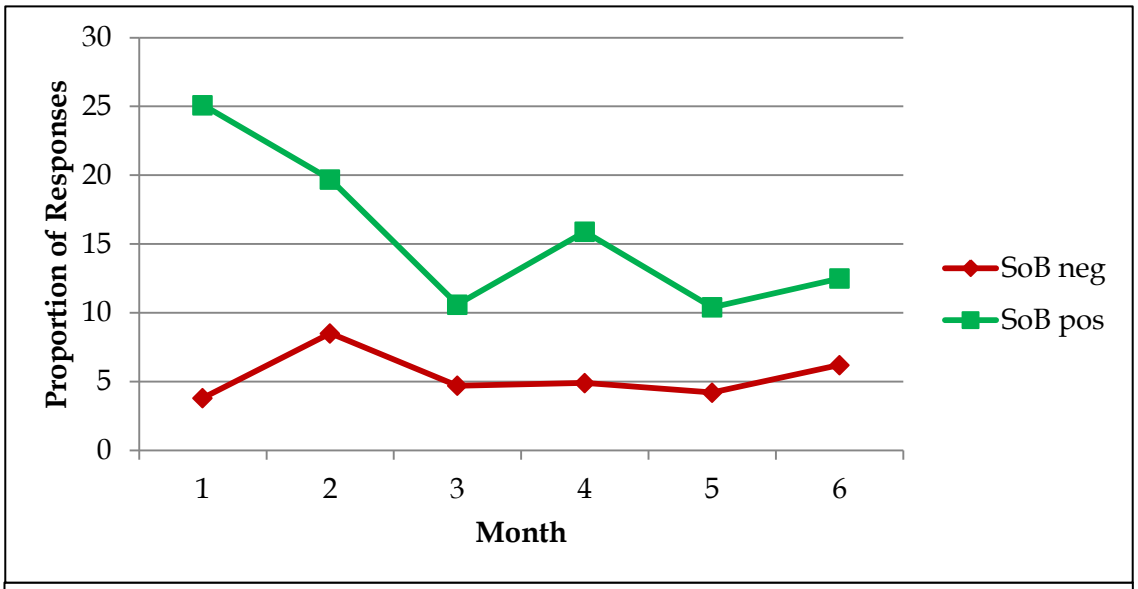

Figure 9: Sense of belonging rates (n=144) across the 6 month period

Three different types of sense of belonging as an EO of technology use emerged from the preliminary data. Firstly, all subject devices within the study can be used for communication purposes therefore many participants mentioned a sense of belonging in relation to the communicative function of their technology. This is perhaps why sense of belonging as an EO is much higher than sense of belonging as an AO:

> **Participant B**: *"Visiting my daughter in Liverpool for the weekend and having no internet connection I checked my emails on the kindle. Very useful as an important one had arrived that needed a quick response."*

Secondly a sense of belonging can be produced when technology users discuss their technology as a commonality and feel part of a particular group of technology users. The first participant discusses the views of Kindle users verses non-kindle users whilst the second participant uses his iPad to relate to his iPad owning friends:

> **Participant G:** *"But there was a definite sense that this was strictly between ourselves: we wouldn't have said it in front of a Kindle-agnostic."*

> **Participant I:** *"You know I play Scrabble with myself on my iPad. My wife's friend of over 70 years does, too…We have another mutual friend, 91, and we meet every few weeks for lunch and Scrabble."*

Finally and unexpectedly, many participants mention a sense of belonging in relation to the negative utility of their device. In other words, many participants are

discovering problems with their technology and communicating with friends and relatives about how to resolve the issues, which heightens communications between people and feelings of belonging even though the initial cause is from negative associations with the technology:

> **Participant C:** *"Lost the weather heading on my home page. My husband showed me how to use a widget to put it back."*
>
> **Participant P:** *"Have spoken with eleven year old grandson and he showed me how to take a photo, so now I have got what I wanted."*
>
> **Participant S**: *"Talked to technie nephew's mum, who has an earlier model iPad. She said to use the right-hand lower keyboard key to move it. This worked."*

As indicated in Figure 9, sense of belonging as an AO has not been very prominent within the present study, however, when sense of belonging is low these are the common causes: embarrassment about not being able to use the technology, embarrassment about using technology when other acquaintances disapprove and disappointment when communication functions fail and prevent feelings of belonging.

3.4.6 Perceptions of self-worth

P5: Perceptions of self-worth are coupled with other CMO-Rs to become a CMO-S of technology use and consequently a CMO-R on the repeated use of technology as an operant behaviour.

The final proposed MO is a CMO-S of technology use triggered by other CMOs such as sense of belonging, utility and enjoyment. In other words, perceptions of self-worth are influenced by the sense of belonging and enjoyment created from using a technological device that has high levels of utility. Once self-worth is heightened through its association with technology use and the aforementioned CMOs, it then acts as a CMO-R itself and evokes technology uses whilst the absence of self-worth abates technology use (Hirsch *et al.*, 2000). Figure 10 indicates a similar pattern of EOs and AOs to the other CMO-S, emotional attachment in that between months 1-3 the self-worth EO starts low and increases towards its peak in month 3. From months 3-6, the EO fluctuates as new technological functions are explored before reaching acceptance levels in month 6. The self-worth AO differs slightly from that of emotional attachment, in that it presents higher peaks and lower troughs. It does however mirror

the results of the self-worth EO and as expected the self-worth EO and AO are inversely related to each other.

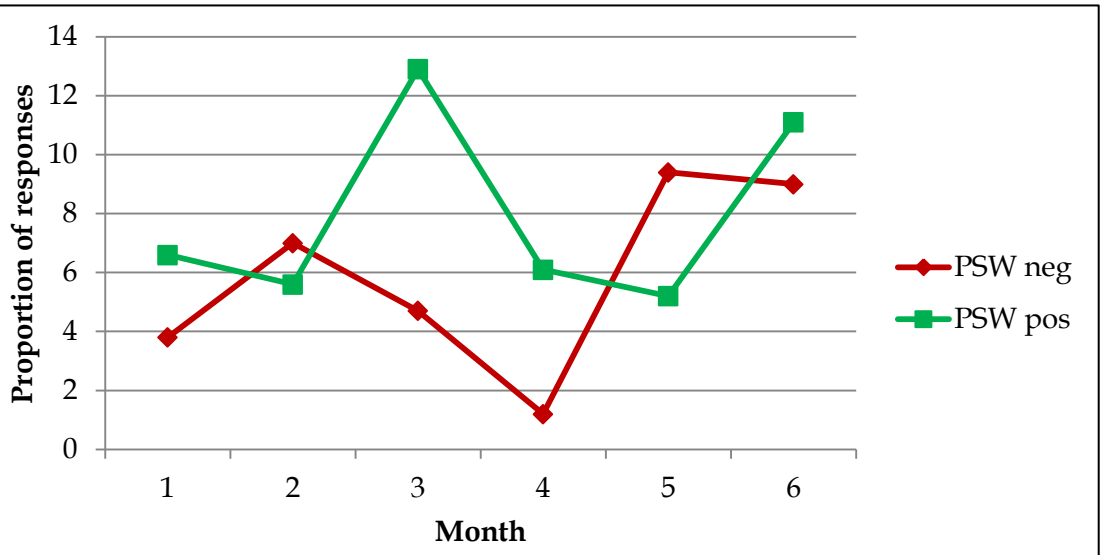

Figure 10: Perceptions of self-worth rates (n=92) across the 6 month period

In the context of technology use, self-worth as an EO has been mentioned by participants in a few different situations. Firstly, self-worth is enhanced through working out how to use certain functions of the technology, which then enables the user to perform tasks that they would usually be unable to do. This, in turn, increases technology use creating a positive cycle between self-worth and usage:

> **Participant S:** *"A short while later I found how you can mark Yahoo mail as unread again, which is something I hadn't discovered on Yahoo on the PC"*

> **Participant P: "***Looked at the weather forecast, the maps app for a geographical question in the crossword and thesaurus to finish it."*

Specific functions of technological devices can also heighten perceptions of self-worth, for instance one player games, diary applications, forms of communication and modern designs. These can affect users in two ways; firstly by always allowing the user to succeed and never fail and secondly, by producing feelings of belonging and modernity:

> **Participant I:** *"I often play Scrabble with myself on the iPad - I choose to be four players, all me, doing my best each time to play to win each one. Of course, I always win!"*

> **Participant I:** "*Technology, of all things, makes one feel so modern, so up-to-date, so 21st century; but, really, we are still in the early days.*"

There are elements of technology use that reduce participants' perceptions of self-worth. The present study indicates that almost all self-worth AOs of technology use are connected to the complexity of the device. If the technology is difficult to use or presents problems that the participants cannot solve then perceptions of self-worth are reduced, leaving participants questioning their own abilities:

> **Participant I:** "*These molehills amount to cliffs I'm now reluctant to try and climb. I was an architect for buildings worth millions of pounds, and dealt with other professionals and MDs of companies (now they call them CEOs) - often older and more senior than me - discussing problems and giving instructions. 'How are the mighty fallen.'*"

The preceding presentation of diary data has been useful for an initial exploration of the propositions; however, there are limitations to this method that need addressing. Firstly, depending on the participant, the data collected may sway towards either an overly positive or overly negative account of technology use. Positive accounts may be produced by participants determined to please the researcher; writing what they think the researcher wants to read, whilst negative accounts may be produced by participants who use the diary as a method of venting their frustration about technology; these participants enjoy the act of complaining. Consequently, the central research phase will use quantitative data to measure the MOs. Secondly, it is difficult to record a set technology usage within a diary format and as such the figures represent utility EOs and AOs but the fluctuations cannot yet be compared to usage rates. Further quantitative usage figures are therefore required within the succeeding analysis in *Chapter Four*.

4. Quantitative Research Phase

4.1 Instrument

The preliminary research phase has established the presence of the proposed MOs within the learning history and consumer setting of technology use. These MOs were discussed in an exploratory nature to indicate key patterns, themes and subsections within them. To validate this research a quantitative study is necessary to indicate the presence of MOs in conjunction with fluctuations of technology use. Time has been validated as a significant independent variable to use in the analysis of MOs with the

aforementioned Pearson's Chi Square test (Table 8a). Differences between technologies can also be used as an independent variable to indicate varying influences of MOs on technology use; the significance of this has not yet been proven as more data from different technologies is required for the Pearson Chi-Square test to be completed. Consequently, further validation through the central quantitative study is essential to test the propositions (P1-P5) and continue the previously attempted significance testing.

For the purpose of this thesis, the method chosen to collect quantifiable data is the anonymous, self-report questionnaire (Hedman *et al.*, 2010; Ramanau, Hosein & Jones, 2010; Huitink, Embregts, Veerman & Verhoeven, 2011; Hankin & Abela, 2011; Gobbens & Assen, 2012; d'Autume *et al.*, 2012). The questionnaire has been used to measure the level of influence that each proposed MO has on technology use. It therefore contains scales indicating each MO alongside usage rates and other socio-dynamic measures that could influence technology use such as education, marital status and age. The MO items within the self-report questionnaire have been carefully selected from a factor analysis whilst the socio-dynamic items resemble the questions from the 2011 UK census. The construction of the final questionnaire will be discussed in the remainder of the present chapter.

The option of using a questionnaire to collect numerical data has increased as social science and market research are leaning towards quantitative methodologies (Foxall, 1995). Self-report questionnaires allow for a large sample size, flexibility in completion time and honest, anonymous answers. Moreover, for the age of the population of this study, a questionnaire is a useful instrument as it allows completion at the chosen pace of the participant and within their own temporal frame (Gobbens & Assen, 2012), which also improves the quality of the data set; a rushed set of answers could disrupt the data and impede the results. For a personal and individual topic such as technology and within the particular population, it can be an extremely personal and sensitive area. Many older people have felt embarrassed, confused and uninterested by using technology (Heerink, Krose, Evers & Wielinga, 2006; 2008a; 2008b), which could prevent willingness to admit to this behaviour vocally in an interview or focus group (Hyden & Biilow, 2003; Wilkinson, 2004; Farnsworth & Boon, 2010; Halkier, 2010), for instance. A questionnaire therefore provides the privacy required to collect honest and frank answers for sensitive issues (Hedman *et al.*, 2010; Huitink *et al.* 2011; d'Autume *et al.*, 2012) as opposed to other self-report methods such as interviews that can be

daunting and focus-groups that can provide herded responses (Bazerman & Moore, 2009).

The participants were given options as to how they wished to complete the questionnaire; these included on-line, on a word document, on paper, over the phone or in person. 89% of the participants chose to take the questionnaire on-line, whilst only 8% opted for the word document and 3% chose paper and pencil. With a large proportion of the quantitative data being collected over the Internet, the reliability of this administration mode must be discussed. Several studies have indicated that there is little difference between an Internet-administered self-report questionnaire and pencil and paper versions; all scores seemed to strongly correlate and consistencies were equal (Richter *et al.*, 2008) even for sensitive issues such as social anxiety disorders (Hedman *et al.*, 2010). Using the Internet as a mode for a self-report questionnaire is therefore a valid and reliable method that can be used in the present thesis.

The questionnaire was also designed to collect data for a longitudinal study. Each participant was therefore required to take the self-report questionnaire once a month for a period of 6 months. Once a month was chosen as the time period for it is regular enough to indicate patterns in usage but not too often that participants would remember and repeat the same answers. The length of study at 6 months would present data on technology usage across the two months in which it takes for stable interactions to emerge and the 6 months that is required for routines to be established (Sung *et al.*, 2009). Longitudinal self-report studies are extremely useful at demonstrating patterns of behaviour across time. For instance, previous studies have focussed on self-injury in adolescence (Hankin & Abela, 2011) and technology use in students (Ramanau, Hosein & Jones, 2010). Research based on the older adult also favours this method as it is less time consuming and less costly but produces the same results as interviews and physical tests (Gobbens & Assen, 2012).

As a result, the following section will describe the procedure behind the central research phase. Firstly, the process of developing the questionnaire, which involves testing and refining factors that indicate the MOs influencing the operant behaviour of technology use. Secondly, how the questionnaire has been used to collect the relevant data necessary for the final results and discussion in *Chapter Four*.

4.2 Participants

Participants were acquired for the central research phase in much the same way as they were for the preliminary study. U3A organisations were approached by the researcher asking for participants that fit the previously outlined criteria. Local U3A organisations were willing to advertise this request on websites, in newsletters and through emails. As such, all the participants who partook in the following research were volunteers. They had made an initial commitment to the study by making the first point of contact with the researcher and volunteering their time, which demonstrates a level of obligation to the research. Commitment is entirely necessary for a longitudinal study of 6 months, as it is important that enough participants complete research by returning 6 questionnaires (Ramanau, Hosein & Jones, 2010; Hankin & Abela, 2011), especially for the statistical analysis phase.

Each participant was therefore over the age of 65, living in the UK and had acquired a new technology in the past 12 months. They completed the questionnaire on their newly attained technology once a month, for a period of 6 months. 29 participants were able to complete all of the 6 questionnaires, giving a total 174 completed responses across 6 months. If the research includes questionnaires completed within a shorter time period, there were 188 responses from 37 participants. Alongside the variation in time across the study, the participants also provided a variation of technologies that included 1 brain trainer, 1 smart TV, 5 smart phones, 6 laptops, 8 Kindles and 9 tablets. The succeeding analysis in *Chapter Four* consequently uses this variation between participants and technologies to produce an analysis to better understand the qualities and influences of the proposed MOs.

In the process of developing the quantitative questionnaire, a factor analysis was required to decipher what scales to include that indicated the proposed MOs alongside usage of the device. Consequently, a pilot questionnaire was constructed consisting of 153 different items for the utility, enjoyment, emotional attachment, social belonging and perceptions of self-worth of technology use. The mobile phone was chosen as the subject technology of the questionnaire as the majority of people within the UK own a mobile phone and would therefore be able to complete the survey (Kalba, 2008; Yamakawa *et al.*, 2013; Lee, Trimi & Kim, 2013). The participants were mainly recruited through social media; they were therefore of any age and the only two requirements being that they owned a mobile phone and lived in the UK. There was a specification that participants had to live in the UK to avoid any translation or language barriers

affecting the factor analysis of the different items. As such, there were 250 responses, 160 of which were fully completed, providing a completion rate of 64%.

4.3 Procedure

The primary step of the quantitative research phase was to develop a questionnaire that would measure the proposed MOs in relation to frequency of technology use, be the correct length to suit the needs of the participants and create a rich set of longitudinal data. As such, the succeeding section will discuss the process behind establishing the items used in the final questionnaire. Primarily, by summarising the pilot study procedure and discussing the results from the factor analysis and secondly, the items selected for the main self-report questionnaire will be justified before the process of the final quantitative research phase is discussed.

Creating an appropriate questionnaire involved refining the scales required to measure each proposed MO and their influence on technology use. Consequently, a pilot questionnaire was carefully constructed of a large pool of Likert-style statements, which were collected from the relevant literature and expanded upon (Clark & Watson, 1995). As mentioned previously, there were 153 different statements indicating 5 different scales for each of the proposed MOs (P1-P5). The survey was published on several social media websites to personal and public connections. The participants were required to use the provided link to anonymously complete the Likert-style statements within an on-line environment (Richter *et al.*, 2008; Hedman *et al.*, 2010). There were 250 responses from on-line participants but of these responses 160 were fully completed and could be used within the factor analysis. The low response rate, at 64%, was due to the sheer size of questionnaire; participants reported difficultly reaching the end. The size of the survey, however, was entirely necessary when attempting to create 5 different psychological scales through a factor analysis. As Clark & Watson describe "in creating the item pool one always should err on the side of over inclusiveness" (1995; 309).

Once the data was collected from the online system, the uncompleted responses were deleted and negative statements inverted. Each scale was separated and a statistical test of reliability was used on each factor. Items were then deleted until a high Cronbach's Alpha was established for all the 5 scales; 0.7 is usually acceptable but 0.9 was used as a benchmark for this data (Clark-Carter, 1997). Following the reliability test for each scale, all the remaining items were statistically analysed using a factor analysis. The extraction method chosen was the Principal Component Analysis, whilst

the elected rotation method was Varimax with Kaiser Normalization (Field, 2013). The following section discusses the Cronbach's Alphas and factor analysis of the scales representing the proposed MOs before revealing which items were included in the final questionnaire.

4.2.1 Utility

This section of the questionnaire was designed for the researcher to measure the perceived utility of the technological devices used by the participants. The empirical strategy is to measure utility as an MO of technology use; by using a scale representative of utility to compare this factor with frequency of use. The scale chosen was an 8 item, 5 point Likert scale used by Schifferstein & Zwartkruis-Pelgrim (2008) in their study on Consumer-Product Attachment, however being a relatively modern scale requiring validation and in specific reference to attachment rather than utility, this metric was extended by the researcher to a 36-item scale with equal positive and negative statements alongside items of usage and frequency. From this expansion of Schifferstein & Zwartkruis-Pelgrim's (2008) scale, a larger pool of items could be collated and tested, which can improve the validity of the final items chosen for the utility scale (Clark & Watson, 1995).

The pilot questionnaire was used to test the reliability and accuracy of each item within the expanded pool so that the scale could be refined for the final questionnaire in the central quantitative study. Once all completed questionnaire responses were returned, the researcher used Cronbach's Alpha to test the reliability of the utility scale. Utility is often an umbrella term for multi functions of a device or product (Czaja & Barr, 1989; Hartke *et al.*, 1998; Zimmer & Chappell, 1999; Wielandt & Strong, 2000; Chamberlain *et al.*, 2001; Slegers *et al.*, 2009; Buse, 2010; Heylen, 2010; Gaymu & Springer, 2010), this scale was therefore split into two separate factors to be statistically analysed individually. In the original *utility* scale, 27 items were tested, which produced a Cronbach's Alpha of 0.874. Following this statistical test, 5 items were deleted from the utility section of the questionnaire to raise Cronbach's Alpha to 0.898. The same statistical test was used to measure the reliability of the remainder of the items, termed as a *usefulness* scale. The 9 items within this section of the pilot questionnaire produced a Cronbach's Alpha of 0.852. One item was deleted to raise this value to 0.855.

After a Principal Component Analysis with Varimax rotation and Kaiser Normalization (Field, 2013) was used to define the presence of each factor within the data, it was evident that *utility* as an umbrella term for the functionality, usability and

usefulness of a technology was too wide-ranging to produce an adequate scale. 6 strong factors emerged from the factor analysis; it was clear that the original *utility* and *usefulness* items were scattered between two factors. Table 9 indicates the results of the factor analysis. It is evident from looking at the nature of the items that a *usefulness* factor has emerged from the pilot questionnaire data (factor 2). Consequently *usefulness*, as a sub-section of *utility* (Slegers *et al.*, 2009; Buse, 2010), becomes the label of one of the scales that is to be used in the final questionnaire. The second factor, presented in Table 10, is also a sub-section of *utility* (factor 6). The items indicate a *functionality* scale, which can be used to measure the level of purpose the technology has within somebody's life (Czaja & Barr, 1989; Hartke *et al.*, 1998; Zimmer & Chappell, 1999; Wielandt & Strong, 2000; Chamberlain *et al.*, 2001; Heylen, 2010; Gaymu & Springer, 2010).

Scales	**Factor 1**	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**	**Factor 6**
My mobile is there for emergencies only*		0.723				
My mobile phone is very useful*		0.718				
I dislike using my mobile*		0.714	0.224			
I very rarely use my mobile phone*		0.707				
I probably only use my mobile phone once a week*		0.693				
I do not find my mobile phone useful at all	0.325	0.676				
I am uninterested by my mobile*		0.667	0.2	0.179		
My mobile is very practical in its daily use*		0.664		0.146	0.209	0.202
I like using my mobile		0.661	0.295		0.246	
My mobile makes life easier for me		0.658				0.208
I probably only use my mobile phone once a month		0.648				
Using my mobile phone makes me feel unhappy	0.219	0.638				
I use my mobile phone every day		0.636				
I really wouldn't care if I lost my mobile phone		0.633	0.325			
I do not find using my mobile phone very pleasurable at all		0.625	0.368			

Table 9: The factor analysis of usefulness
* Denotes items chosen in final scale.

Scales	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
My mobile helps me get everything done quicker*		0.424				0.45
My mobile makes me more independent*		0.359				0.441
When people talk, I feel that I can identify with them	0.446				0.185	0.44
Thanks to my mobile I save a lot of time *		0.467				0.438
I find that people accept me for who I am	0.647	0.155			0.197	0.323
With a mobile phone, I feel confident about my future*			0.38			0.319
I find my mobile phone easy to use*		0.473				0.28
I think that others respect me	0.724	0.111				0.27
My mobile does not help me save time		0.453				0.256
My mobile enables me to do things myself, without needing the help of others*		0.331	0.354			0.252
I like to boast about my mobile phone			0.657			0.251
I feel that I am good at most things	0.696					0.239
Whenever I speak people listen to me	0.591				0.234	0.238
I like to show off my mobile to other people		0.235	0.567	0.273		0.23
My mobile does not give me a feeling of independence		0.491	0.201			0.212
My mobile makes life easier for me*		0.658				0.208

Table 10: The Factor analysis of functionality.
* Denotes items chosen for final scale

Both the *functionality* and *usefulness* scales were used to analyse utility and proposition one (P1) in the central quantitative research phase. 7 relevant items with equal negative and positive statements were chosen for each sub-section of utility. Table 9 and 10 demonstrate the factor analysis for *usefulness* and *functionality* whilst indicating the final Likert style statements chosen for the subsequent questionnaire (see Appendix 1). It should be noted here, however, that the sub-section of utility, *usability,* which was identified within the preliminary qualitative research phase did not appear within the psychological scales, with the exception of one item within the *functionality* scale. The main reason for this is that, *usability* or *ease-of-use* is technically a discriminative stimulus as opposed to being a MOs. In other words, it makes technology use merely available to the consumer in contrast to changing how strongly the consumer wants to use a device (Fagerstrom *et al*., 2010). Consequently, within a factor analysis of

motivating variables, it makes sense that *usability* did not emerge as strongly as *functionality* and *usefulness.*

4.2.2 Enjoyment

According to the literature, enjoyment is a necessary measure to heighten technology use as an operant behaviour (Heerink *et al.*, 2006; 2008a, 2008b; Young *et al.*, 2008). For example if a businessman originally bought an iPad to manage his emails during a long commute to work and found that he enjoyed using the iPad for other functions, their frequency of using the iPad would increase; not only would he use it for communication purposes but to play games, surf the internet and use social networks, which increases the technology usage. Enjoyment is therefore an extremely important MO of technology use. If using a technology is enjoyable, the reinforcement is positive, which increases the stimulus and encourages further usage. Consequently, it was proposed in *Chapter Two* that enjoyment acts as an MO on technology use (P2).

To measure proposition 2, there are items within the pilot questionnaire that indicated the level of enjoyment that technology use produces. The metric originated from a 7 item, 5 point Likert scale by Schifferstein & Zwartkruis-Pelgrim (2008) in their paper on Consumer-Product Attachment. The 7 items were intended to measure the enjoyment of a product post-purchase. For the purpose of this research and to increase validity, the scale has been adapted and expanded to include both positive and negative items, which are relevant for technology use (Clark & Watson, 1995). The extended scale therefore included 24 items, which could measure, represent or indicate enjoyment related to technology use.

After the data for the pilot questionnaire was collated, the reliability of the 24 item enjoyment scale was tested using Cronbach's Alpha. The statistical test indicated a high reliability of 0.920. One item was deleted, which raised the figure to 0.921. Following Cronbach's Alpha, a factor analysis was used to decipher each factor within the pilot questionnaire. The results for enjoyment can be seen in Table 11: The items that appear to be significant within the factor do not entirely indicate that the scale should be used to measure enjoyment, which questions the validity of the measure (Clark & Watson, 1995). Although the majority of items in this factor are from the original 24 item enjoyment scale, other items such as "My mobile phone reminds me of whom I am" are more directed towards the emotional attachment of the user to their technology. A combination of certain emotional attachment items with the enjoyment items has created a scale to test the *personalisation* of a technology to its user. In this

context, personalisation implies the amount that a technology is individual to its user and has consequently been personalised by the user. *Personalisation* of technology was also indicated in the preliminary diary data where enjoyment of usage and personalisation of the device appeared to create similar emotions and responses.

The *enjoyment* scale has therefore been refined to include items that measure the *personalisation* of a technology. Eight items were chosen for the final questionnaire. These items had the highest values within factor 4 in the rotated component matrix. Several items were not chosen for being too similar to the negative/positive version of other items in the final refined scale. The ultimate Likert scale elected to measure the *personalisation* of a technology had equal positive and negative statements that were high scoring within the factor analysis. Table 11 displays the final items chosen for the *personalisation* scale within the final questionnaire.

Scales	**Factor 1**	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**	**Factor 6**
Probably people who know me might sometimes think of my mobile phone when they think of me*			0.334	0.67		
I think about my mobile a lot*				0.616		
When my friends think of me, they would probably picture my mobile phone			0.512	0.61		
I very rarely have my mobile phone on my mind		0.393	0.257	0.584		
My mobile phone reminds me of who I am*			0.426	0.584		
I am always thinking about my mobile			0.27	0.563		
My mobile represents who I am*			0.337	0.539		0.163
I do not like to boast about my mobile phone			0.317	0.495		
I do not think my friends would associate me with my mobile phone			0.493	0.448		
My mobile is not reflective of me*			0.258	0.43		
My mobile has no connection to my personality*			0.398	0.417		
I do not think about my mobile at all		0.311		0.388		
My mobile phone inspires strong emotions in me*			0.55	0.368		
My mobile evidences my taste, interest or knowledge*		0.306	0.477	0.365		
My mobile provides me with no protection		0.35		0.355		0.152

Table 11: The factor analysis of personalisation.
* Denotes items chosen for final scale.

It should be mentioned here that, following the collection of the final quantitative survey data, further reliability testing and factor analysis was performed on each scale. Cronbach's alpha was used to test the reliability, but unlike the preliminary survey data, items had to continuously be deleted to strengthen this figure. As such, the *personalisation* scale was further reduced to four items, which could not be representative of an MO. Moreover, the factor analysis revealed five strong factors that were completely consistent with the preliminary data; *usefulness, functionality, emotional attachment, sense of belonging* and *perceptions of self-worth.* Unfortunately, no factor emerged for *personalisation*; instead these items were statistically included within the *emotional attachment* scale. From the lack of strength in the *enjoyment* metric and similarity of the items to the *emotional attachment* scale, it is at this point in the thesis that enjoyment can no longer be quantitatively analysed as an MO. Alternatively, the items that remained within the final survey data will be analysed in accordance with the *emotional attachment* scale, whilst considering *enjoyment* and *personalisation* to be subsections of attachment (Schifferstein & Zwartkruis-Pelgrim, 2008).

4.2.3 Emotional Attachment

Proposition 3 states that an emotional attachment to a technological device increases both the positive reinforcement and frequency of use. If emotional attachment is a MO of technology use, it will influence the positive or negative reinforcement, alongside the stimulus and response of further usage of the particular technology. According to the literature on mobile phones (Vincent, 2006; Stelmaszewska *et al.*, 2004; 2006) many users develop an emotional attachment to the device. This attachment could be both to the information stored on the technological gadget and the gadget itself. If a person were emotionally attached to a technological device, they would be highly likely to spend more time with it on their person and hence additional time using it. The fear of upset caused by losing or misplacing the mobile phone could cause the user to keep it close and use it regularly, again increasing the frequency of use.

For the emotional attachment section of the pilot questionnaire, a well-established measure of attachment in consumer psychology (Ball & Tasaki, 1992) was chosen. This 9 item, 6 point Likert scale was expanded to include a range of positive and negative items that could apply to a technology. 28 items for emotional attachment were tested within the preliminary study. The data from this section of the questionnaire was statistically analysed using Cronbach's Alpha. The reliability test indicated that the 28

items had an initial score of 0.930. One item was deleted to increase the reliability of the emotional attachment scale to 0.932.

The factor analysis performed on the pilot questionnaire data indicated a clear and strong factor (factor 3) for emotional attachment. Table 12 exhibits the factor scores of each item within the scale. The items used for the final questionnaire were the highest scoring statements, despite one which was almost identical to one of the other chosen statements. The elected articles are highlighted within the table, alongside the original phrases from Ball & Tasaki's (1992) measure of attachment. It is evident that the majority of the surviving items are from the primary scale; however, a few of the extended items have also emerged strongly within factor 3 and were included into the main empirical questionnaire. The pilot study has therefore added validity and further depth to previous scales, which justify the researcher's choice of the final statements used in the principal quantitative study (Clark & Watson, 1995).

Scales	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
If someone praised my mobile phone, I would feel somewhat praised myself*+			0.742			
I would feel touched if someone complimented my mobile*			0.735			
If someone ridiculed my mobile phone, I really wouldn't care*			0.663			
If somebody made fun of my mobile phone, I would get angry*			0.658			
I like to boast about my mobile phone*			0.657			0.251
If someone ridiculed my mobile phone, I would feel irritated+			0.652			
If somebody destroyed my mobile phone, I would feel like I've lost a bit of myself*+			0.646			
If I no longer had my phone, I would feel empty inside*			0.624			
I have very strong feelings about my mobile*		0.241	0.592			
In conversation with other people I often talk about my mobile phone			0.592			
If I were describing myself, my mobile phone would be something I would mention+			0.588			
My mobile gives me confidence in the future			0.578			0.167
I like to show off my mobile to		0.235	0.567	0.273		0.23

other people						
If I lost my mobile phone, I would feel like I had lost a little bit of myself+		0.229	0.564			

Table 12: The factor analysis of emotional attachment.
* Denotes items chosen for final scale.
+ Denotes items from the original Ball & Tasaki's (1992) emotional attachment scale.

4.2.4 Social Belonging

This thesis proposes that social belonging is a MO of technology use; implying that feelings of social belonging created by technology use increase positive reinforcement, which in turn influences the stimulus for further responses (Kirkvold *et al.*, 2012; Ballantyne *et al.*, 2010). The theory is that feelings of social belonging produced from using a technology create a positive learned behaviour, which encourages the user to continue using the technology, maintaining feelings of social belonging (P4). For example, an older person may be isolated at home due to health problems or geographical limitations and for this reason, they acquire a Laptop. This Laptop allows the older person to communicate with family and friends through email, Skype and social networks, which increases their feelings of social belonging and desire to continue using the Laptop. Alongside this, another form of social belonging involves using technology as a sign of social status within a community. An example of this would be if somebody decided to join a book club where every member had a Kindle; acquiring and using a Kindle in this situation increases a feeling of social belonging and hence frequency of use.

This section of the pilot questionnaire encompassed items from Hagerty and Patusky's (1995) scale on sense of belonging alongside other relevant Likert-style statements. Hagerty and Patusky's (1995) sense of belonging metric is an 18 item, 4 point Likert scale, which was expanded to include 37 individual measures. These items give the statistical analysis more depth and allow the most accurate measures to be used in the final questionnaire. A 5-point Likert scale was used in accordance with the other items within the questionnaire and to heighten the validity of the metric (Clark & Watson, 1995).

The results of the social belonging scale within the pilot study were analysed using Cronbach's Alpha. The reliability of the 37 items was calculated to be 0.956. Following this calculation, 3 items were deleted to increase the reliability to 0.961. With such a high reliability between the final 34 items, the subsequent factor analysis discovered a

strong factor (factor 5) of 9 social belonging items. The highest scoring eight were chosen to represent a social belonging scale in the final questionnaire. These items had an equal number of positive and negative statements alongside a range of items asking for various responses. It is evident however, from Table 13, that these individual measures are related to social belonging. Once the answers to the negative statements are reversed, a scale of social belonging can be produced.

Scales	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
I feel like a square peg in a round hole*	0.692				0.372	
I would describe myself as a misfit*	0.651				0.358	
I feel part of mainstream society*	0.546				0.342	
I never feel left out*	0.587				0.334	
I always feel like I belong*	0.615				0.331	
This world is strange to me*	0.448				0.325	
I've always been a do-er not a watcher*	0.336				0.319	
I often feel like I have to change the way I behave in public*	0.471				0.315	
I always feel comfortable around my peers*	0.579				0.312	
It is not a pleasure to use my mobile phone		0.49	0.465		0.3	
I do not find my mobile phone very practical		0.544			0.292	
It is a pleasure to use my mobile phone		0.482	0.515		0.267	
I enjoy using my mobile phone		0.609	0.381		0.265	
It is not a joy to use my mobile		0.543	0.436		0.257	
My mobile phone is not fun to use		0.531	0.405		0.248	

Table 13: The factor analysis of social belonging.
* Denotes items chosen for final scale.

4.2.5 Perceptions of Self-Worth

It is proposed in this thesis that if self-worth is increased through technology use, which then influences further responses. In other words, technology use as an operant behaviour is influenced by the user's perceptions of self-worth. Many older people admitted to feeling embarrassed by using technology to aid their daily lives (Heerink *et al.*, 2006; 2008a; 2008b). If using a technology, rather than creating humiliation, caused an increase in perceived self-esteem the user is more likely to continue to use the device (Hirsch *et al.*, 2000).

To measure this MO, the Rosenberg (1989) scale of self-esteem was chosen and expanded to include additional terms, which give the statistical analysis further depth and significance. The Rosenberg (1989) scale of self-esteem is a 10 item, 4 point Likert scale which was extended to include 28 individual measures. The 28 item self-worth scale was placed in the final section of the pilot questionnaire. The results were analysed using Cronbach's Alpha. The reliability of the scale was discovered to be 0.960. Following this test 4 items were deleted to increase the reliability to 0.964. With such a high reliability, the subsequent factor analysis clearly indicated perceptions of self-worth as a factor.

The 8 highest scoring items within the factor were chosen for the final scale. These items included 5 positive statements and 3 negative statements. Table 14 shows the strong factor figures (factor 1) of between 0.872 and 0.78 of the items that are to be used in the central quantitative study. The individual measures will be presented with a 5 point Likert scale, which will measure participant's perception of self-worth. 1 is strongly agree, 2 is agree, 3 is neither agree or disagree, 4 is disagree and finally 5 equals strongly disagree. Once the negative statements have been inverted, the higher the score, the higher the participant's self-esteem.

Scales	**Factor 1**	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**	**Factor 6**
Lots of people value me*	0.872	0.113				
I feel that I can't do anything right*	0.85	0.167				
I take a positive attitude toward myself*	0.842		0.13			
I often think that I'm worthless*	0.833					
I feel valuable in society*	0.817					
I feel that I'm a person of worth, at least on an equal plane with others*	0.805	0.102				
All in all, I am inclined to feel that I am a failure*	0.791					
On the whole, I am satisfied with myself*	0.78		0.112			
I wonder if there is any place on earth where I really fit in	0.774				0.187	
There aren't many things that I'm good at	0.771					
I feel completely included in this world	0.758				0.244	
I often feel left out	0.757				0.205	

If I disappeared, hardly anyone would notice I was gone	0.754	0.211				
I'm not sure if I fit in with my friends	0.753	0.136		0.167	0.2	
I feel like I fit in, in most situations	0.75				0.236	
Table 14:The factor analysis of perceptions of self-worth. * Denotes items chosen for final scale.						

Once each of these scales had been statistically analysed using Cronbach's Alpha and specific factors had emerged from the Principal Component Analysis extraction, with a Varimax rotation and Kaiser Normalization, the final items within each scale were selected. The ultimate questionnaire was therefore comprised of 7 sections; 6 sections for the 6 different factors (including two sub-sections for utility) and 1 section for socio-economic questions. The socio-economic questions were derived from the 2011 census and include measures for sex, age, marital status, education, technology use and experience. The questionnaire therefore included 53 items in total; 7 questions for socio-economic factors, 7 items for usefulness, 7 for functionality, 8 for personalisation, 8 for emotional attachment, 8 for social belonging and 8 for perceptions of self-worth. Only the first two factors; usefulness and functionality contained 7 items as these were testing two different segments within utility. All the other factors were included as an 8-item 5-point Likert scale with equal positive and negative statements.

In summation, the final self-report questionnaire (see Appendix 1) was developed for the central research phase. This phase intended to collect quantitative data on the proposed MOs that are evoking/abating technology usage by people over the age of 65. Therefore, the questionnaire was completed 6 times across a 6 month period by 29 participants who were all aged between 65 and 88, living in the UK and using a technology acquired no longer than 12 months before the start of the longitudinal study. This chapter has discussed the philosophical approach of the present research within the context of Skinner's radical behaviourism. By drawing on previous applied behaviour analysis and consumer behaviour empirical strategies, a strategy complimentary of collecting MO data within a real-life setting has been produced. The preliminary qualitative research results strengthen the theory behind each proposed MO (P1-P5) and justify further quantitative analysis in a similar fashion to a functional analysis. The remainder of the chapter has presented the process behind the construction of psychological scales that reliably represent measures for each of the

proposed MOs. The final questionnaire, indicating these scales, can be viewed in Appendix 1.

The following chapter expands upon the preliminary data represented within this chapter, by analysing and discussing the results of the longitudinal survey data in relation to the 6 propositions developed from the literature within *Chapter Two.* It uses both the quantitative survey data and qualitative diary data to further comprehend the propositions and the effect of motivation on technology use by older adults.

CHAPTER FOUR

A NETWORK OF MOTIVATIONS

1. Introduction

The previous chapter established a statistically significant difference between each month of measurement for the different MO scales, indicating that time can be used to demonstrate a variation in variables affecting frequency of use. However, the discrepancy between technologies was not statistically significant due to a low number of observations for certain devices. Therefore, the initial statistical tests in the present chapter have been applied to test if different technologies produce statistically significant different frequencies of use. Using the logic of Greene and D'Oliveira (2005; see Appendix 2), when measuring the difference between three or more conditions (in this instance the different technologies) on one variable (for instance the frequency of usage) with unrelated participants, an unrelated one-way ANOVA is required. Consequently, using the survey data, an unrelated one-way ANOVA has been applied to the frequency of use across different technologies.

The four devices with the most survey responses were included within this statistical analysis and will be used for further comparisons within the present chapter; iPad, Laptop, Kindle and Smart Phone. Table 15 indicates the descriptive statistics for the frequency of use of each of these technologies. Table 16 demonstrates Levene's test of homogeneity of variances, which should be a non-significant value at more than 0.5. As a result of the significant value in the present analysis, both Welch and Brown-Forsythe (Table 18) have been applied to support the ANOVA in Table 17. Moreover, due to this violation of the assumption of homogeneity of variances, Games-Howell was applied in the post-hoc analysis to indicate individual significant differences between each technology (Field, 2013).

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
iPad	53	66.92	47.880	6.577	53.73	80.12	1	120
Laptop	40	27.25	35.119	5.553	16.02	38.48	0	120
Kindle	48	43.02	42.397	6.119	30.71	55.33	0	120
Smart Phone	35	40.17	42.467	7.178	25.58	54.76	3	120
Total	176	46.07	44.848	3.381	39.40	52.74	0	120

Table 15: Descriptive statistics of usage per technology.

Levene Statistic	df1	df2	Sig.
4.841	3	172	.003

Table 16: Test of Homogeneity of Variances of usage per technology.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	38882.033	3	12960.678	7.120	.000
Within Groups	313109.149	172	1820.402		
Total	351991.182	175			

Table 17: ANOVA of usage per technology

	Statistic[a]	df1	df2	Sig.
Welch	7.042	3	92.267	.000
Brown-Forsythe	7.326	3	165.291	.000

Table 18: Robust Tests of Equality of Means of usage per technology.

. [a] Denotes asymptotically F distributed.

The descriptive statistics demonstrate a difference in frequency of use between the four devices. The iPad produced the highest mean at 66.92 usages per month, followed by the Kindle with 43.02 and the Smart Phone with 40.17. The technology with the lowest mean was the Laptop, which had an average of 27.25 usages per month. The remaining three tables above indicate whether the differences between these means are significant. As previously discussed the assumption of homogeneity of variances has been violated with a significant Levene's test (p value = 0.003). Consequently two robust tests were performed to indicate the F-ratio when the homogeneity of variances is not assumed. The ANOVA produced an F-ratio of 7.120 at a significance of 0.00;

following the tests of robustness, the Welch test indicated an F value of 7.942 (p=0.000) whilst the Brown-Forsythe test showed an F value of 7.326 (p=0.000). These tests confirm that there is a significant difference between the means of frequency of use for the different technologies. To establish a further understanding of the differences between each device, a Games-Howell post-hoc test was applied. The Games-Howell was chosen as opposed to the Bonferroni, as it does not rely on the assumption of equal variances (Field, 2013).

(I) Technology	(J) Technology	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
iPad	Laptop	39.675*	8.607	.000	17.15	62.20
	Kindle	23.904*	8.983	.044	.43	47.38
	Mobile Phone	26.753*	9.736	.037	1.20	52.31
Laptop	iPad	-39.675*	8.607	.000	-62.20	-17.15
	Kindle	-15.771	8.263	.232	-37.42	5.88
	Mobile Phone	-12.921	9.075	.489	-36.84	11.00
Kindle	iPad	-23.904*	8.983	.044	-47.38	-.43
	Laptop	15.771	8.263	.232	-5.88	37.42
	Mobile Phone	2.849	9.433	.990	-21.95	27.65
Mobile Phone	iPad	-26.753*	9.736	.037	-52.31	-1.20
	Laptop	12.921	9.075	.489	-11.00	36.84
	Kindle	-2.849	9.433	.990	-27.65	21.95

Table 19: Games-Howell multiple comparisons of usage between technologies.
* the mean difference is significant at the 0.05 level.

The Games-Howell multiple comparison test indicates significant differences between means for the following three pairs of technologies: iPad and Laptop (p = 0.000), iPad and Kindle (p=0.044) and iPad and Smart Phone (p = 0.037). However, for a further three pairs of technologies there is not a significant difference; for instance between Laptop and Kindle (p=0.232), Laptop and Smart Phone (p = 0.489) and Kindle and Smart Phone (p = 0.990). The former pairs of technologies produce a significantly different frequency of use and therefore can be used to indicate which MOs are impacting on the usage of which device; for instance the iPad usage has the highest correlation with each of the MOs, which explains why it has the highest frequency of use. Alternatively the Laptop usage has fewer correlations with each of the MOs, which may explain why the frequency of use is significantly lower. The most significant comparison is between the iPad and the Laptop (p = 0.000); these two

devices and other significant comparisons will therefore be used in the subsequent chapter.

Research propositions P1-P5 propose that 5 different factors (utility, enjoyment, emotional attachment, sense of belonging and perceptions of self-worth) are Motivating Operations (MOs) of technology use. When analysing an MO there are two impacts that need to be considered; the first of these is the value altering effect of the MO on the value of responding. The second of which involves the behaviour altering effect, which either increases or decreases the rate of response (Michael, 1993; Michael, 2000; Fagerstrom *et al.*, 2010). The present thesis is focussed on the second impact; the behaviour altering affect and will therefore measure the influence that each proposed MO has on the rate of response or in this case, the frequency of technology use. To establish if an MO either abates or evokes behaviour, it is important to distinguish between frequency of use that increases over time, frequency of use that decreases over time and frequency of use that remains constant, so that factors influencing these trends can be investigated. By calculating an absolute percentage change over time, each participant's results have been divided into three categories; usage increase, usage decrease and constant usage. To test that there is significant difference between the mean frequencies of use for each of these groups, an unrelated one-way ANOVA was applied. Greene and D'Oliveria (2005) suggest that if the differences between three or more conditions on one variable are being tested for an unrelated data set then this parametric test should be used (see flow chart in Appendix 2). Similar to the tables above, the first table indicates the descriptive statistics for the three groups, the second table demonstrates whether the assumption of homogeneity of variances has been violated, the third table indicates the F-ratio from the ANOVA, the fourth table tests the robustness of the F-value and the final table shows the post-hoc test of individual group comparisons.

	N	**Mean**	**Std. Deviation**	**Std. Error**	**95% Confidence Interval for Mean**		**Minimum**	**Maximum**
					Lower Bound	**Upper Bound**		
Decrease	47	17.34	22.356	3.261	10.78	23.90	0	75
Constant	88	47.41	46.630	4.971	37.53	57.29	1	120
Increase	53	63.45	42.571	5.848	51.72	75.19	0	120
Total	188	44.41	43.928	3.204	38.09	50.74	0	120

Table 20: Descriptive Statistics of usage per rate-of-response group

Levene Statistic	df1	df2	Sig.
28.696	2	185	.000
Table 21: Test of Homogeneity of Variances of usage per rate-of-response group			

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	54450.680	2	27225.340	16.438	.000
Within Groups	306398.958	185	1656.211		
Total	360849.638	187			
Table 22: ANOVA of usage per rate-of-response group					

	Statistic[a]	df1	df2	Sig.
Welch	29.121	2	113.812	.000
Brown-Forsythe	19.222	2	157.351	.000
Table 23: Robust Tests of Equality of Means of usage per rate of response group. [a] Denotes asymptotically F distributed				

The descriptive statistics clearly indicate differences between the means for the three groups; unsurprisingly the increase in usage group has the highest mean at 63.45 uses per month, followed by the constant group with 47.41 uses per month and finally the decrease group has an average of 17.34 usages per month (see Table 20). The other three tables decipher whether these differences are significant. Levene's homogeneity of variances test is significant, which means that the robust tests need to be applied. The F-ratio for the ANOVA is 16.438 ($p = 0.000$), however for the robust tests that do not rely on the assumption of equal variances; the Welch statistic was 29.121 ($p = 0.000$) and the Brown-Forsythe result was 19.222 ($p = 0.000$). These results clearly indicate a significant difference between frequency of use means for the increase group, decrease group and constant group. Consequently, these three groups can be used to analyse the different effects that the proposed MOs may have on technology usage. The following table shows the results of the Games-Howell post-hoc test, which demonstrates significant differences for each comparison.

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Games-Howell	Decrease	Constant	-30.069*	5.945	.000	-44.16	-15.98
		Increase	-46.112*	6.695	.000	-62.10	-30.13
	Constant	Decrease	30.069*	5.945	.000	15.98	44.16
		Increase	-16.044	7.675	.096	-34.26	2.17
	Increase	Decrease	46.112*	6.695	.000	30.13	62.10
		Constant	16.044	7.675	.096	-2.17	34.26
Table 24: Games-Howell multiple comparisons of usage per rate-of-response group. * the mean difference is significant at the 0.05 level.							

Table 24 reveals significant differences between the following pairs: increase and decrease groups (p = 0.000) and constant and decrease groups (p = 0.000), however, the difference between the increase and constant groups is not significant (p = 0.096). For a test that measures the significance between means, this is understandable considering that many of the participants with a constant usage are still using their device at a high frequency and many people who have an increased usage over time, begin with a lower frequency before increasing to a higher frequency, which of course will affect the mean value. For a deeper understanding of the variance between the groups, it is imperative to see if there is a significant variation over time. A mixed factor, repeated measure ANOVA was therefore applied to the aggregate data; unfortunately this test revealed a significant Levene's value which invalidates the use of this parametric test (Field, 2013). As such, to show a variation within and between the groups over time, two different non-parametric tests have been applied (see Appendix 2; Green & D'Oliveria, 2005). The first of which is Friedman's Two-Way Analysis of Variance by Ranks for related data (Table 25), which tests the null hypothesis that the distributions of usage for Months 1-6 are the same. This test was conducted for each of the groups; increase, constant and decrease and as expected the increase and decrease groups had a significant different between the months (p = 0.006 and p = 0.002 respectively), indicating a change in values over time whilst the constant group had no temporal significant difference (p = 0.45), indicating a constant value.

	N	**Test Statistic**	**Degrees of Freedom**	**Asymptotic Sig. (2-sided test)**
Decrease	7	18.418	5	0.002
Constant	14	4.725	5	0.450
Increase	8	16.275	5	0.006

Table 25: Related samples Friedman's Two-Way Analysis by Variance of Ranks.

The second non-parametric test applied was the Independent-Samples Kruskal-Wallis unrelated test (see Appendix 2; Greene & D'Oliveira, 2005), which assesses the differences between the increase, constant and decrease groups for each individual month. Table 26 displays these results and demonstrates that there is a significant

difference between the groups from months 3-6. As expected, the significant differences between the three groups increase in strength over time as one set of data demonstrates an evoking of behaviour, the other an abating of behaviour and the final group, maintenance of technology use. Both the one-way ANOVA and the non-parametric tests demonstrate a significance difference between these groups over time for the mean or median frequency of use. This grouping of data will therefore be used in the present chapter to illustrate the proposed MOs influence on technology use by people over the age of 65.

	N	Test Statistic	Degrees of Freedom	Asymptotic Sig. (2-sided test)
Month1	32	0.239	2	0.887
Month2	32	3.859	2	0.145
Month3	32	6.734	2	0.034
Month4	32	6.779	2	0.034
Month5	31	11.178	2	0.004
Month6	29	11.925	2	0.003

Table 26: Independent- Samples Kruskall-Wallis Test

The following figure visually depicts the mean frequencies of use over the 6 month period for the three significantly different groups; decrease, constant and increase usage. As is evidenced, the three means for the first month begin at 40 uses per month before the increase group climbs to over 80 uses in month 6, the constant group maintains 40 uses and the decrease group's usage drops to a mean of merely 10 uses per month. This pattern is explained by the trialability section of Rogers' (2003) framework alongside recent supportive literature (Mallenius, Rossi & Tuunainen, 2010; Xie, Watkins, Golbeck & Huang, 2012). Mallenius *et al.* (2010) discover how experimentation and exploration of a device create the three patterns of usage; a positive experience that leads to an increase or continuous usage and a negative experience that leads to a decrease in use but before the trialability stage all usages are equal. Xie *et al.* (2012) concur with their study of social media use; they explain how both young and older participants start with simplistic and uniformed preconceptions resulting in similar usage patterns. As knowledge increases through usage either

limitations or strengths of the technology are discovered, which influences whether usage increases or decreases, similar to the patterns depicted below.

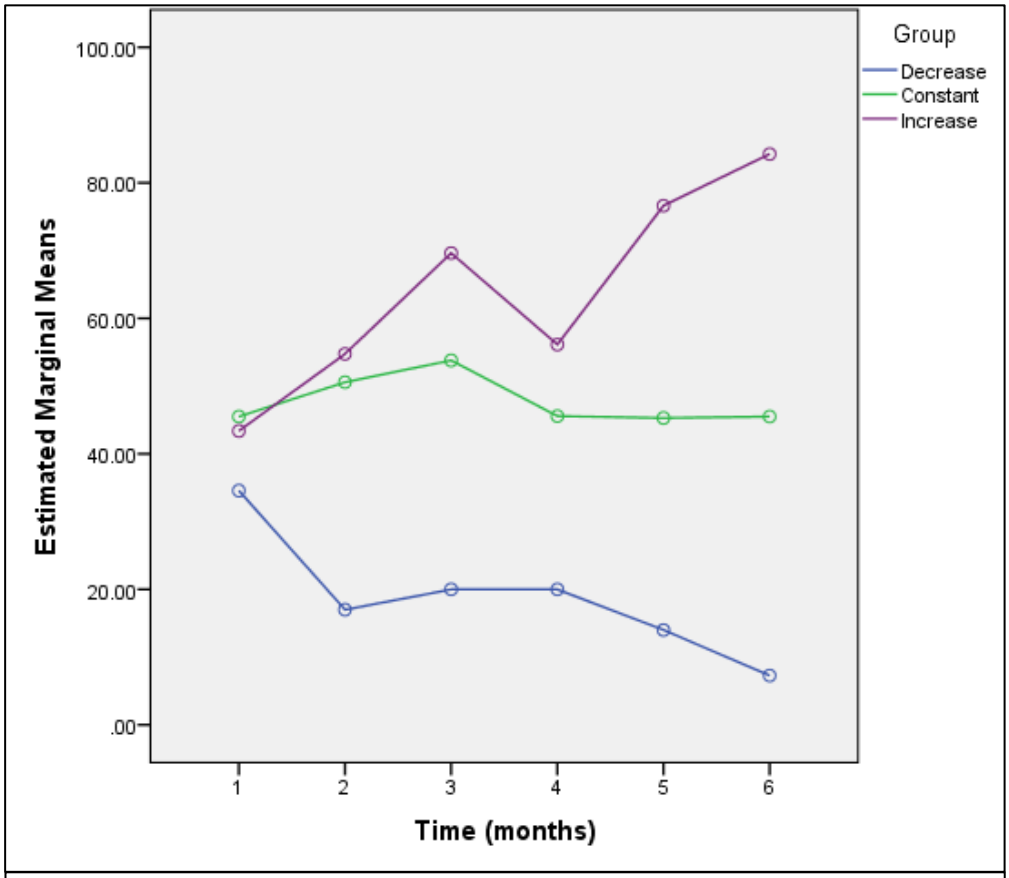

Figure 11: Estimated marginal means of frequency of use over time.

In sum, the three rates of response groups are significantly different; with one increasing over time, one remaining constant and one decreasing over time. These groups of data will therefore be used to decipher which MOs are affecting rate of response; in other words which independent variables influence the dependent variable; an increase in technology use by older adults and which independent variables decrease usage for this age group. The mean usages for the four main technologies; iPad, Laptop, Kindle and Smart Phone are also significantly different, which means that in the analysis, different technologies can be used to infer which independent MOs are affecting the dependent technology use. With these two useful groups of data, a network of factors influencing technology use should be painted in the succeeding section; data can be interpreted by factors affecting frequency of use and different technologies being subject to varying MOs.

2. Utility

P1: The utility of a technological device acts as a CMO-R on technology use as an operant behaviour.

The rationale behind P1 is that the perceived utility of a technological device acts as a CMO-R on the usage of that device. Perceived utility incorporates the perceived functionality, usability and usefulness of a device and acts as an initial motivating factor of usage. After initial usage, if the perceived utility is positive, it is correlated with the "improvement" of the users' condition and increases the frequency of use. For instance, a device providing a high utility will enable that person to use their device effectively, whilst having an enjoyable experience and achieving their aims, which consequently improves that user's condition. Through this improvement, perceived utility establishes its own removal or termination as a punisher, which will reduce the frequency of technology use. In other words, if the perceived utility of a device suddenly drops and the user no longer finds it useful, easy to use or functional then the device usages will also decrease.

To explore this proposition, the first requirement was to produce a scale that can measure the utility of a device. From the preliminary results, two separate scales emerged that were both indicative of utility. The first scale indicated perceived usefulness whilst the second scale contained items for both the usability and functionality of a technology. Both the measures were tested for reliability using Cronbach's Alpha in the preliminary study and with the present survey data. The number of items were refined until the reliability reached its potential strength, 0.9 being the benchmark for the present data. Using these scales, a usefulness and functionality score was computed for each survey completion, which in the following table, has been correlated with frequency of use to indicate whether there is a relationship between the perceived utility of a device and the number of uses.

The Pearson product moment correlation measures the relationship between two continuous sets of scores (Greene & D'Oliveria, 2005). The present chapter explores the relationships between independent variables (utility, emotional attachment, sense of belonging and perceptions of self-worth) and the dependent variable, which in this instance is frequency of use, of the chosen technological device, per month. The self-report frequency of use scale is discrete and represents continuous data from 0 uses per month to the maximum of 120. For the independent variables, the reliability of the

scales were tested in chapter 3, and from these scales continuous scores from 7 to 35 have been produced, altering the data from ordinal to continuous and warranting the use of the Pearson product moment correlation measure.

Consequently, in this section Pearson correlations were applied to the usefulness score, the functionality score and the monthly frequency of use (Table 27) to establish any relationships between the factors. As is demonstrated the entire data set of 188 responses portrays correlations between the perceived usefulness of a device and uses per month; this correlation is positive at 0.687, with a significance of 0.000, which clearly indicates that the perceived usefulness impacts on the frequency of use. Moreover, the second measure of utility, the functionality score, also correlates with usage per month at a Pearson value of 0.316 (p=0.000). As one would expect with two different measures of utility, the usefulness and functionality score also correlate with each other (r=0.438, p=0.000).

		Usage Frequency/month	**Usefulness score**	**Functionality score**
Usage Frequency/month	Pearson Correlation Sig. (2-tailed N	1 188	.687** 0.000 188	.316** 0.000 188
Usefulness score	Pearson Correlation Sig. (2-tailed) N	.687** 0.000 188	1 188	.438** 0.000 188
Functionality score	Pearson Correlation Sig. (2-tailed) N	.316** 0.000 188	.438** 0.000 188	1 188

Table 27: Pearson product moment correlation of frequency of use, usefulness and functionality.

		Usage/Frequency
Usefulness score (Laptop)	Pearson Correlations Sig (2-tailed) N	0.854** 0.000 39
Usefulness score (iPad)	Pearson Correlations Sig (2-tailed) N	0.825** 0.000 53
Usefulness score (S-Phone)	Pearson Correlations Sig (2-tailed) N	0.780** 0.000 35

Usefulness score (Kindle)	Pearson Correlations Sig (2-tailed) N	0.524** 0.000 50
Functionality score (S-Phone)	Pearson Correlations Sig (2-tailed) N	0.538** 0.001 35
Functionality score (iPad)	Pearson Correlations Sig (2-tailed) N	0.517** 0.000 53
Functionality score (Laptop)	Pearson Correlations Sig (2-tailed) N	0.362* 0.024 39
Functionality score (Kindle)	Pearson Correlations Sig (2-tailed) N	0.115 0.426 50
Table 28: Pearson product moment correlation of frequency of use, usefulness and functionality for each technology.		

Table 28 displays Pearson correlations between the two utility scales and frequency of use for the different technologies. The two devices with the highest correlation of usefulness to frequency of use are the Laptop (r=0.854, p=0.000) and the iPad (r=0.825, p=0.000). After establishing, in the introduction of this chapter, that the usage of each of these devices is significantly different, it is possible to use a comparison between these devices to establish what motivates behaviour. According to the descriptive statistics, the iPad has the highest mean frequency at 66.92 usages per month whilst the Laptop has the lowest mean frequency at 27.18 usages per month. The usefulness scores for each of the technologies indicate the iPad with the highest mean score of 30.79 and the Laptop with the second to lowest mean score of 27.58. These figures demonstrate that when a technology usage is both high (iPad) and low (Laptop) it is still correlated with the usefulness score of the device. The same is also true of the functionality of a device; the highest correlations between functionality and usage are for the Smart Phone and the iPad. As previously mentioned, the iPad had the highest mean usage (66.92) whilst the Smart Phone also had a significantly different mean usage (40.17), which was calculated as the second lowest of the technologies. Consequently functionality appears to correlate with usage for devices that produce both a high usage and a relatively low usage. To explore this observation further and establish whether Utility can be considered a CMO-R of technology use, the following graphs depict usefulness and functionality over time for increasing, decreasing and constant behaviours.

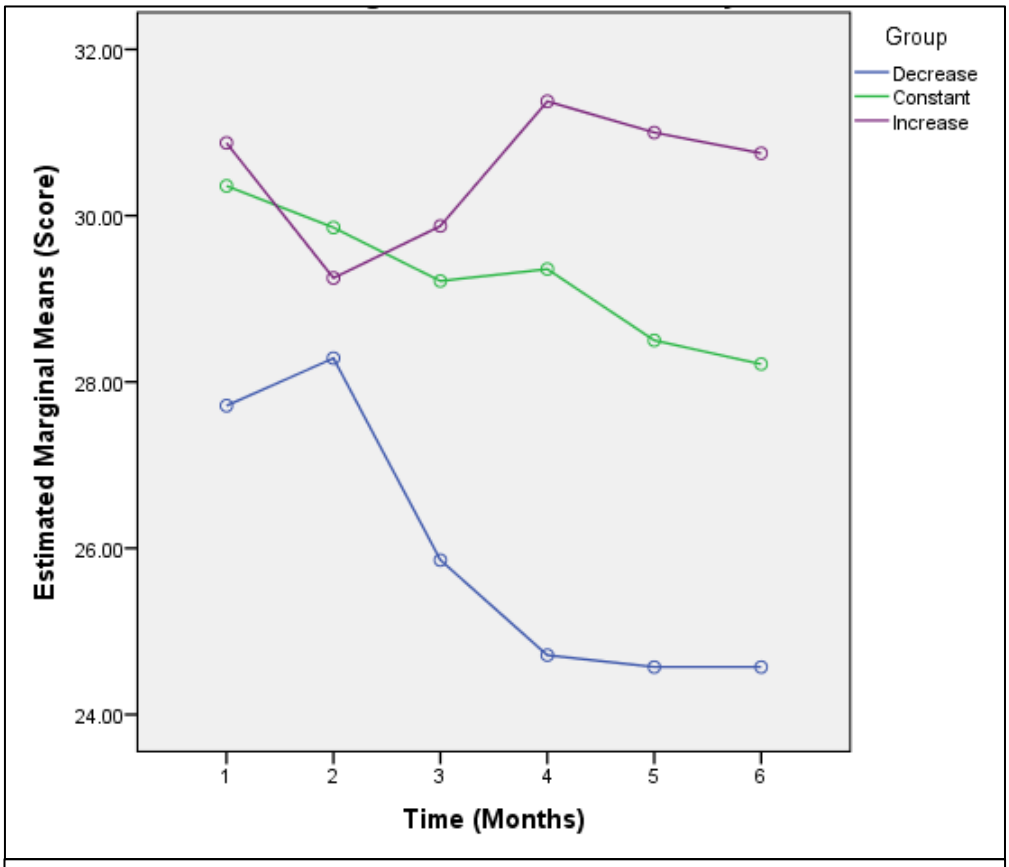

Figure 12: Estimated marginal means of the usefulness score over time.

Figure 12 depicts the mean usefulness scores across the 6 months of measurement for three different groups of results; frequency increase, frequency decrease and constant usage. The first observation is that the mean usefulness score for the decreasing frequency group evidently decreases over the 6 month period; from a mean score of approximately 28 to a reduced score of 24. Secondly, although the usefulness score for the increasing usage group does not clearly increase itself, the monthly scores are still larger than the other two groups, wavering around an average score of 31. The constant group's usefulness scores decrease slowly over time from a mean of 30 to 28 but still remains a middle value between the other two groups. From this graph, it can be concluded that a high usefulness score of a technology can increase the usage of the device. A middle valued score of usefulness can maintain the usage levels of the technology whilst a decreasing usefulness score can influence the decrease and even extinction of use.

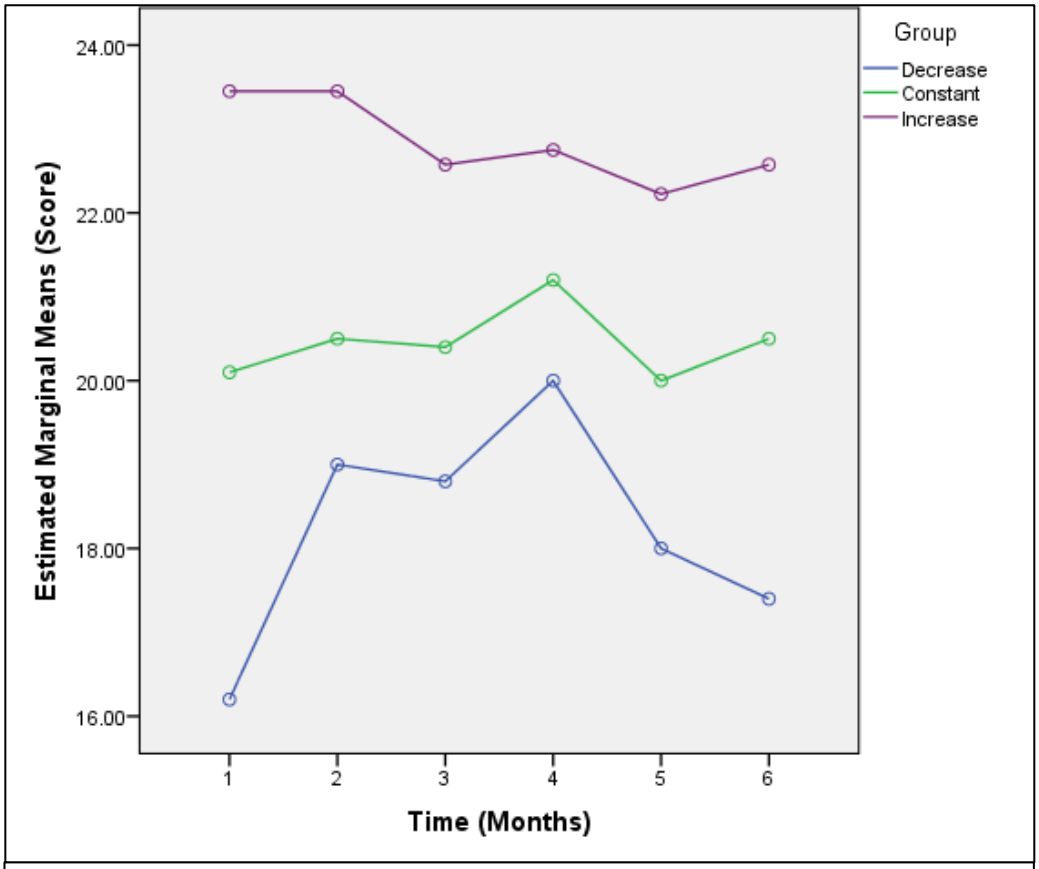

Figure 13: Estimated marginal means of the functionality score over time

The second graph portrays the mean functionality score across time for the three different rates of response; increase, decrease and constant. The mean functionality values clearly indicate discrepancies between these groups; for instance, functionality scores are on average higher for the group whose usage increases over time and lower for the group whose frequency decreases over time. The increasing and decreasing trends cannot be observed temporally for the functionality score, however, the values are certainly indicative of whether technology use will be evoked or abated. These observations suggest that the perceived functionality of a device does not fluctuate with usage over time, but a constant high functionality can influence an increase of use whilst a constant low functionality can influence a decrease of use or even extinction of behaviour. To test the significant difference between functionality scores for these three groups an unrelated one-way ANOVA was applied (see Appendix 2; Greene & D'Oliveira, 2005).

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Usefulness score	Decrease	47	25.8936	4.20783	.61377	24.6582	27.1291	15.00	35.00
	Constant	88	29.3523	5.18184	.55239	28.2543	30.4502	15.00	35.00
	Increase	53	30.3962	3.99682	.54901	29.2946	31.4979	22.00	35.00
	Total	188	28.7819	4.92731	.35936	28.0730	29.4908	15.00	35.00
Functionality score	Decrease	47	17.9021	4.74257	.69177	16.5097	19.2946	7.00	26.60
	Constant	88	20.5227	4.01565	.42807	19.6719	21.3736	14.00	29.40
	Increase	53	23.0604	4.42381	.60766	21.8410	24.2797	8.40	32.20
	Total	188	20.5830	4.69303	.34227	19.9078	21.2582	7.00	32.20

Table 29: Descriptive statistics of usefulness and functionality scores per rate-of-response group

	Levene Statistic	df1	df2	Sig.
Usefulness score	2.503	2	185	.085
Functionality score	.974	2	185	.380

Table 30: Test of homogeneity of variances for usefulness and functionality scores per rate-of-response group

		Sum of Squares	Df	Mean Square	F	Sig.
Usefulness score	Between Groups	558.832	2	279.416	12.984	.000
	Within Groups	3981.227	185	21.520		
	Total	4540.059	187			
Functionality score	Between Groups	663.394	2	331.697	17.760	.000
	Within Groups	3455.191	185	18.677		
	Total	4118.586	187			

Table 31: ANOVA of usefulness and functionality scores per rate-of-response group

The first table from the unrelated one-way ANOVA reveals the descriptive statistics for usefulness and functionality for the three different rates of response. As one would expect the mean value across both the usefulness and functionality scores are indicative of the response rate; the lowest values (25.89 for usefulness and 17.90 for functionality) are within decreasing frequency of use results, whilst the highest values (30.40 for usefulness and 23.06 for functionality) are for the increasing response rates. The remainder of the tables establish whether there is a significant difference between these values for each of the response rate groups. The second table assesses the assumption of homogeneity of variances; with both figures being insignificant at the 0.5 level, it can be assumed that the data has not violated the homogeneity of variances

assumption and the ANOVA can proceed. The results of the ANOVA in the third table indicate an F-value of 12.984 (p=0.000) for usefulness and an F-value of 17.760 (p=0.000) for functionality. From these results there is a significant difference between the usefulness and functionality scores for each of the three response groups.

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Usefulness score	Decrease	Constant	-3.45866*	.83811	.000	-5.4835	-1.4338
		Increase	-4.50261*	.92947	.000	-6.7482	-2.2571
	Constant	Decrease	3.45866*	.83811	.000	1.4338	5.4835
		Increase	-1.04395	.80659	.592	-2.9926	.9047
	Increase	Decrease	4.50261*	.92947	.000	2.2571	6.7482
		Constant	1.04395	.80659	.592	-.9047	2.9926
Functionality score	Decrease	Constant	-2.62060*	.78078	.003	-4.5069	-.7343
		Increase	-5.15825*	.86589	.000	-7.2502	-3.0663
	Constant	Decrease	2.62060*	.78078	.003	.7343	4.5069
		Increase	-2.53765*	.75142	.003	-4.3530	-.7223
	Increase	Decrease	5.15825*	.86589	.000	3.0663	7.2502
		Constant	2.53765*	.75142	.003	.7223	4.3530

Table 32: Multiple comparisons (Bonferroni) of usefulness and functionality scores per rate-of-response group.
* the mean difference is significant at the 0.05 level

The Bonferroni comparisons for the usefulness score clearly display significant differences between certain groups; for instance between the decrease and the increase response rate groups and the decrease and constant groups. However, there is no significant difference between the constant frequency of use group and the increasing frequency of use group, which could be due to high usefulness scores for both groups. The Bonferroni comparisons for the functionality scores per group show significant differences between every individual comparison. There are significant differences in functionality between the group of users with an increasing usage and with a decreasing usage; alongside the increase and constant group and the decrease and constant group.

2.1 Interpretation

The Pearson correlations expose relationships between both the utility factors and frequency of technology use, which implies that perceived utility, can have a motivating influence on technology usage. The additional correlations explore the characteristics of this relationship to establish which technologies produce the highest correlations; for instance the perceived utility of the device may have more impact on

usage for some devices than for others. Moreover, certain technologies have more functions and would create a stronger relationship between functionality and usage, which is evidenced by the high correlations between functionality and usage for smart phones ($r = 0.538$ $p = 0.001$) and iPads ($r = 0.517$ $p = 0.000$) and no significant correlation for the Kindle ($r = 0.115$, $p = 0.426$), which only really has one function.

It is evident that there is a relationship between utility and usage, however, to support the proposition that utility is a CMO-R of technology use; the withdrawal of utility must act as a punisher and reduce the frequency of technology use. The two graphs, which indicate the usefulness and functionality levels for frequency of use that increases, decreases or remains constant over time, visually demonstrate that for a decreasing usage the usefulness also decreases. Alternatively, a reduction or termination of the usefulness of a technological device can reduce or terminate the usage of said device, which supports the proposition. The graph that visually depicts functionality over time for the three different response groups portrays distinctly different trends. Most notably, the mean functionality scores for decreasing use do not decrease over time; they are, however, significantly lower than the mean scores for constant and increasing use ($F = 17.760$, $p = 0.000$). This suggests that perceived functionality varies less than perceived usefulness but a low functionality score still reduces the frequency of technology use. The shape of this line is also interesting, showing a peak of functionality around month 4 before a swift decrease in months 5 and 6. The peak could imply an exploration of use (Mallenius *et al.*, 2010), which increases the functionality score. Alternatively, once functionality establishes itself as a reinforcer (peak in month 4), the reduction of this MO acts as a punisher on technology use (months 4-6), which again supports the proposition that utility is a CMO-R of technology use.

Interestingly, introducing perceived utility as a CMO-R on technology use is producing a behavioural perspective on elements of other models of technology adoption and acceptance. The two principle models of technology acceptance and adoption are the TAM (Davis *et al.*, 1989) and the innovation diffusion theory (Rogers, 2003), respectively. The original TAM included two influencing factors on attitudes towards technology usage, which are perceived usefulness (PU) of a device and perceived ease of use (PEU). Both of which are to do with beliefs; for instance how much somebody believes the technology is useful or easy to use and how these beliefs influence the

attitudes towards using the device, which according to Davis *et al.* (1989) influence the intention to use the technology and the actual usage of the device or programme. The two scales developed to measure perceived utility in the present study, were not devised to discover the participants' beliefs or attitudes towards technology but created to assess the actual usefulness and functionality of the devices. The scale with the highest correlation to technology usage is the usefulness measure whilst the functionality measure also demonstrates a positive and significant correlation. Functionality, in this instance, also included measures of usability or ease of use and so the results are consistent with the previous technology acceptance literature but provide a behavioural interpretation of how these factors influence usage.

The results are also indicative of characteristics of the diffusion of innovation theory (Rogers, 2003). Rogers (2003) suggests that innovators and early adopters are heavily influenced by the innovation or utility of a device (e.g. usefulness and ease-of-use) whilst the late adopters and laggards are mostly influenced to purchase and use a technology through the verbal accounts of the innovators and early adopters. It would therefore be expected that people who are early adopters or innovators would be influenced more by perceived utility as a motivation than people who are motivated by other factors such as word-of-mouth and subjected norms (Lee, Trimi & Kim, 2013). In other words correlation between frequency of use and perceived utility will be higher for people who are considered early adopters or innovators. In contrast to this assumption, much of the literature suggests that older people are generally late adopters or imitators but still value utility as the highest motivator of usage (Lunsford and Burnett, 1992; Leventhaul, 1997; Laukkanen *et al.*, 2007; Slegers *et al.*, 2009; Buse, 2010). Proposition 6 explores the connection of Rogers' (2003) diffusion of innovation with the BPM (Foxall, 1994) and the MOs proposed in the present thesis; it will therefore be established in the final section whether utility is more of a motivating factor for innovators and early adopters than for late adopters and imitators.

The implications of these results on the age group of the chosen study are vast. Firstly, the extremely high correlation between the two utility factors and usage supports the literature linking technology use by people over the age of 65 with usefulness (Lunsford and Burnett, 1992; Leventhaul, 1997), usability (Laukkanen *et al.*, 2007) and functionality (Sledgers *et al.*, 2009; Buse, 2010). The literature demonstrates that, for this age group, the utility of a technology is the main motivator for using and accepting it,

which is especially prominent for assistive technology (McCreadie & Tinker, 2005). Secondly, the results also indicate the importance of usefulness, functionality and ease-of-use of the device and that without these factors usage will decline or even terminate post-purchase. This is especially significant for technologies that are designed specifically for the older adult and rely on their purchase and usage. One such technology is the smart home (Poland, Nugent, Wang & Chen, 2011) or unobtrusive in-home sensing (Wild, Boise, Lundell & Foucek, 2008), which involves the monitoring of individuals through sensors in an attempt to keep older people living at home for longer periods of time.

Previous smart home literature has focussed on either the technical and practical aspect of the technology (Poland *et al.*, 2011) or on the attitudes of the target market towards the assistive nature of the system (Wild *et al.*, 2008). The attitude based research discovered that older people were positive towards smart home technology as long as the utility of the monitoring system outweighed the perceived barriers (Melenhorst & Bouwhuis, 2004). Wild *et al.* (2008) discovered particular useful functions to be important; for instance maintaining independence in the home, detecting cognitive decline and sharing imperative information. One of the expected barriers, privacy and safety of information, was viewed as secondary behind the utility of the technology. In other words as long as technology serves its purpose, the potential issues of misuse of data are less influential on the actual use of devices. The survey results support the importance of usefulness, functionality and ease-of-use as motivating factors of technology acceptance; however, to understand the particular characteristics of these factors further, this chapter will now re-examine the diary data.

The diary data also supports Wild *et al.*'s (2008) conclusions that the utility of assistive technology undermines any worries or barriers concerning safety and privacy. A word frequency search of the top 500 words within the submitted participant diaries, indicated no results for 'safety', 'safe' and 'privacy' and only 15 counts of 'security' and 26 counts for 'password', which were mostly in reference to the inconvenience of having to enter a security password:

> **Participant S:** "*After about 20 attempts to key in the Livebox's 26-digit security code, iJack was connected to the internet.*"

Alternatively, there were higher counts for words directly associated with utility such as use (66), used (45), using (27), user (26), which indicate a high utility of the measured devices in comparison to the barriers of safety and privacy. Moreover, the word frequency search also demonstrated the characteristics of utility; for instance the particular functions of technologies. The most popular activity recorded in the diaries was sending and reading emails; the word 'email' was written 115 times, making it the word with the second highest frequency. Other functions that were highlighted in the word search include reading (86), apps (63), iTunes (45), play (23), iPlayer (20), news (19), shop (19), Google (17), Internet (17), Scrabble (14), search (14), Facebook (13), music (12), Dropbox (11), crossword (10), radio (10), games (9), TV (9) and fun (8). It is evident that the top functions of the devices in the present study (iPad, Smart Phone, Kindle and Laptop) involve firstly, communication through emails and less so through social media sites such as Facebook and Twitter, secondly, information collation through reading the news, searching Google and the Internet and thirdly, entertainment from music, TV programmes, apps and games. Several interesting points from the functionality of devices is the low usage of social media sites such as Facebook (n=13) and the low usage of games (9) and other entertainment, with the exception of music. Music seems to be an important factor for participants in this study with 45 mentions of 'iTunes', 12 references to 'music' and 10 inferences to 'radio'. Whatever the function, it is apparent that the utility of a device is one of the most important factors for the older adult and as the word frequency search indicates, this utility overrides any worries and concerns regarding privacy and safety (Wild *et al.*, 2008).

Communication is evidently the most prominent use of technology within the present study with 115 references to emails, 19 to messages, 13 to Gmail and 13 to Facebook. It is interesting that email is so much preferred to other communication methods such as social media sites. This is in comparison with the literature, which states that older adults' most common use of computers is for communication and social support (Wagner, Hassanein & Head, 2010) and for this they often use more traditional methods of communication such as email (Jones & Fox, 2009). In fact, Lenhart (2009) discovered that for the older adult (65+) Internet users, only 7% have a profile on a social networking site, which is in comparison to 75% of younger adults (18-24). Cornejo, Favela & Tentori (2010) suggest that this is because older adults are less technically inclined whilst Xie *et al.* (2012) highlight privacy as the main obstacle to

social media use. Moreover, Xie *et al.* (2012) also discovered that as older people were educated about social media and discovered the utility of certain sites, for example a blog communicating family progress or problems as opposed to individual emails, the privacy issue became less of a barrier. Even though older adults may choose email over social media, the important factor is that communication is the primary function of technology use, which is beneficial in reducing loneliness (Ballantyne *et al.*, 2010) and increasing successful ageing (Rowe & Khan, 1987; 1998; Kirkvold *et al.*, 2012). The following quote demonstrates that for older people who are more likely to experience death and loss (Kirkvold *et al.*, 2012) technology can facilitate the process and help alleviate the stress associated with losing a loved one:

> **Participant I:** "*I'm a widower again. My wife has been in a home for about 3.5 years. With frequent visits, now I feel strangely more alone than ever, though I have been living alone and looking after myself all that time. There are so many things to do now, so many people to notify; my computers are now being used for serious purposes. Even for somebody in New Zealand, whose phone and email I don't know, so I typed a letter for airmail. Information for the solicitor, information for the funeral director, preparing what to say, what music to play, looking up where to have the after-funeral reception, looking up how to register the death, with what seems like a lot of information, addresses galore, much of it stored on the computer. With a lot of this I have been helped by my son and his partner, but computers, iPads, and iPhones have all supplied their uses.*"

Additionally the word frequency search discovered words such as people (38), friend (22), son (23), wife (18), contacts (15), nephew (13) and family (9) demonstrating that technology utilises the communication between older people and their family and friends. Whether the sense of belonging created from this utility is a motivation for further technology usages will be explored later in this chapter, in proposition 4.

The second prominent function of technology use is information searching or collation, with words such as reading (86), news (19), Google (17), Internet (17) and search (14) topping the word frequency count. Previous research on information searching by older adults indicates that ageing has a negative impact on the effectiveness of Internet searches (Mata & Nunes, 2010; Dommes, Chevalier & Lia, 2011). In other words older adults might take longer to search for answers or have to use more links to find

information (Chevalier, Dommes & Martins, 2013). This may be true and cannot be proved within the present study due to a lack of comparison with younger adults but the important implication from the diary and survey data is that the motivation behind searching for information is not lacking, as suggested by previous academics (Selwyn, Gorard, Furlong & Madden, 2003; Carpenter & Buday, 2007; Morris, Goodman, & Brading, 2007; Peacock & Kunemund, 2007). Stereotypical assumptions of older people having negative opinions towards technology and unwillingness to explore the systems have been heavily contested in recent literature, which has discovered positive attitudes (Mitzner *et al.* 2010) and enthusiasm towards Web based activities (Zaphiris, Kurniawan & Ghiawadala, 2007). The results of this study support these positive attitudes and motivation to use technology through the heavy presence of the following words within the diary data: tried (57), find (54), new (47), found (45), trying (19) and help (18). Although using technology was occasionally difficult and challenging for the participants there was never a lack of motivation to try and find out how to use certain functions of the device. In fact, ironically, often Internet searches were used to discover information regarding the use of the technology:

> **Participant S:** "*I Googled the problem: iPad forums.net. Others had the same problem. Solution offered: press on/off button and Home at the same time.*"

The final usage of technology portrayed in the diary data is leisure and entertainment, which is also in accordance with the literature (Wagner, Hassanein & Head, 2010). Previous studies have found the that uses of computers and the Internet by older adults for entertainment and leisure purposes often reflect offline interests such as genealogy (White & Weatherall, 2000). The frequency word search also compliments this theory by highlighting words such as apps (63), iTunes (45), iPlayer (20), news (19), shop (19), Scrabble (14), music (12), crossword (10), radio (10), games (9) and TV (9), which insinuate interests in mostly music, news, shopping and word games; all of which can be accessed offline and most probably reflect offline hobbies. The multiple references to music and iTunes highlight very interesting results; the literature has suggested encouraging cultural interests as a solution to isolation and loneliness in older adults (Lizardo, 2006), however, it was also discovered that as people age their cultural tastes narrow. Harrison and Ryan (2010) proclaim a narrowing in musical taste as age increases, which according to Peterson and Ryan (2004) is due to the new technologies used to distribute music and a lack of understanding or willingness to use these novel distribution channels. On the surface, the diary results seem to contradict

these arguments; although there is no evidence of narrowing tastes, the frequency of words suggests that new music technologies such as iTunes are being used to access music. However, by exploring the data further, it is evident that even though there is a familiarity or element of usage of iTunes, these experiences are mostly negative:

> **Participant A:** "*Getting documents from my computer to the iPad was difficult, involving either emailing or an elaborate routine using iTunes.*"

> **Participant S: "***I still don't know how to get my iTunes Library etc on iJack, showing all my podcasts and purchased items.*"

On the flip side, there were positive experiences with new music technologies; for instance having music easily accessible on the smart phone or being able to listen to the radio online via an iPad or Laptop:

> **Participant C: "***Preparing for holiday in Poland. My husband has loaded music onto the phone*."

In summary, the data supports the proposition that perceived utility acts as a CMO-R on technology use. Although future research should isolate this MO and apply and withdraw utility to determine direct influence on the rate of response, the data clearly indicates a strong relationship between perceived utility and frequency of technology use. It can also be concluded that lower or reducing levels of utility will reduce technology use; in other words utility has established its removal as a punisher, which will abate or even terminate usage. There are also strong implications of the importance of utility for the older adult, especially in the design of assistive technologies. The diary data indicates the characteristics of utility of a device for the chosen population. As predicted in the literature, there are three main uses of technology; firstly for communication purposes, secondly for information searching and thirdly for entertainment and leisure pursuits (Wagner, Hassanein & Head, 2010). These specific functions will no doubt influence the remaining MOs in propositions 3, 4 and 5; for instance communication impacts on sense of belonging.

3. Emotional Attachment

P3: Emotional attachment is coupled with other CMO-Rs to become a CMO-S of technology use and consequently a CMO-R on the repeated use of technology as an operant behaviour.

In *Verbal Behaviour*, Skinner (1957) first associated the term emotion with operant behaviour and unbeknown to him, he was referring to what is now defined as a motivating operation (Michael, 2004). Emotions that impact on behaviour are very applicable to the ownership and use of personal items; in this instance a portable technology. Consequently, an emotional attachment to a technological device has been proposed as a CMO-S of technology use. The rationale behind this proposition emanates from literature on emotional connections to mobile phones (Vincent, 2006; Stelmaszewska *et al*., 2004; 2006; 2008) where users have a connection to both the device itself and the information stored within the technology. It is proposed that if the device serves its function; if it creates positive reinforcement from utility or enjoyment then an emotional attachment towards the device will be created, which will increase both the frequency of use and level of positive reinforcement. In other words the initial CMOs create an improvement of circumstances, which can lead to an emotional attachment. The emotional attachment is a CMO-S, as after being coupled with other CMOs such as utility and enjoyment, it then acts as a CMO-R on technology use. Consequently, emotional attachment establishes its own removal as a punisher and can abate or terminate behaviour.

The previous proposition has explored the motivational impact of the utility of a device on the frequency of use of that technology; it discovered that for the older adult, utility is an important motivating factor of using a technology. This proposition explores the impact of utility on emotional attachment and how this then evokes or abates technology use, for the chosen population. Moreover, the following section will explore whether emotional attachment improves the older adult's situation and hence its removal may act as a punisher, which can reduce the frequency of use and impact of reinforcement.

The primary step for testing emotional attachment as a CMO-S was to produce a scale that could measure this factor in relation to technology use. The scale chosen was Ball and Tasaki's (1992) measure of attachment, which was expanded and tested on 160 participants in the preliminary study. The final factor was a 10 item, 5 point Likert scale including the original attachment items and additional personalisation items, which are a large influence on attachment towards a technological device. The results

of this scale were summed for each response to produce an emotional attachment score, which could be compared to the frequency of use and other factors from the survey.

Pearson correlations were applied to measure the relationship between the emotional attachment score and frequency of use, alongside the other factors that may impact upon the emotional attachment of a device. Table 33 indicates these correlations; firstly, it can be confirmed that there is a positive and significant relationship between the emotional attachment score and the usage of a device ($r = 0.221$, $p = 0.002$). Secondly, it is notable that emotional attachment also has positive relationships with both the utility measures; usefulness ($r = 0.289$, $p = 0.000$) and functionality ($r = 0.409$, $p = 0.000$). The final two figures in the table indicate a significant negative relationship between the emotional attachment towards a device and a sense belonging ($r = -0.376$, $p = 0.000$) and perceptions of self-worth ($r = -0.170$, $p = 0.020$).

		Emotional Attachment score
Usage Frequency/month	Pearson Correlation Sig. (2-tailed) N	.221** 0.002 188
Usefulness score	Pearson Correlation Sig. (2-tailed) N	.289** 0.000 188
Functionality score	Pearson Correlation Sig. (2-tailed) N	.409** 0.000 188
Emotional Attachment score	Pearson Correlation Sig. (2-tailed) N	1 188
Social Belonging score	Pearson Correlation Sig. (2-tailed) N	-.376** 0.000 188
Perceptions of self-worth score	Pearson Correlation Sig. (2-tailed) N	-.170* 0.020 188
Table 33a: Pearson product moment correlation of emotional attachment with frequency of use and other MOs. ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed)		

The second table of Pearson correlations reveals the relationship between emotional attachment and frequency of technology use for specific technologies. The highest Pearson correlation value, demonstrating the strongest relationship between emotional

attachment and usage, is for the Laptop (r = 0.441, p = 0.005). The Laptop has the lowest mean frequency of use at 27.25, which implies that a low emotional attachment score can influence a reduction in technology use; this will be explored later with an additional graph and ANOVA. Other technologies with a significant correlation between emotional attachment and usage are the Kindle (r = 0.336, p = 0.017) and the iPad (r = 0.306, p = 0.026), which both had higher mean frequencies than the Laptop at 43.02 and 66.92, respectively. According to the Games-Howell post-hoc test in the introduction of the chapter, the iPad and Laptop also had significantly different mean usage values (39.625, p = 0.000), which means that comparisons between the two can be made.

		Usage/Frequency
Emotional Attachment (Laptop)	Pearson Correlations Sig (2-tailed) N	0.441** 0.005 39
Emotional Attachment (Kindle)	Pearson Correlations Sig (2-tailed) N	0.336* 0.017 50
Emotional Attachment (iPad)	Pearson Correlations Sig (2-tailed) N	0.306* 0.026 53
Emotional Attachment (S-Phone)	Pearson Correlations Sig (2-tailed) N	0.067 0.703 35

Table 33b: Pearson product moment correlation of frequency of use and emotional attachment for each technology

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed)

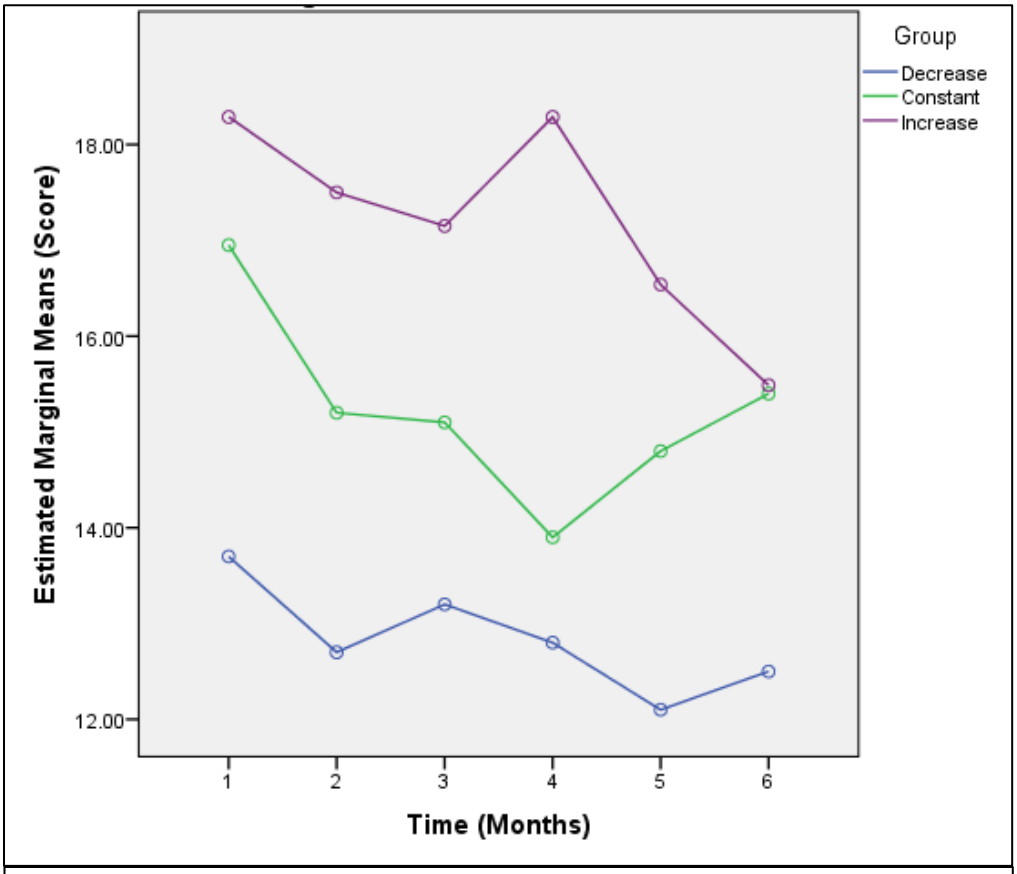

Figure 13: Estimated marginal means of emotional attachment score over time

Figure 13 graphically depicts the mean emotional attachment scores over the 6 month period of measurement for three different groups: increasing, decreasing and constant frequency of technology use. The participants whose usage increased had a generally higher emotional attachment towards the device than the participants whose usage either declined or remained constant. The emotional attachment score did not increase over time but after peaking at approximately 18 in week 4, it declined rapidly to 16 in week 6; this is a similar trend to the increase group's usefulness score discussed in the previous section. The constant rate of response group had a lower emotional attachment towards their devices wavering between a mean value of approximately 17 in week 1 and 14 in month 4. Finally, the decreasing usage group had a mean lower emotional attachment between 12 and 14; this score gradually decreased over time alongside the frequency of use. An interesting comparison between the present graph and the previous graphical figures for usefulness and functionality is that the mean scores are generally lower for emotional attachment. All the scores have been summed to have a maximum of 35, which means that anything below 17.5 is essentially a negative score. Other than the first 4 months of the increase group, all the mean scores

represented in figure 34 are less than 17.5 and consequently demonstrate a negative emotional attachment towards the devices. To determine if there is a significant difference between the emotional attachment scores for each of the three groups, an unrelated one-way ANOVA was applied (see Appendix 2; Greene & D'Oliveira, 2005).

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Decrease	47	12.4064	3.94282	.57512	11.2487	13.5640	7.00	21.00
Constant	88	15.1693	5.31382	.56645	14.0434	16.2952	7.00	24.50
Increase	53	16.6283	4.36482	.59955	15.4252	17.8314	7.00	23.80
Total	188	14.8899	4.97013	.36248	14.1748	15.6050	7.00	24.50

Table 34: Descriptive statistics of emotional attachment scores per rate-of-response group

	Levene Statistic	df1	df2	Sig.
Emotional Attachment score	3.975	2	185	.020

Table 35: Test of homogeneity of variances of emotional attachment scores per rate-of-response group.

		Sum of Squares	Df	Mean Square	F	Sig.
Emotional Attachment score	Between Groups	456.928	2	228.464	10.154	.000
	Within Groups	4162.383	185	22.499		
	Total	4118.586	187			

Table 36: ANOVA of emotional attachment scores per rate-of-response group.

		Statistic[a]	df1	df2	Sig.
Emotional Attachment score	Welch	13.388	2	113.590	.000
	Brown-Forsythe	11.321	2	178.071	.000

Table 37: Robust tests of equality of means of emotional attachment scores per rate-of-response group.
[a] Asymptotically F distributed

The first table created from the ANOVA displays the descriptive statistics for the emotional attachment scores of each of the three groups (Table 34). It is evident that the group of participants with a decreasing frequency of use have the lowest mean emotional attachment score to their devices at 12.41, whilst the group with an increasing frequency of use have a higher mean value of 16.63 and the constant group have a middling value of 15.17. Interestingly, for all three groups the minimum

emotional attachment value is 7, which is the lowest score possible for the scale. The second table indicates the results of Levene's test of equality of error variances, (Table 35) which is just significant at 0.02; in this instance the data has violated the assumption of homogeneity of variances, which means that robust tests also need to be applied. The ANOVA F-value is 10.154 (p = 0.000); with the robust tests the asymptotically F distributed values are 13.388 (p = 0.000) for Welch and 11.321 (p = 0.000) for Brown-Forsythe. These statistics are significant at the 0.01 level and higher than the original F-value, which means that the differences between the emotional attachment scores for the three groups is significant. To further examine the differences between each specific group a Games-Howell multiple comparison test was applied post-hoc.

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Emotional Attachment score	Decrease	Constant	-2.76294*	.80724	.002	-4.6788	-.8471
		Increase	-4.22192*	.83080	.000	-6.1991	-2.2447
	Constant	Decrease	2.76294*	.80724	.002	.8471	4.6788
		Increase	-1.45898	.82483	.184	-3.4152	.4972
	Increase	Decrease	4.22192*	.83080	.000	2.2447	6.1991
		Constant	1.45898	.82483	.184	-.4972	3.4152

Table 38: Multiple Comparisons Games-Howell of emotional attachment scores per rate-of-response group.
* the mean difference is significant at the 0.05 level

Table 38 confirms significant differences in emotional attachment scores between the decrease group and the increase group (4.22, p = 0.000) and between the decrease group and the constant group (2.76, p = 0.002) but no significant difference between the increase and constant group (1.46, p = 0.184). These significantly different comparisons mirror those discovered for frequency of use (Table 24), which suggests that the emotional attachment scores resemble and impact upon the usage of a technology. The following section will discuss the implications of these results; whether they support or challenge P3 and how this impacts upon the older adult and their acceptance of technology. In addition, the qualitative diary data will be re-examined to give depth to the characteristics of emotional attachment towards technology for the chosen population.

3.1 Interpretation

The following section will decipher whether the results of the survey data support the proposition that emotional attachment is a CMO-S of technology use (P3). To approve this proposition emotional attachment should be paired with other CMO-Rs and produce the same effect as those MOs. In other words, once emotional attachment is established as an MO by being associated with other motivating factors such as utility, it then acts in the same manner as these MOs on the frequency of use. Firstly, the emotional attachment scores correlate with the two utility scores (usefulness and functionality), which indicates a positive relationship between the factors. The Pearson correlation was the most prominent between emotional attachment and functionality at 0.409 ($p = 0.000$) and secondly between emotional attachment and usefulness at 0.289 ($p = 0.000$), which implies that the utility of a device as a CMO-R can impact upon the emotional attachment towards that device. The results therefore support the first criterion of P3 that emotional attachment is paired with other MOs; in this instance the CMO-R perceived utility of a device. The second condition is that emotional attachment then adopts the motivating function of this CMO-R; in other words, a high emotional attachment should evoke an increased frequency of use, which 'improves' the user's conditions; this improvement establishes the removal of emotional attachment as punisher which could abate or terminate behaviour.

There is a significant correlation between the emotional attachment score and frequency of use ($r = 0.221$, $p = 0.002$), which implies the level of emotional attachment towards a device evokes usages; the higher the emotional attachment, the more the technology is used. This is truer for some devices than for others; for instance the Laptop users' frequency of use was highly influenced by the level of emotional attachment ($r = 0.441$, $p = 0.005$) as were both the Kindle ($r = 0.336$, $p = 0.017$) and iPad users ($r = 0.306$, $p = 0.026$) but the smart phone users' frequency of use had no significant correlation with emotional attachment ($r = 0.067$, $p = 0.703$). This is an interesting observation as it was the mobile phone literature that implied there would be a level of emotional attachment between user and device (Vincent, 2006; Stelmaszewska *et al.*, 2004; 2006; 2008). This lack of relationship could be explained by the age of the participants and their different associations to smart phones than the younger generation, which will be explored subsequently using the diary data collated in the preliminary phase.

For emotional attachment to have adopted the properties of CMO-Rs such as utility, it should establish its own removal as a punisher, which would abate or terminate behaviour. The graph in Figure 13 demonstrates that participants whose usage decreases over time have much lower scores of emotional attachment towards a device than participants whose usages either increase or remain constant. The implications of this are that a low or decreasing emotional attachment towards a device can abate or even terminate behaviour (see Figure 11). The results of the one-way ANOVA prove that the emotional attachment scores are significantly different for the three rate-of-response groups, which implies that the emotional attachment score is significantly lower for a decreasing rate of response than for an increasing or constant usage of technology. Consequently, the results support the proposition that emotional attachment is a CMO-S of technology use. It is paired with utility to act as a CMO-R on technology use, establishing its own removal as a punisher, which abates or terminates the behaviour.

Although the results indicate that emotional attachment can act as a CMO-S on technology use by older adults, the recorded scores of emotional attachment towards devices were low and often negative (below 17.5) with an overall mean of 14.89. The majority of the literature would argue that this is due to older people's indifference towards technology and lack of motivation to use devices (Selwyn, Gorard, Furlong & Madden, 2003; Carpenter & Buday, 2007; Morris, Goodman, & Brading, 2007; Peacock & Kunemund, 2007). However, the comparison of the present survey data with the preliminary data would suggest otherwise; the survey used to refine the psychological scales had 160 responses from mobile phone users between the ages of 18-60; the mean emotional attachment score from these data is 13.99, which is surprisingly less than the mean emotional attachment score for the older participants. Even though the average was lower, there was more of a range of scores in the preliminary study, which you would expect from such a broad range of ages, with a maximum emotional attachment value of 32.9, this is in comparison to the present study where the maximum score recorded is 24.5. More research would be required to validate any effects that age has on emotional attachment towards a device but it can be concluded from these results, however, that the apparent low scores are not due to age but are merely the nature of the chosen scale. Despite its low values, there is still a positive relationship between emotional attachment and usage and a clear distinction between emotional attachment scores for increasing, decreasing and constant technology usage.

The studies specifically aimed at measuring emotional attachment towards a technological device (Gomez *et al.*, 2008; Vincent, 2006; Stelmaszewska *et al.*, 2004; 2006; 2008) have not targeted age as variable but merely propose that emotional attachment towards technology is apparent on both a social and personal level. Technology studies that do mention age as a variable do not propose emotional attachment as having an influence on usage (Selwyn, 2004; Eastman & Iyer, 2005; Arning & Ziefle, 2007; 2008; 2009; Renaud & van Biljon, 2008; Mallenius, Rossi & Tuunainen, 2010; Buse, 2010). There is literature that briefly refers to the emotional connection that older people have with certain new technologies but these studies are predominantly focused on specific devices such as scooters (May, Garrett and Ballantyne, 2010) or care robots (Heerink, Krose, Evers and Wielinga, 2006; 2008a; 2008b; Wada & Shibata, 2007). For the older adult, there may be more suggestion of an emotional connection towards scooters and robots as opposed to portable interactive devices (PIDs; Gomez *et al.*, 2008) or mobile phones (Vincent, 2006; Stelmaszewska *et al.*, 2004; 2006; 2008) because firstly, scooters can become so important in people's lives at creating freedom and autonomy and secondly, robots are interactive and often lifelike, which can install strong emotions such as enjoyment (Heerink, Krose, Wielinga & Evers; 2006). The following section will further explore the characteristics of emotional attachment towards technology by people over the age of 65 and how this impacts on lifestyle and usage. To delve further into this CMO-S and its impacts, the diary data will be revisited.

The importance of a device for an older user seems to instil emotional attachment towards that technology. May, Garrett & Ballantyne (2010) report on the importance of scooters in older adult's lives; they enable freedom and independence, maintain friendships, help carry out daily errands and keep in touch with wider communities. "The emotional, personal and physical importance of scooters in the lives of the older people in this study repeatedly emerged from the data" (May, Garrett & Ballantyne, 2010: 10) and through this dependence, the older adults establish an emotional relationship with their scooters. The qualitative data collected in this thesis supports May, Garrett & Ballantyne's (2010) observations to a certain degree. For instance, words such as want (40), need (25), needed (13), useful (11) and needs (5) emerged in the frequency word search, whereas negative words indicating a lack of importance were low, for example useless (6). It appeared that some users really needed their technology and through this importance an emotional attachment to the device was formulated. One participant reported needing to use her Kindle to access emails whilst away from home:

> **Participant B**: "*Visiting my daughter in Liverpool for the weekend and having no internet connection I checked my emails on the Kindle. Very useful as an important one had arrived that needed a quick response.*"

The same participant also described her Kindle as "great", "exciting", "excellent", "fantastic" and "invaluable", which demonstrates a link between how important or invaluable a device is and the attachment towards it. Moreover, the same participant portrayed an emotional attachment to her Kindle as she "regretted not having it [her hardback book-group book] on the Kindle so that [she] I could pop it in [her] my bag and read on the train."(Participant B).

Alternatively, the domestic technical devices that were investigated in this study could explain the low emotional attachment scores in the survey data. Although a few participants commented about not being able to live without technology after having experienced its benefits, the devices that were investigated were generally not imperative to the continuation of people's lives. The devices were discovered to be useful and beneficial but more as an enhancement to lifestyle as opposed to being essential for living. It would be interesting to continue the research with devices of more importance to people to see if this impacts upon levels of emotional attachment.

The other implied impact of emotional attachment towards technological devices for older adults is the interactivity of the technology. Heerink, Krose, Evers and Wielinga (2006; 2008a; 2008b) discovered that the emotional attachment, especially enjoyment, towards a robot was dependent on how interactive the robot was with the participants. The diary data supports this research by indicating more emotional attachment to technologies that are interactive or allow interaction with friends and relatives. For instance, words discovered in the frequency search denote a level of interaction with the devices: email (115), play (23), message (19), Google (17) and Internet (17). One participant, who used her iPad up to three times a day, indicates how interaction with and through her device can improve negative feelings and enhance positive emotions:

> **Participant M:** *"just checked and received some lovely joke e'mails from friend, feeling pretty fed up with re-wiring so really appreciated them. Sent a quick "thank you""*

An extremely noticeable connection between emotional attachment towards a device and interaction is the relationships that are upheld through technology. Proposition 4 will explore a sense of belonging as a CMO-S of technology use but it is also apparent from the diary data that interaction and hence emotional attachment towards a

technology is often associated with personal relationships. For instance photographs and images of family and friends hold a high importance with older adults and can impact on the attachment towards a device:

> **Participant J:** "*Shots of Granddaughter's Birthday visit, created a "Fun Multiple Image" for the Family Album"*

In summary, the data indicates that emotional attachment is a CMO-S of technology use with utility factors pairing with emotional attachment to formulate the effects of a CMO-R. Proposition 3 is therefore supported with positive correlations between utility and emotional attachment and emotional attachment and frequency of use. The graph (Figure 13) indicates the levels of emotional attachment for decreasing, increasing and constant usage; the scores for these three groups are significantly different, which specifies that emotional attachment establishes its own removal as a punisher, which again supports P3. The literature and diary data outline further motivating factors that emotional attachment could be paired with, predominantly the importance of a device in maintaining quality of life and how interactive this device is with the user. The following section explores how interactivity with people through devices can impact upon usage by establishing whether a sense of belonging is a CMO-S of technology use.

4. Sense of Belonging

P4: Sense of belonging is coupled with other CMO-Rs to become a CMO-S of technology use and consequently a CMO-R on the repeated use of technology as an operant behaviour.

The reasoning behind P4 is that as an older person's social circle reduces through loss and illness (Cumming *et al*., 1960; Carstensen, 1992; 1995; Fung, Carstensen and Lang 2001; Drennan *et al.,* 2008; Gray, 2009; Scherher, Nazroo & Higgs, 2010), this makes communication with remaining family and friends all the more important. Consequently, if a device fulfils its utility and function in aiding communication despite geographical and health obstacles, then this utility may enhance a sense of belonging, which in turn impacts the frequency of use of the device. As such a sense of belonging is a CMO-S of technology use; it is paired with the utility of a technology before acting as a CMO-R of usage. In other words a sense of belonging created from the utility of a device should create an improvement in a person's condition; this improvement then establishes the removal of social belonging as a punisher. If a device

no longer links its user with their friends and family, this will negatively impact upon the rate of response.

The first step to measuring a sense of belonging in relation to technology use was to develop a scale. Hagerty and Patusky's (1995) sense of belonging metric was expanded and tested in the preliminary survey to develop a scale appropriate for the present study. The refined measure was a 7 item, 5-point Likert scale, containing items such as "I would describe myself as a misfit" and "I never feel left out". An overall score was computed for this scale, where the higher the score (maximum 35), the higher the level of sense of belonging felt by participants. These scores were then used in the following statistics to determine whether sense of belonging is a CMO-S of technology use:

		Social Belonging score
Usage Frequency/month	Pearson Correlation Sig. (2-tailed) N	.099 0.177 188
Usefulness score	Pearson Correlation Sig. (2-tailed) N	.140 .055 188
Functionality score	Pearson Correlation Sig. (2-tailed) N	-.070 .340 188
Emotional Attachment score	Pearson Correlation Sig. (2-tailed) N	-.376** .000 188
Social Belonging score	Pearson Correlation Sig. (2-tailed) N	1 188
Perceptions of self-worth score	Pearson Correlation Sig. (2-tailed) N	.733** .000 188

Table 39: Pearson product moment correlation of social belonging with Frequency of use and other MOs
** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed)

The first table of this section shows no significant linear correlation between the sense of belonging scores and the recorded frequency of use, which would be expected if sense of belonging is a CMO-S of technology use. There are however, significant Pearson correlations between sense of belonging and the perceptions of self-worth score ($r = 0.140$, $p = 0.055$) and a negative relationship between emotional attachment

and sense of belonging (r = -0.376, p = 0.000). Due an unexpected lack of correlation between sense of belonging and frequency of use, the results have been segmented into different technologies to explore the survey data in more detail.

		Usage/Frequency
Sense of Belonging (S-Phone)	Pearson Correlations Sig (2-tailed) N	0.590** 0.000 35
Sense of Belonging (iPad)	Pearson Correlations Sig (2-tailed) N	0.186 0.182 53
Sense of Belonging (Kindle)	Pearson Correlations Sig (2-tailed) N	0.105 0.466 50
Sense of Belonging (Laptop)	Pearson Correlations Sig (2-tailed) N	-0.266 0.101 39
Table 40: Pearson product moment correlation of social belonging with Frequency of use for each technology. ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed)		

Table 40 demonstrates no correlations between a sense of belonging and frequency of use for the iPad, Kindle and Laptop. It does, however, show a significant positive correlation for the Smart Phone (r = 0.590, p = 0.000), which suggests that a sense of belonging acts as a motivating factor on technology usage for highly communicative devices such as phones but not on devices used for other purposes; e.g. the Kindle for reading. The smart phone for this study had an average use of 40.17 usages per month, which is a medium usage in comparison to the iPad (66.92) and the Laptop (27.25). Considering that the smart phone is the only technology with a positive relationship between sense of belonging and frequency of use, the following table will explore correlations between factor scores just for this technology.

		Social Belonging score
Usage Frequency/month	Pearson Correlation Sig. (2-tailed) N	.590** 0.000 35
Usefulness score	Pearson Correlation Sig. (2-tailed) N	.427* .010 35
Functionality score	Pearson Correlation Sig. (2-tailed) N	.296 .084 35
Emotional Attachment score	Pearson Correlation Sig. (2-tailed) N	-.354* .037 35
Social Belonging score	Pearson Correlation Sig. (2-tailed) N	1 35
Perceptions of self-worth score	Pearson Correlation Sig. (2-tailed) N	.698** .000 35

Table 41: Pearson product moment correlation of social belonging with Frequency of use and other MOs (Smart Phone data)
** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed)

Pearson correlations solely for the smart phone data do not only indicate a positive relationship between usage and sense of belonging but also between the sense of belonging and usefulness scores ($r = 0.427$, $p = 0.010$) and sense of belonging and perceptions of self-worth scores ($r = 0.698$, $p = 0.000$). Interestingly, there is also a negative relationship between sense of belonging and emotional attachment towards a device ($r = -0.354$, $p = 0.037$), which will be discussed, alongside the other connections, within the following interpretation.

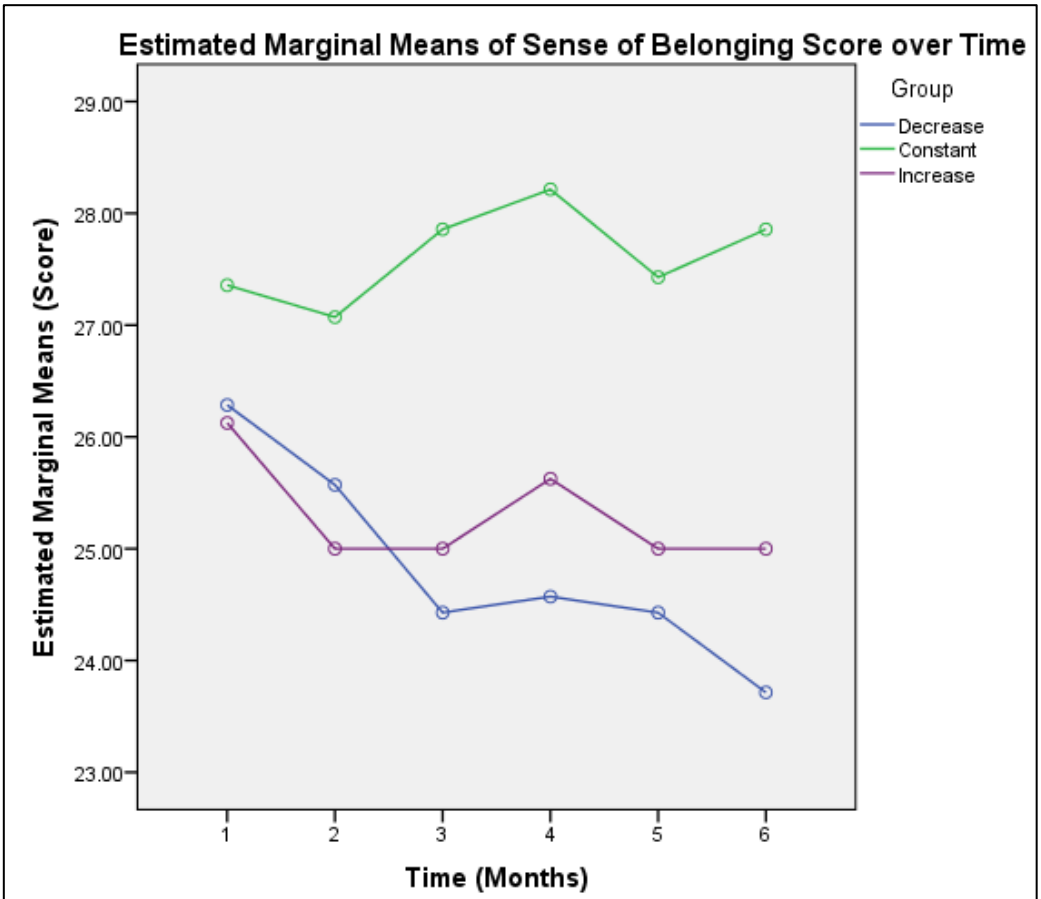

Figure 14: Estimating marginal means of sense of belonging score over time

Finally, the graph (Figure 14) depicts the mean sense of belonging scores over the 6 months of measurement for three different groups of participants; participants, whose usage increased, decreased or remained constant throughout the study. As is evidenced, a sense of belonging is not as representative of increasing, decreasing and constant data as the other MOs. There is a clear distinction between the mean values for a decreasing and a constant frequency of use; the decreasing group reported lower means than the others and these lessen over time (26.5 -23.5) whilst the constant usage group's values are higher and remain level between 27 and 28. Conversely the increasing usage group's social belonging does not reflect their usage patterns; the mean values remain relatively low and constant between scores of 25 and 26. Moreover, the unrelated one-way ANOVA showed no significant difference between the sense of belonging scores for the three different groups; the F-value was just insignificant at 2.787 ($p = 0.064$) and no significant differences were flagged by the post-hoc Bonferroni multiple comparisons. The subsequent interpretation will discuss the inferences of these results in respect to proposition 4.

4.1 Interpretation

As previously discussed the present proposition aims to establish whether a sense of belonging has a motivating impact on technology usage. It is proposed that sense of belonging acts as a CMO-S on technology use by being paired with other CMO-Rs such as utility. The initial Pearson correlations do not support this proposition as there is no significant relationship between sense of belonging and frequency of use. Moreover, there are no significant correlations between either of the utility scores and a sense of belonging, indicating no pairing between utility as a CMO-R and a feeling of belonging. There were, however, interesting interactions between sense of belonging, perceptions of self-worth and emotional attachment, which will be revisited in the succeeding analysis.

The graph in Figure 14 demonstrates why there is no significant correlation between a sense of belonging and usage; for the increasing frequency of use data, the mean sense of belonging scores are lower than the constant usage group and similar to the decreasing usage group with the mean value staying between 25 and 26. The mean values for the constant and decreasing usage groups are indicative of sense of belonging being a CMO-R with the constant group's means remaining level between 27 and 28, whilst the decreasing group's values are generally lower and gradually decrease over time from approximately 26.5 to 23. Unfortunately, the increasing group's mean scores do not resemble those of an MO and are not much higher than the decreasing group's sense of belonging values. Furthermore, there are no significant differences between sense of belonging scores for the three groups, which means that in this instance P4 cannot be supported by the survey data.

These unexpected results have led to further statistical analysis (Tables 40 and 41), which did indicate a relationship between sense of belonging and frequency of use but only for the smart phone data ($r = 0.590$, $p = 0.000$); for the other technologies (iPad, Kindle and Laptop) a sense of belonging had no impact on how often the device was used. Examining the smart phone data further reveals an additional positive correlation between sense of belonging and the usefulness of a device ($r = 0.427$, $p = 0.010$), which implies that for highly communicative devices such as phones, the usefulness of that technology can impact upon a sense of belonging. If the usefulness is high, the feeling of belonging is enhanced, which in turn impacts upon the frequency of use of the device. In this situation the proposition is supported but for other less communicative technologies, the proposition cannot be reinforced with the current

survey data. Consequently, the diary data will be revisited to explore P4 and discover any further support or dismissal of sense of belonging acting as a CMO-S on technology use. Firstly, however, the analysis will discuss the two significant correlations between sense of belonging and perceptions of self-worth and sense of belonging and emotional attachment.

The strong Pearson correlation between a sense of belonging and perceptions of self-worth ($r = 0.733$, $p = 0.000$) support the notion that if older people feel as if they belong within society, family and friends then they are more likely to have higher perceptions of self-worth, which in turn leads to a reduction in depression (Krause, 2005). The question remains whether technology has an influence on these factors. For highly communicative devices such as mobile phones, it appears that a sense of belonging could be influenced by the usefulness of a device ($r = 0.427$, $p = 0.010$), which may therefore impact upon the usage of that device ($r = 0.590$, $p = 0.000$); the higher the usefulness, the higher the level of sense of belonging, which increases the usage. This deduction is also supported by the literature on older people and mobile phone use; Mallenius, Rossi & Tuunainen (2010) argue that with technology older people often seek advice from relatives whilst also being influenced by the opinion of friends and family, especially children and grandchildren. In other words, using a technology increases social contact and is often a result of social influence, which impacts on general feelings of social belonging (Selwyn, 2004; Karavidas, Lim & Katsikas, 2005).

An interesting relationship that emerges from the survey data was a negative association between social belonging and emotional attachment towards a device ($r = -0.376$, $p = 0.000$). In other words the more emotionally attached a participant was to their technology, the lower their feelings of social belonging. This relationship is fascinating as it was not predicted by any literature on older adults and technology use. In contrast, the negative association is usually found amongst adolescents and young adults with a dependence on video games (Schmit, Chauchard, Chabrol & Sejourne, 2011; Wei, Chen, Huang & Bai, 2012). Schmit *et al.* (2011) used the same scales as the present study to measure social belonging (Hagerty & Patusky, 1995) and perceptions of self-worth (Rosenberg, 1989) and discovered that the more participants were dependent on their technology, in this instance video games, the lower their feelings of social belonging and perceptions of self-worth. The present study seems to indicate similar results but for older adults' emotional attachment to their portable interactive devices and feelings of social belonging. Further investigation would be

required to support this finding, but it could have important implications on public policy makers striving to introduce older people to technology and encourage them to go online (Eastman and Iyer, 2005). For instance overdependence could have the opposite effect to what policy makers were hoping and actually reduce the feelings of social belonging that older adults have.

Currently, however, the literature supports technology use as improving older adults' social connections and sense of belonging. Karavidas, Lim & Katsikas (2005) demonstrate how the majority of older technology users stay connected through emails and participation in computer clubs, which encourage gatherings and discussions with likeminded individuals. Additionally, Selwyn (2004) and Mallenius, Rossi & Tuunainen (2010) stress the importance that using technology has on keeping older people connected with relatives and close friends; for instance often the former encourage technology use in the first place, often provide new or second hand devices and help with technological issues. Technology therefore becomes a point of contact for many older people and their families. The subsequent section will use the qualitative diary data collected in the preliminary research phase to evaluate the characteristics of technology use and social belonging, to establish concurrences or conflicts with the literature.

The frequency word search of the diary data identified words for family and friends such as people (38), son (23), friend (22), wife (18), contacts (15), nephew (13) and family (9). The reported interaction with family and friends supports Mallenius, Rossi & Tuunainen (2010) proposal that social influence strongly encourages technology usage for older adults; for instance 50% of participants reported having help from relatives and friends if they had problems with their devices. Some participants required help only occasionally whilst others were frequently in contact with people regarding the technical difficulties that they were experiencing. The following participant had help with her iPad from a large array of acquaintances:

> **Participant S:** "*Presumably I can still make appointments to get advice from our local Apple store, and if not I've got techie nephew, his mum, sister and her techie boyfriend to appeal to.*"

Interestingly, however, when it came to the acquisition of the technical device, very few participants reported either being encouraged to buy or being given a technology by friends or family, which is in contradiction to the discoveries of the Selwyn (2004)

study on ICT use by older adults. Alternatively, participants demonstrated an independence of choice and desire to purchase and use their technologies for specific purposes:

> **Participant S**: "*Ordered iPad from Apple online*"

> **Participant J:** "*I purchased the laptop to take to the MK U3A 'Fun with Photography' Group meetings, for 'Hands On' sessions and to give demonstrations of photo editing techniques.*"

These discoveries may be due to when the data was collected. In 2004, technology was not as widely used as it is currently and many older people would be unfamiliar with devices, programmes, processes and the Internet. Any data collected from older adults in the current environment does include more participants who used technology either in a professional or domestic context prior to retirement. Consequently, the majority will have previous experience with devices or processes similar to the ones they are reporting on in the present study (Olson *et al.*, 2011; Nagle & Schmidt, 2012). Although participants may have independently acquired their technology as opposed to receiving second hand machines, technological presents and strong advice from relatives (Selwyn, 2004), 50% still relied on connections with friends and family to support the use of technology. It can therefore be reasoned that technology, even when it is causing problems, can enhance a feeling of social belonging.

As revealed in previous sections, when the utility of a technology is high, the main function of technology use is communication. The frequency word search highlights the type of communication being adopted with email or derivatives of featuring 115 times whilst other forms of communication such as Facebook only being mentioned 13 times. Consequently, the present data supports Wagner, Hassanein & Head's (2010) observation that communication is the central function of technology use by older adults, which helps with social support and feelings of belonging. An interesting observation is the divide between social media and email use, with the majority of participants strongly favouring the latter (Jones & Fox, 2009) whilst social media such as Facebook received mixed and even negative reviews:

> **Participant M:** "*Matthew has now transferred my photo to Facebook, I have gleaned a little more information about how people use the facility and how to post photo to e'mail files. Spent fifteen minutes looking at Facebook information but continue of the opinion that it's not for me.*"

> **Participant I:** "*Several other things are really too small to be of use; icons are there I don't need, and I'm not into Facebook or Twitter.*"

These observations are similar to discussions raised by previous academic research; for instance Cornejo, Favela & Tentori (2010) conclude that older adults are less interested in social media because they are less technically inclined whilst Chakraborty, Vishik & Rao (2013) and Xie *et al.* (2012) suggest that privacy is the largest issue. This study merely presents a lack of interest and desire as other forms of communication, for instance emails, are sufficient. Xie *et al.* (2012) present educational strategies to target negative and apathetic perceptions of social media, which could improve usage of this type of communication by people over the age of 65. The contention with this, however, is would the use of social media actually improve the quality of life of older adults? Currently, many participants appear content with communication through email and over the phone, which maintains levels of social belonging; as indicated by the strong correlation between usage and sense of belonging for the most communicative device (smart phone) but not for the other devices (iPad, Laptop and Kindle).

The final observation of social belonging related uses of technology include the group mentality that certain devices produce. For instance, there is this sense of Apple users in contention with PC users and Kindle users in contention with non-Kindle users. 62.5% of the participants in the diary study noted a group mentality towards their device; 2 participants were multiple Apple technology owners, one very much stated herself as part of the PC contingency whilst the other 2 participants discussed a rivalry between Kindle users and non-Kindle users amongst their friends:

> **Participant G:** "*G and K were discussing Kindles. G said: "I don't think anything compares to the feel of a page turning in your hands." K agreed; and they looked at me as though I should leap to the defence of my Kindle. I didn't take any notice – I was getting the lunch. It reminded me of when I was a vegetarian, and people expected you always to be defending vegetarianism. Yes, it's nice to feel a page turning..., but not that nice – nicer to have the promise of another book always there to be read.*"

This type of technology use influenced by group camaraderie has been observed previously in research on Scooter use (May, Garrett & Ballantyne, 2010). In this study participants formed scooter support-groups that met regularly, held outings and travelled together. This type of loyalty towards a technology or brand is called social

identification (Kim, Han & Park, 2001) and involves social belonging towards particular groups or organisations. Several studies on mobile phone adoption have also indicated the importance of brand loyalty and social identification of post-purchase usage (Kim, Han & Park, 2001; Lee 2011) but argue for more studies focussing on the influence of brand loyalty on post-adoption behaviours.

At first glance the statistics do not support P4, however, after more exploration it becomes apparent that there is a significant positive relationship between social belonging and frequency of use but only for the mobile phone data. This data also reveals a pairing of the CMO-S with other CMO-Rs such as usefulness (P1) and perceptions of self-worth (P5). The diary data also supports the proposition by indicating three key themes behind sense of belonging as an MO; these are the importance of the technology to a person's wellbeing, the communication with peers and relatives that the technology provides and brand or device loyalty leading to social identification. Overall, the proposition is not completely supported by the statistical data but there is qualitative evidence that a sense of belonging motivates technology usage.

5. Perceptions of Self-Worth

P5: Perceptions of self-worth are coupled with other CMO-Rs to become a CMO-S of technology use and consequently a CMO-R on the repeated use of technology as an operant behaviour.

The final MO that this thesis sought to test in relation to technology use was perceptions of self-worth. The rationale behind this CMO-S is that perceptions of self-worth are coupled with other MOs such as utility and social belonging to then act as a CMO-R on technology use. For instance, if the function of a device is to improve connections despite health or geographical limitations then the social belonging of the user may increase, this can then impact upon the users' perceptions of self-worth. Moreover if a device is easy-to-use then the older adult feels confident and successful in the use of their device, which again impacts upon feelings of self-worth. After coupling with other MOs, perceptions of self-worth act as a CMO-R on technology use by creating an improvement to the user's condition; this improvement establishes the removal of perceptions of self-worth as a punisher, which can negatively impact on technology use. In other words, if perceptions of self-worth are enhanced by using a

device, then a reduction in self-worth from a lack of confidence using the technology could act as a punisher and reduce the frequency of use.

The first step, before exploring P5, was to develop a scale that could measure perceptions of self-worth. The chosen metric was based on the Rosenberg (1989) scale of self-esteem, which was expanded and tested within a preliminary study of mobile phone users before being refined through factor analysis to an 8 item, 5 point Likert scale. Further factor analysis and reliability tests with the current survey data refined the scale again to contain 7 items. The self-worth scores presented throughout this section are based on this scale, the highest possible value is 35, which reflects extremely strong perceptions of self-worth and the lowest possible value is 7, which reflects extremely low self-esteem.

Table 42 demonstrates Pearson correlations between perceptions of self-worth scores and number of uses per month, alongside additional scores for other MOs such as utility, emotional attachment and sense of belonging. The most notable significant correlation is between self-worth and frequency of use per month. As the rationale predicted, there is a positive relationship between self-esteem and technology usage ($r = 0.261$, $p = 0.000$). Furthermore, perceptions of self-worth are clearly coupled with other MOs by having a positive relationship with the usefulness of a device ($r = 0.261$, $p = 0.000$) and feelings of social belonging ($r = 0.733$, $p = 0.000$). In other words, the more useful a technology is, the more somebody has a sense of belonging, which positively impacts upon their perceptions of self-worth.

		Perceptions of self-worth score
Usage Frequency/month	Pearson Correlation Sig. (2-tailed) N	.261** 0.000 188
Usefulness score	Pearson Correlation Sig. (2-tailed) N	.271** 0.000 188
Functionality score	Pearson Correlation Sig. (2-tailed) N	0.119 0.105 188
Emotional Attachment score	Pearson Correlation Sig. (2-tailed) N	-.170* 0.020 188
Social Belonging score	Pearson Correlation Sig. (2-tailed) N	.733** 0.000 188
Perceptions of self-worth score	Pearson Correlation Sig. (2-tailed) N	1 188

Table 42: Pearson product moment correlation of perceptions of self-worth, frequency of use and other MOs
** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed)

The second table indicates Pearson correlations between perceptions of self-worth and frequency of use for each of the 4 main technologies within the present study (Smart Phone, Kindle, iPad and Laptop). As is evidenced, the highest correlation between the two variables is for the smart phone ($r = 0.634$, $p = 0.000$), which is a highly communicative device that impacts upon social belonging as demonstrated in table 40 in the previous section ($r = 0.590$, $p = 0.000$). The Kindle and iPad also have positive correlations between self-worth and usage; the Kindle demonstrating the strongest relationship with a value of 0.472 ($p = 0.001$) and the iPad creating a significant correlation at the 0.05 level ($r = 0.332$, $p = 0.015$). The iPad also has the highest average usage rate per month at 66.92 on contrast to the smart phone (40.17) and Kindle (43.02). The Laptop has the lowest mean frequency of use per month at 27.25 uses and also incidentally establishes no significant relationship between self-worth and this frequency ($r = -0.115$, $p = 0.484$).

		Usage/Frequency
Perceptions of Self-Worth (S-Phone)	Pearson Correlations Sig (2-tailed) N	0.634** 0.000 35
Perceptions of Self-Worth (Kindle)	Pearson Correlations Sig (2-tailed) N	0.472** 0.001 50
Perceptions of Self-Worth (iPad)	Pearson Correlations Sig (2-tailed) N	0.332* 0.015 53
Perceptions of Self-Worth (Laptop)	Pearson Correlations Sig (2-tailed) N	-0.115 0.484 39

Table 43: Pearson product moment correlation of frequency of use and perceptions of self-worth for each technology.
** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed)

Figure 15 graphically portrays the relationship between perceptions of self-worth and frequency of use over the 6 month recording period. Data from participants was split into three groups; frequency of use that increases, decreases and remains constant over time. The succeeding figure demonstrates the mean perceptions of self-worth scores over the 6 month period for the three groups. The increase and constant groups' mean perceptions of self-worth generally remain constant yet are significantly higher than the scores recorded for the decrease group. The increase group's mean scores waver between 27.7 and 28.7, whilst the constant group's scores are fractionally lower between 27.5 and 28.2. Comparatively, the decrease group's mean scores are noticeably lower and decreasing over time, from a maximum average value of 26.2 in month 2 to 24 in month 6. To test whether the differences between the perceptions of self-worth scores for the three groups are significant, a one-way ANOVA was applied to the data (see Appendix 2, Greene & D'Oliveira, 2005). The following 5 tables represent the results of this statistical analysis.

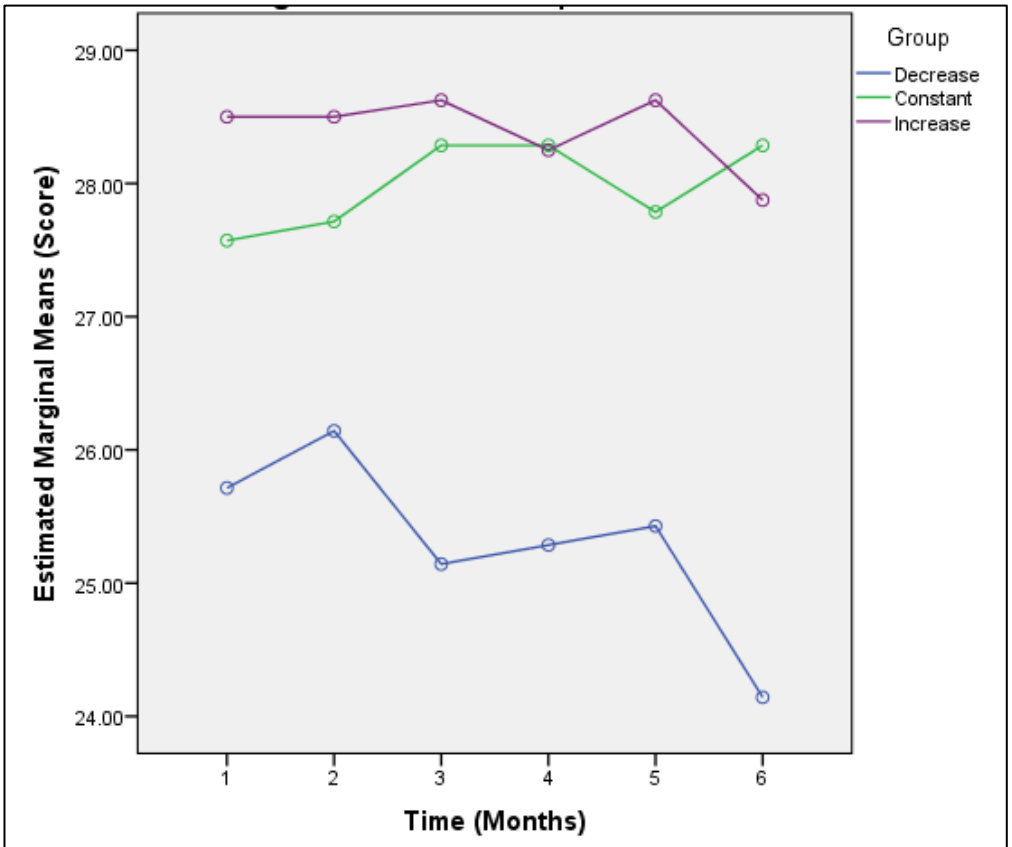

Figure 15: Estimated marginal means of perceptions of self-worth score over time

The descriptive statistics in the first table clearly indicate that perceptions of self-worth scores reflect frequency of use; for instance the mean self-worth value for the group of participants whose frequency of use increases over time is 28.7, whilst for decreasing usage, the mean value is lower at 25.9 and for the constant group, the self-worth mean score is central at 27.8. The minimum value for the three groups is also interesting at 23 for the increase group, 21 for the constant group and a mere 7 for the decrease group. The remaining tables test whether the differences between these means are significant. Table 45 demonstrates a significant Levene's test, which means that the assumption of homogeneity of variances has been violated. As such, to support the F-value produced from the ANOVA ($F = 5.05$, $p = 0.007$), robust tests need to be applied (Field, 2013); the two chosen were Welch (1951) and Brown-Forsythe (1974). Both of these tests indicated a significant asymptotically F distributed statistic at 4.07 ($p = 0.02$) for the Welch test and 4.24 ($p = 0.018$) for Browne-Forsythe. It can therefore be deduced that there are significant differences between the self-worth scores for technology use that is evoked, abated or maintained. The final table explores the differences further by looking at

multiple comparison permutations to identify which comparisons are the most significantly different.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Decrease	47	25.9362	6.86011	1.00065	23.9220	27.9504	7.00	35.00
Constant	88	27.8295	3.62057	.38595	27.0624	28.5967	21.00	35.00
Increase	53	28.6792	2.37595	.32636	28.0244	29.3341	23.00	34.00
Total	188	27.5957	4.50506	.32857	26.9476	28.2439	7.00	35.00

Table 44: Descriptive statistics of perceptions of self-worth scores per rate of response group.

	Levene Statistic	df1	df2	Sig.
Perceptions of self-worth score	18.394	2	185	.000

Table 45: Test of homogeneity of variances of perceptions of self-worth scores per rate of response group.

		Sum of Squares	df	Mean Square	F	Sig.
Perceptions of self-worth score	Between Groups	196.478	2	98.239	5.050	.007
	Within Groups	3598.799	185	19.453		
	Total	3795.277	187			

Table 46: ANOVA of perceptions of self-worth scores per rate of response group.

		Statistic[a]	df1	df2	Sig.
Perceptions of self-worth score	Welch	4.068	2	97.231	.020
	Brown-Forsythe	4.242	2	76.751	.018

Table 47: Robust tests of equality of means of perceptions of self-worth scores per rate of response group.
[a] Asymptotically F distributed

Due to the violation of the assumption of homogeneity of variances a Games-Howell test was used to assess the multiple comparisons between the three usage groups (Field, 2013). As is evidenced, there is a significance difference between the self-worth scores for the increasing and decreasing usage groups. The mean difference is 2.74 with a significance of 0.031, which is above the 0.05 threshold; perceptions of self-worth are therefore significantly lower for the participants whose technology usage is abated in comparison to the participants whose usage increases over time. The succeeding

section is going to use the present results to discuss the relationship between perceptions of self-worth and technology within the context of P5.

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Games-Howell	Decrease	Constant	-1.89338	1.07250	.190	-4.4708	.6841
		Increase	-2.74308*	1.05253	.031	-5.2774	-.2087
	Constant	Decrease	1.89338	1.07250	.190	-.6841	4.4708
		Increase	-.84970	.50544	.216	-2.0472	.3478
	Increase	Decrease	2.74308*	1.05253	.031	.2087	5.2774
		Constant	.84970	.50544	.216	-.3478	2.0472

Table 48: Multiple comparisons Games-Howell of perceptions of self-worth scores per rate of response group
* the mean difference is significant at the 0.05 level.

5.1 Interpretation

Proposition 5 implies that perceptions of self-worth are coupled with other MOs to produce their own motivating influence on technology use (CMO-S). To support this proposition the data must provide evidence of a significant relationship between other MOs and self-worth, alongside a significant relationship between self-worth and frequency of use. The Pearson correlations in Table 42 provide this evidence by demonstrating a positive significant relationship between usefulness and self-worth ($r = 0.271$, $p = 0.000$) and social belonging and self-worth ($r = 0.733$, $p = 0.000$), which shows a pairing between perceptions of self-worth and other MOs such as utility and social belonging. Through interpretation the level of usefulness of a device may influence perceptions of self-worth; for instance, a useful device will fulfil the desired needs of the user, which can increase confidence levels. Moreover, the usefulness of a technology can improve communication with friends and family, which impacts upon social belonging and self-worth.

The second requirement of the proposition is that once self-worth is paired with these MOs, it then acts in the same motivating fashion as a CMO-R. A high self-worth must therefore evoke a high frequency of use that in turn improves the user's condition. The positive correlation between self-worth and frequency of use ($r = 0.261$, $p = 0.000$) is the primary indicator that this is the case. If self-worth is high, the usage of the device will be frequent whereas if self-worth and confidence levels are low, the usage will be less. To further support P5, self-worth must establish its own removal as a punisher, which

will abate the behaviour. Figure 15 graphically depicts that for a decreasing frequency of use, perceptions of self-worth are also decreasing over time and are significantly lower than the self-worth scores for the rate of response group that increases over the measurement period (2.74, p = 0.031). In other words, the removal of self-worth acts as a punisher on technology use and abates the behaviour, which supports the proposition that perceptions of self-worth is a CMO-S of technology use.

The data infers that different technologies affect the relationship between perceptions of self-worth and usage; for instance the Smart Phone has the highest Pearson correlation between the two variables at 0.634 (p = 0.000), closely followed by the Kindle (r = 0.472, p = 0.001) and the iPad (r = 0.332, p = 0.015) whilst the Laptop displayed no significant correlation (r = -0.115, p = 0.484). The Smart Phone also produced the highest correlation between sense of belonging and usage (r = 0.590, p = 0.000), which is indicative of previous research by Cattan, Kime & Bagnall (2011) on telephone befriending schemes for socially isolated older people. They discovered that the use of a telephone to talk to friends and family improved older people's sense of belonging, which in turn alleviated loneliness and improved self-esteem and confidence levels amongst the participants. Highly communicative devices such as smart phones, telephones and mobile phones can therefore enhance self-worth, which can become associated with the use of technology and encourages further responses. Additionally, research on the communication utility of the Internet for older immigrants by Khvorostianov, Elias and Nimrod (2011) also supports these findings but in reference to the Internet as a communicative source. They discovered that for socially isolated older immigrants the Internet helps maintain social networks, which improves the psychological wellbeing and self-worth of their participants. Further research specifically on Internet use by older adults would be required to clarify this point; the current research measures on and off-line technology use.

An additional influence on self-worth as an MO of technology use, other than communication, is the confidence produced from a technology that is easy to use. Arning & Ziefle (2007) discovered a strong relationship between technical confidence and performance for their older participants. In other words how easy a device is to use directly effects the confidence of the older user (Arning & Ziefle, 2007) and how often that technology is used (Mallenius, Rossi & Tuunainen, 2010). This may explain why the Kindle, which has little communicative quality other than checking emails, has a high correlation between self-worth and usage (r = 0.472, p = 0.000). The Kindle is

generally user friendly and with fewer functions, it is easy to use whilst fulfilling the user's needs. The statistics reveal that 87.5% of Kindle users in this study agree or strongly agree that their Kindle is easy to use; this is in comparison to 59% for Laptop users, 79.3% for iPad users and 85.8% for Smart Phone users. Consequently, use of the Kindle enhances confidence levels and self-worth as participants relate to its user friendly design.

Perceptions of self-worth are therefore triggered through technology use that encourages communication (Khvorostianov, Elias & Nimrod, 2011; Cattan, Kime & Bagnall, 2011) and confidence by being easy-to-use (Arning & Ziefle, 2007; Mallenius, Rossi & Tuunainen, 2010). The self-worth produced in association with technology use, evokes further responses, which increases the frequency of use of the technology. The impact that this relationship between self-worth and technology has on the older adult population is imperative to future research and policy making. For instance, for successful ageing to be implemented the older adult must maintain a high mental functionality whilst keeping in touch with people and continuing an involvement in valued activities (Rowe & Khan, 1987; 1998), these activities preserve a sense of self (Nimrod & Kleiber, 2007). Consequently technology is used primarily for communicative purposes, which encourages maintenance of personal relationships; secondly this helps a person on the brink of isolation from developing mental disabilities and low self-worth; finally, technology itself can become a valued activity (Khovorostianov, Elias & Nimrod, 2011). The connection of technology use with self-worth can aid older people in ageing successfully, a definition developed to define a 'good way' of ageing.

The diary data seems to support the two themes that have emerged from the literature and the survey data; firstly, that ease of use impacts upon feelings of self-worth and secondly, that communication through technology improves social belonging which in turn impacts perceptions of self-worth. In reference to ease-of-use, it appears that if participants find a technology easy to use or manage to decipher how something works, they often have feelings of pride and achievement. For instance the frequency word search has identified words such as used (45), found (43), worked (17) and able (15), which often refer to the accomplishment of understanding and using a technology:

Participant S: "*Downloaded BBC iPlayer Radio app onto iJack, and it worked!"*

> **Participant I:** "*I tried this OCR app on a paragraph from a book: no trouble, it worked. You snap a picture, send it to yourself by email, open it up and there's both picture and transcript; the picture helps to corroborate the correct transcription.*"

The sense of achievement that participants feel when correctly deciphering their technology, improves technological confidence and self-worth. Previous research on assistive technology has discovered a similar trend, with participants who use the devices successfully reporting a significant improvement in accomplishment scores (Mortenson *et al.*, 2012). On the flip side, if a technology proves too challenging, this may negatively impact on the users' technical confidence and perceptions of self-worth. The diary data indicates that this is the case; for instance participants who experienced technical difficulties often question themselves and their own abilities:

> **Participant M**: "*Advertising e'mail from Holland & Barrett, reminded me to check if I have collected any points on my reward card but it still appears, despite purchases I've not been awarded any. This is where I find on-line activity frustrating…"is it me doing something wrong?""*

> **Participant I:** "*Oddly enough, Apple are a 'Which?' best buy, and O2 are a members' favourite. Is it me?*"

As Arning & Ziefle (2007) argue technical confidence is closely linked to performance for the older adult and so if a device provides technical difficulties, the older adult as evidenced above, begins to question their own worth. The following quote demonstrates the extent to which technical problems can affect the older user; forcing self-blame and belittling:

> **Participant S:** "*Back to Home. Then I remembered I could slide to the left: and there were all 5 of my apps! Dumb Sara!*"

These results have important impacts on policy makers encouraging technology use by people over the age of 65 (Eastman & Iyer, 2005). A difficult technology could have adverse impacts on older adult's perceptions of self-worth whilst an easy to use technology can improve life satisfaction and lower computer anxiety (Karavidas, Lim & Katsikas, 2005). Consequently, if technology use is being introduced to the aforementioned population, it should be stylised for the consumer so that it is easy to use or introduced with a learning programme so that the consumer develops a technology confidence. For instance the introduction of a telephone befriending

scheme (Cattan, Kime & Bagnall, 2011) or encouraging older adults to use the Internet to connect with friends and family (Khvorostianov, Elias & Nimrod, 2011; Mitchell *et al.*, 2011; Eastman & Iyer, 2005) are successful examples.

The use of technology to connect with acquaintances is the second theme that impacts upon the relationship between self-worth and technology use. The strong correlation between social belonging and perceptions of self-worth ($r = 0.733$, $p = 0.000$) reveals that when somebody feels as if they belong within their environment and society this positively impacts upon their feelings of self-worth and general life satisfaction (Karavidas, Lim & Katsikas, 2005; Cattan, Kime & Bagnall, 2011; Khorostianov, Elias & Nimrod, 2011). The diary data indicates that this feeling of belonging can emerge from the use of technology and as such positively impact further uses and feelings of self-worth. Images, stories, moments and information can be shared across space in a matter of moments; a function that is imperative for people whose health problems affect mobility and participation in social and leisure activities (Drennan *et al.*, 2008; Scherger, Nazroo & Higgs, 2010):

> **Participant I**: "*The other day a recent carer in my wife's nursing home took it into her head to take my wife out to the local park in a wheelchair, for the first time out for over two years. I was delighted. She helped to pick blackberries, and the carer gave her an ice cream in a cornet; she took a picture on her iPhone of both of them. I asked her to email it to me…I have forwarded that iPhone photograph I told you about of herself with Liz to various people that knew her.*"

This vital function of technology is highly important to the participants in the present study; all of which shared jokes, stories, photographs and correspondence over email, whatever device they were using (iPad, Kindle, Laptop or Smart Phone), which often became a lifeline of support, relief and enjoyment. There were of course technical difficulties for most participants (87.5%), however, the communication that devices provided often outweighed the user problems, providing a sense of belonging and self-worth within a world that, without technology, could be restrictive and lonely (Kirkvold *et al.*, 2012). The following quote is from a participant who had great technical difficulties with her iPad; she found it challenging and poorly designed yet she still admits that she will use it for communicative purposes and keeping up-to-date with worldly and local information through reading the news and watching television:

Participant S: "*Overall, I find iJack a fiddly, time-wasting device that's not nearly as intuitively designed as our PC – but perhaps that's because I'm used to the PC's foibles. iJack will still serve well for its main purpose: to take travelling to keep abreast of bank and credit card accounts, pay bills, check email and listen to news in English. And take pictures. And watch missed TV shows on iPlayer and ITV player.*"

In summary, both the ease of use of a device and the communication that technology can provide enhance feelings of self-worth through building confidence and maintaining social belonging. This is evidenced with the diary data as well as positive correlations between self-worth and usefulness and self-worth and social belonging. These MOs are paired with self-worth to give self-worth its own motivating function on the frequency of technology use, which is why there is a significant positive correlation between perceptions of self-worth and frequency of use. Moreover, once self-worth is established as having a motivating influence, its removal acts as a punisher. The graphical representation in Figure 15 demonstrates that for a decreasing frequency of use, the self-worth also decreases, implying that as self-worth decreases, usage is abated. Consequently P5 is supported by the current data, which has important implications on any policies or campaigns targeting older people and technology use. Technology can increase self-worth and successful ageing but at the same time, if it is difficult to use, it can negatively impact self-worth and cause more damage than good. A sophisticated balance is therefore required when encouraging older adults to use technology; the technology or device should be appropriate, useful and useable and from there it will enhance social belonging and perceptions of self-worth.

6. Operant Interpretation of Adopter Classes

P6: There is a significant difference between the MOs influencing the operant interpretation of adopter classes.

The final proposition that this thesis sought to explore is that the previously proposed MOs influence usage differently across the various adopter categories determined by the degree of innovation (Rogers, 2003). The rationale behind P6 originates from Foxall's (1994) consumer behaviour interpretation of Rogers' (2003) model; Foxall applied the four operant classes of consumer behaviour; accomplishment, hedonism, accumulation, and maintenance, to the different adopter categories in respective order; innovators, early adopters, late adopters and laggards. He proposed that the level at which a consumer adopts an innovation depends on the informational and utilitarian

reinforcement of that adoption. For instance, the innovators adopt first and they are influenced by high levels of both utilitarian and informational reinforcement (accomplishment), early adopters are mostly influenced by utilitarian reinforcement (hedonism), late adopters strive for informational reinforcement (accumulation) and finally laggards have low utilitarian and informational reinforcement (maintenance; Foxall, 1994). The present thesis intends to extend this interpretation by testing the impact of various MOs on each of the different adoption categories. The proposed motivating impacts on innovators, early adopters, late adopters and laggards are as follows:

	High utilitarian reinforcement	**Low utilitarian reinforcement**
High informational reinforcement	ACCOMPLISHMENT (innovators) P1 (Perceived utility) P4 (Social belonging) P5 (Perceptions of self-worth)	ACCUMULATION (late adopters) P3 (Emotional attachment) P4 (Social belonging) P5 (Perceptions of self-worth)
Low informational reinforcement	HEDONISM (early adopters) P1 (Perceived utility) P2 (Perceived enjoyment)	MAINTENANCE (laggards) Low P1 (Perceived utility) Low P4 (Social belonging)
Table 49: Proposed MOs within Foxall's (1994) operant classes of consumer behaviour		

The primary step to exploring P6 was to develop a measure to decipher which adopter category the participants belong to. The participants were placed in categories according to the level of experience that they had with their current technology, be this an iPad, Kindle, Laptop or Smart Phone. All of the subject devices are modern, domestic and portable; having been introduced to the mass market in the past 10 years. Consequently, the experiences that participants had with their technology can affect at which stage they adopted the innovation of portable technologies. Very experienced individuals would represent innovators who adopted portable devices at the beginning of the century whilst very inexperienced individuals represent laggards who are only just adopting devices such as mobile phones. The results of the scale were as follows: very experienced (0), experienced (81), slightly experienced (95), slightly inexperienced (6), inexperienced (6) and very inexperienced (0). By using Rogers' (2003) bell curve of adoption, the results were placed into the following adoption categories: innovator (very experienced, 0), early adopters (experienced, 81), late adopters (slightly experienced, 95) and laggards (slightly inexperienced, inexperienced,

12). The following results will use these groups to explore the different MOs on each of the adoption categories.

Table 50 shows the correlations between the proposed MOs and frequency of use for the early adopters. The prediction for the early adopters was that perceived enjoyment and utility would be the main motivating influences on adoption and usage. Unfortunately, the enjoyment scale for the present thesis did not present itself within the factor analysis and so had to be discarded from the survey data whilst a few items were incorporated into the emotional attachment metric. The statistics in table 50 support the predictions by demonstrating strong correlations between usefulness and usage ($r = 0.729$, $p = 0.000$) and functionality and usage ($r = 0.313$, $p = 0.004$). As such the early adopters' usage of technology is motivated mostly by the usefulness of their device and its various functions.

		Usage Frequency/month
Usage Frequency/month	Pearson Correlation Sig. (2-tailed) N	1 81
Usefulness score	Pearson Correlation Sig. (2-tailed) N	.729** .000 81
Functionality score	Pearson Correlation Sig. (2-tailed) N	.313** .004 81
Emotional Attachment score	Pearson Correlation Sig. (2-tailed) N	.213 .056 81
Social Belonging score	Pearson Correlation Sig. (2-tailed) N	-.021 .855 81
Perceptions of self-worth score	Pearson Correlation Sig. (2-tailed) N	.107 .343 81

Table 50: Pearson product moment correlation - early adopters.
** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

The second table shows correlations between MOs and usage for the second represented adoption category; the late adopters. This group was predicted to be motivated mostly by social influences and informational reinforcement; it was therefore proposed that the CMO-Ss of emotional attachment, sense of belonging and

perceptions of self-worth, would influence the adoption and uses of technology by this category of initiators. The Pearson correlations indicate positive relationships between usefulness and usage (r = 0.639, p = 0.000), functionality and usage (r = 0.264, p = 0.010), emotional attachment and usage (r = 0.217, p = 0.035) and perceptions of self-worth and usage (r = 0.405, p = 0.000). The correlations with the utility metrics are still high for the late adopters but less than the correlations for the early adopters, which suggests that for the present adoption group, utility has less of an influence on usage. The other correlations support the predictions by demonstrating a strong influence of emotional attachment and perceptions of self-worth on the usage of a device.

		Usage Frequency/month
Usage Frequency/month	Pearson Correlation Sig. (2-tailed) N	1 95
Usefulness score	Pearson Correlation Sig. (2-tailed) N	.639** .000 95
Functionality score	Pearson Correlation Sig. (2-tailed) N	.264** .010 95
Emotional Attachment score	Pearson Correlation Sig. (2-tailed) N	.217* .035 95
Social Belonging score	Pearson Correlation Sig. (2-tailed) N	.187 .070 95
Perceptions of self-worth score	Pearson Correlation Sig. (2-tailed) N	.405** .000 95

Table 51: Pearson product moment correlation – Late adopters.
** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

The final table of correlations indicates the motivating influence behind technology users for the laggards; people who are last to adopt an innovation and often do so to merely maintain their standard of living. As predicted there are very few motivating factors of use for this adoption group, with the only significant correlation emerging between usefulness and usage (r = 0.662, p = 0.019). This relationship is weaker than it is in the previous groups; the correlation is lower and only significant at the 0.05 level. The succeeding section is going to discuss the implications of these results in relation to

Rogers' (2003) categories of adoption, Foxall's (1994) operant classes of consumer behaviour and the older adult population.

		Usage Frequency/month
Usage Frequency/month	Pearson Correlation Sig. (2-tailed) N	1 12
Usefulness score	Pearson Correlation Sig. (2-tailed) N	.662* .019 12
Functionality score	Pearson Correlation Sig. (2-tailed) N	-.078 .809 12
Emotional Attachment score	Pearson Correlation Sig. (2-tailed) N	.257 .420 12
Social Belonging score	Pearson Correlation Sig. (2-tailed) N	-.487 .108 12
Perceptions of self-worth score	Pearson Correlation Sig. (2-tailed) N	-.259 .416 12

Table 52: Pearson product moment correlation – Laggards
** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

The previous sections of this chapter have demonstrated statistical and qualitative evidence to support P1, P3 and P5. Unfortunately, the scale for enjoyment was difficult to establish from factor analyses of the preliminary data and the present survey data, resulting in the failure of sufficient evidence to support P2. For P4, there was little statistical evidence to suggest that a sense of belonging is a CMO-S for technology usage, with the exception of the data from the smart phone users. Moreover, although this MO could not be proven quantitatively, sense of belonging was still a residing theme within the qualitative diary data. Consequently, P4 cannot be rejected but at the same time, further evidence and future research is necessary to support this observation. The correlations in Tables 50, 51 and 52 for early adopters, late adopters and laggards are additional evidence to indicate which MOs influence technology use but at different stages of innovation diffusion. In correspondence with the support of P1, P3 and P5, early adopters are mostly influenced by the perceived utility of a device (P1). Late adopters, although still influenced by utility (P1) are also motivated by emotional attachment (P3) towards the technology and how it improves their self-worth (P4). Finally, laggards demonstrate low motivational influences to use the device

with the exception of a weak correlation with usefulness (P1). The following paragraphs are going to discuss the characteristics of these groups of adopters and how these characteristics are represented by the MOs evoking usage and the qualitative diary data.

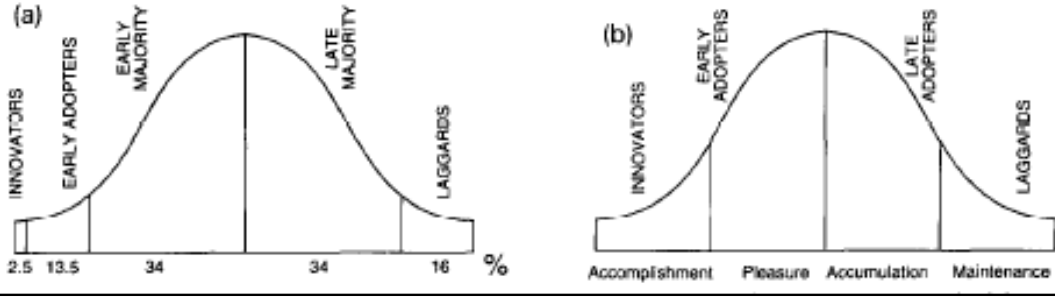

Figure 16: (a) Adopter categories determined by degree of innovation (after Rogers, 1983). (b) BPM categorization of adopter categories according to the pattern of reinforcement contingencies. Foxall (1994)

The innovators are the first to adopt a new technology; they are active information-seekers, who do not rely on other people's reports and are able to cope with uncertainty (Rogers, 2003). Foxall (1994) combined Rogers' adoption categories of innovator and early adopter to one group of innovators who were influenced by both informational and utilitarian reinforcement and hence motivated by accomplishment; the original utility that the innovation provides, the self-esteem associated with owning such a product and setting the trend for technological followers. This thesis therefore predicted that for this group utility (P1), a sense of belonging (P4) and perceptions of self-worth (P5) would strongly motivate usage. Noticeably, there is little data to support the innovative group of adopters and therefore these predictions cannot be validated. The lack of data is no indication that older people are not innovative or have a low innovativeness (Descubes & Truong, 2011) but in this instance no participants admitted to being 'very experienced' with PIDS, mobile media devices or other technologies similar to their own.

The early adopter category in the present thesis refers to Rogers' (1995) definition of the early majority of consumers, which Foxall (1994) has redefined as the early adopters who seek pleasure, as seen in Figure 16. Whichever terminology is used to describe this group of adopters, they comprise of one third of people who adopt the innovation but they do so before it reaches its maximum exposure. They may

deliberate for some time before adopting an innovation but this group do have a purposeful willingness to accept new ideas (Rogers, 2003). They therefore are motivated by utilitarian reinforcement such as dropping prices, functional performance, high compatibility and a low level of perceived complexity. As such, the present thesis predicted that this group of adopters would be primarily motivated by perceived utility (P1) and perceived enjoyment (P2). Due to an insubstantial enjoyment metric the relation that enjoyment has with usage for the early adopters cannot be supported. For utility, however, there are very clear and strong correlations between usefulness and usage ($r = 0.729$, $p = 0.000$) and functionality and usage ($r = 0.313$, $p = 0.004$); more so than for any other adoption category, which supports the proposition that early adopters are heavily motivated by perceived utility.

The early adopters in the present study comprise 43% of the participants; the technologies that the early adopters are using are as follows: 33.3% of the group use iPads, 30% use Kindles, 22% use Laptops and only 13.6% use Smart Phones. For early adopters, popular technologies appear to be novel devices developed in the last few years such as the Kindle and iPad whilst more traditional devices such as Laptops and Smart Phones being less popular. Also, interestingly the early adopters have the highest decrease of use rate out of the three adoption categories, with 38.3% of the group experiencing a decreasing usage over time, 40.7% with constant usage and only 21% with an increase in frequency of use. Age is also an interesting characteristic; the mean age of early adopter is 70.91, which is lower than for any other adoption category. On the surface, this observation supports research from Arning and Ziefle (2007) and Ziefle, Bay and Schwade (2006) that age plays a major role in people's interaction with technology. However, further examination of the means reveals no significant difference between the average ages of each group. Consequently, for the participants in the present study, chronological age is not a predictor of technical experience, technical adoption or technical usage (Eastman & Iyer, 2005).

The late adopters represent the third of people who adopt an innovation after it has reached its maximum exposure. This category was originally termed 'late majority' by Rogers (2003) but re-labelled the 'late adopters' by Foxall (1994) as depicted in figure 16. This group of people have been described as having a lower social status; they learn new ideas from interpersonal channels such as through peers and relatives and are less inclined to use mass media channels. This group adopt later because they rely on

pressure from peers and need to have all levels of uncertainty removed before they adopt a new idea (Rogers, 2003). The late adopters are subject to how utilitarian or functional advantages of the innovation but are heavily influenced by the informational reinforcement from friends, family and society; this operant class is called accumulation (Foxall, 1994). Consequently, the proposed MOs evoking technology usage for the late adopters were P3 (emotional attachment), P4 (social belonging) and P5 (perceptions of self-worth). The statistics support these predictions with correlations between emotional attachment and usage ($r = 0.217$, $p = 0.035$) and perceptions of self-worth and usage ($r = 0.405$, $p = 0.000$); unfortunately no correlation emerged between social belonging and frequency of use. The results also support a low utilitarian influence on adoption by displaying lower correlations between functionality and usage ($r = 0.639$, $p = 0.000$) and usefulness and usage ($r = 0.264$, $p = 0.010$), than the early adopter group displayed.

Characteristically, the older adult technology user is often indirectly described as a late adopter for being encouraged to use technology by peers and relatives (Selwyn, 2004; Mallenius, Rossi & Tuunainen, 2010). It is therefore predictable that this is the largest group within the present study, containing 95 of the 188 responses; 51% of the participants are late adopters. In comparison to the early adopters, the late adopters contain fewer iPad (23%) and Kindle (24%) users, a higher proportion of Laptop users (23%) and more mobile phone users (19%), alongside a small proportion of brain trainer (6%) and smart TV users (6%). This indicates a desire from late adopters to use more traditional technologies such as mobile phones, laptops and TVs, which resemble previously owned and familiar technologies such as PCs, PDAs and telephones (Slegers *et al.*, 2009; Buse, 2010). Furthermore, the late adopters are less likely than the early adopters to have a decreased usage over time(16.8%); their usage is more likely to remain constant (53.7%) or increase (29.5%), which implies that although late adopters embrace technology after the maximum exposure of the product, they intend to use the innovation for longer periods.

The final group to adopt an innovation are the laggards, who represent the last 16% to accept a new idea or technology. According to Rogers (2003), laggards are often suspicious of innovations and as a result, their decision making process is lengthy and their adoption is after widespread knowledge and acceptance of a new idea. Foxall (1994) explains that laggards often adopt as a matter of economic necessity, to socially

conform and avoid ridicule. This consumer behaviour can be described as maintenance, which involves low utilitarian and low informational reinforcement. As such, this thesis predicted that maintenance behaviour is subject more to S^{d}s and less to MOs, which is why the only proposed MOs impacting upon technology use for laggards were low levels of utility (P1) and low levels of social belonging (P4). The results support these predictions by showing only one weak correlation between usefulness and usage ($r = 0.662$, $p = 0.019$).

For the aggregate survey data, there were 12 responses from laggards, which comprised 6.4% of the 188 completions. This is less than Rogers' (2003) proposed 16%, which is due to one reason; the innovation lifecycle of the technologies used by participants has not reached the end, making it difficult to compile complete data for the laggard category. Of the collected responses however, a substantial 50% of participants used Smart Phones, a third used iPads whilst the remaining two responses were from a brain trainer user and a smart TV user. Mobile phone technology has been described by academics as being ubiquitous, implying that anybody adopting the technology for the first time in the current market is a laggard (Kalba, 2008; Yamakawa *et al.*, 2013; Lee, Trimi & Kim, 2013). The results indicating that 50% of the technological inexperienced participants were adopting mobile or smart phones, supports the literature that mobile phones are reaching the end of their normal distribution. Consequently the participants adopting a mobile phone for the first time are laggards according to Rogers' (2003) model of adoption. Interestingly, the laggard adoption group demonstrated no decrease in usage, with a third of participants (n = 4) maintaining a continuous usage and two thirds (n = 8) demonstrating an increase in frequency of use.

In summary, the aggregate data reveals that there are more participants in the late adopter category (n = 95) than any other adoption group; innovators (n = 0), early adopters (n = 81) and laggards (n = 12). This is in correspondence with the literature, which portrays older technology users as being heavily influenced to adopt by friends and family (Selwyn, 2004; Mallenius, Rossi & Tuunainen, 2010). Also indicated by previous academic research is the concept that older adults are mostly motivated to adopt a technology due to its usefulness, function and usability (Lunsford and Burnett, 1992; Leventhal, 1997; Laukkanen *et al.*, 2007; Slegers *et al.*, 2009; Buse, 2010). This supposition is in accordance with the second largest group of adopters; the early

adopters (n = 81), whose primary motivation for usage is utility (P1). As such, two main groups of technology users emerge from the present population; the older adult early adopter who is mostly influenced by what a technology can offer and the older adult late adopter who is encouraged by peers to use a particular device. The data also revealed a difference in usage between the two groups; the early adopters are more likely to reduce their usage frequency of a device whilst the late adopters and laggards are more like to experience a constant or increasing usage. This suggests that a low usage of a device may not be due to older persons' inexperience with technical products as previously concluded (Arning & Ziefle, 2008) but perhaps for the older adult early adopters, user problems may heavily abate or even terminate usage; encouraging that adopter to leave their present technology and move on to the next. The following quote from a male participant clarifies the point that devices that are not user friendly will encourage the older adult early adopter to cease usage and discover alternative options:

> **Participant A:** "*Note that I am very familiar with the Apple operating system and routines, and this helped a great deal. So I was not coming to the iPad cold. That being said, I did find it difficult to get used to the touch screen routines, particularly when using a word processing app (Pages). I still do not find it easy to edit on screen and far prefer using a mouse and keyboard on my desktop computer.*"

Overall, the results of the survey data support Foxall's (1994) interpretation of Rogers' (2003) categories of adoption for the diffusion of innovations. The participants with experience of mobile and personal communication devices were defined as the early adopters; their main motivation for usage was the perceived usefulness and functionality of a device (P1), which supports Foxall's (1994) inferences that early adopters are hedonistic in their search for utility and pleasure. The data for the late adopters emerges from participants with less experience of the subject technologies; these participants were motivated by emotional attachment (P3) and perceptions of self-worth (P4) alongside utility (P1), which again supports Foxall's (1994) insinuations that early adopters are subject to accumulation from high social influences and low utilitarian reinforcement. Finally the laggards had little experience of technology and were new to their devices; these participants displayed one weak correlation between usefulness and usage, which also supports Foxall's (1994) reference to laggards as the maintenance class of operant behaviour who adopt an innovation through necessity.

With the proposed MOs adhering to Foxall's (1994) application of the operant classes of consumer behaviour to Rogers' (2003) adoption of innovation categories, this thesis is one step closer to amalgamating MOs into the BPM. The central consideration of Fagerstrom *et al.* (2010) was to incorporate MOs into the BPM so that discriminative and motivational antecedents could be understood separately. In this example, discriminative stimuli represent the availability of the behaviour whilst the MOs influence how often that behaviour occurs and the reinforcing effectiveness of each occurrence. Technology use is made available by the device working, a charged battery, the connection it may have with the Internet and so on. The motivations for usage have been statistically proven in the present thesis as being perceived utility (P1), emotional attachment (P3) and perceptions of self-worth (P5). A sense of belonging only has statistically proven motivating influence on mobile phone users; however, the qualitative data is supportive of this MO impacting on users of a range of communicative devices. The following diagram indicates how these motivational influences of technology use can be incorporated within the BPM.

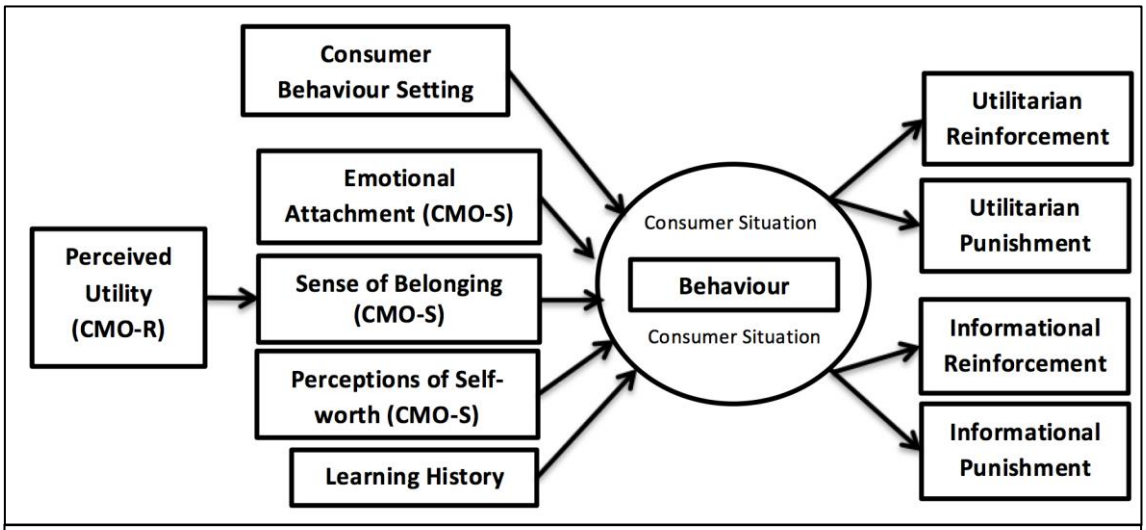

Figure 17: Incorporation of MOs into the BPM

Although the results of the present study have focussed on the behaviour altering effects of MOs; for instance the number of responses in correlation to the strength of the motivating influences, there is also evidence of the value altering effects of these MOs; unfortunately these are more difficult to present with statistics. The fact that different MOs impact upon different operant classes of consumer behaviour, in the context of technology use (P6), implies that each one has an impact upon the reinforcement of responding. For the early adopters in the hedonism class, utility measures were the main MOs, which increase the utilitarian reinforcement. A

reduction in perceived utility, decreases utilitarian reinforcement and technology use can cease, as observed in the previous quote by participant A. The late adopters within the accumulation class, where influenced by the MOs emotional attachment and self-worth, which enhanced the informational reinforcement. Additionally, a reduction in these MOs would impact negatively upon the informational reinforcement and abate technology use.

In conclusion, the statistics presented have demonstrated a complex network of relationships between MOs and the behaviour of technology use. The behaviour altering effect of each MO has been established by relating the independent MO variables to the dependent variable of frequency of use, across a 6 month period. The following chapter intends to summarise these relationships to develop one final portrait of post-purchase technology use by people over the age of 65. It will refer to the contributions, strength and weaknesses of the present thesis as a radical behaviourist perspective on post-purchase consumer behaviour.

CHAPTER FIVE

EXPANDING THE NETWORK

1. Introduction

The present thesis set out to explore the characteristics of post-adoption technology use by older adults and the motivating influences on usage. A radical behaviourist approach was adopted to examine technology use as an operant behaviour. Within the consumer behaviour literature, the most prominent radical behaviourist tool is the BPM, which was developed by Gordon Foxall between 1989 and 2000. The present study sought to amalgamate Jack Michael's (1982; 1988; 1993; 2000; 2004) work on motivating operations (MOs) with Foxall's work on the BPM by proposing and testing the influence of MOs on technology use by people over the age of 65, before applying MOs to the BPM's four operant classes of consumer behaviour; accomplishment, hedonism, accumulation and maintenance (Foxall, 1994).

The first chapter outlined the necessity behind such research and the importance that technology use can have on the lives of older people. As a result the literature was lacking research in areas of post-adoption, older adults and MOs. The second chapter therefore sought to present this literature in a structured manner before proposing potential MOs that have motivating qualities over post-adoption technology use, especially within the context of people over the age of 65; these MOs were identified as utility, enjoyment, emotional attachment, a sense of belonging and perceptions of self-worth. The third chapter revealed the philosophical stance and empirical strategy of the present thesis whilst validating the proposed MOs and creating reliable measurement scales for each proposition. It was in this chapter that a scale for enjoyment could not be validated and as such had to be excluded from the succeeding chapter. Consequently, the fourth chapter presented the results of the survey and diary data for the remaining MOs before discussing the implications of these results.

This chapter, as the final episode, will review the work presented in the previous sections and evaluate the effectiveness of the theoretical and empirical narrative at

addressing the previously disclosed research objectives. It will therefore be structured around the three research contributions revealed in the introductory chapter;

1) *To develop a detailed account of older adults' post-purchase usage of a technology from a radical behaviourist perspective, detailing the motivations behind behavioural response through the assessment of MOs and their evoking or abating qualities.*

2) *Extending the technology acceptance and adoption literature by providing a behavioural perspective on post-purchase consumption by the older adult consumer market, focussing on the motivation of usage.*

3) *Updating the BPM research to incorporate MOs into the conceptual model and discover their motivating impact upon post-purchase behaviour in the context of technology use by people over the age of 65.*

Each section will discuss the impact that the present thesis has as a contribution to the literature, whilst highlighting the strengths and weaknesses of the empirical work and identifying any future investigation that may reinforce the present thesis's discoveries. The final section addresses the validity of radical behaviourism as a philosophical perspective on post-adoption technology use by older adults.

2. Older adult's technology use

To develop a detailed account of older adults' post-purchase usage of a technology from a radical behaviourist perspective, detailing the motivations behind behavioural response through the assessment of MOs and their evoking or abating qualities.

The primary contribution of the present thesis was to develop an in-depth analysis of technology use by people over the age of 65. This exploration is from a radical behaviourist perspective focussing on the motivation of use after the acquisition of the device. As emphasised throughout the thesis, academic research on technology use by older adults only became a focal issue within the last 20 years and as such some areas have received copious attention whilst others are lacking in scholarship. For instance, studies measuring age as a variable on technology performance (Eastman & Iyer, 2005; Thayer & Ray, 2006; Czaja *et al.*, 2006; Peacock & Kunemund, 2007; Arning & Ziefle, 2007; 2008; 2009) and technology acceptance (Morris & Venkatesh, 2000; McClosky, 2006; Nagle & Schmidt, 2012) have been extremely prominent whilst academic research

on actual technology usage over time has been lacking. Moreover, often the technologies of interest have included more traditional ICTs such as computer and Internet use (Wagner, Hassanein & Head, 2010) or assistive technologies such as robotics and in-home monitoring (Heerink *et al.*, 2006; 2008a; 2008b; Wild *et al.*, 2008; Gaul & Ziefle, 2009; Poland *et al.*, 2011; Mortenson *et al.*, 2012). There has been very little focus on domestic hand held devices or PIDs, which are becoming increasingly popular with people of all ages. Consequently, there was scope for longitudinal cross-sectional research to provide rich data on the real-time post-purchase use of everyday technology by older adults. Considering that the previous literature focuses on the pre-purchase attitudes of older consumers or the effects of age on speed and performance, the present study intended to extend and strengthen this literature by exploring technology use after purchase; the assessment of MOs on the rate of response provides the necessary long term research on actual technology usage.

The findings in the preceding chapter suggest that the use of PIDs by older adults is subject to several MOs; namely the utility of a device, the emotional attachment towards the technology and the perceptions of self-worth associated with using it. The sense of belonging connected to using technology was only statistically proven for Smart Phone users; however, the qualitative dairy data supported this MO for all of the subject devices. These MOs impact the rate of response, which in this case is the frequency of use of the subject technical devices. If an MO is related to technology use, it will positively impact the behaviour and improve the consumer's condition, which further increases the rate of response. With this improvement, the MO establishes its own removal as a punisher, which means that a consumer will firstly maintain behaviour to maintain the MO and secondly if the MO reduces, the behavioural responses will decrease or even cease.

Table 53 displays the correlations of the MOs in relation to frequency of use across the four different subject technologies; iPad, Laptop, Smart Phone and Kindle. As is evidenced different technologies with various functions and characteristics have, as expected, different MOs impacting upon the rate of usage. The smart phone, for instance, has the most of the proposed MOs influencing its frequency of use with positive and strong correlations between rate of usage and usefulness, functionality, sense of belonging and perceptions of self-worth. The Laptop users, on the other hand, are more heavily influenced by just utility (usefulness and functionality) and emotional attachment whilst the Kindle users are motivated by the usefulness of the device, their

emotional attachment towards it and the perceptions of self-worth that the easy use of the Kindle provides. Table 53 also displays a comparison between the strength of the proposed MOs on the usage of the devices with utility (usefulness and functionality) clearly displaying the strongest correlations; followed by perceptions of self-worth and emotional attachment. Sense of belonging had the lowest Pearson correlations with only the smart phone having a significant relationship between the social belonging metric and the rate of usage of the device. The implications of each of these MOs on technology use by older adults will presently be discussed and concluded in the following section.

	Usefulness	Functionality	Emotional Attachment	Sense of Belonging	Perceptions of self-worth
iPad	r = 0.825 p = 0.000	r = 0.517 p = 0.000	r = 0.306 p = 0.026	r = 0.186 p = 0.182	r = 0.332 p = 0.015
Laptop	r = 0.854 p = 0.000	r = 0.362 p = 0.024	r = 0.441 p = 0.005	r = -0.266 p = 0.101	r = -0.115 p = 0.484
Smart Phone	r = 0.780 p = 0.000	r = 0.538 p = 0.001	r = 0.067 p = 0.703	r = 0.590 p = 0.000	r = 0.634 p = 0.000
Kindle	r = 0.524 p = 0.000	r = 0.115 p = 0.426	r = 0.336 p = 0.017	r = 0.105 p = 0.466	r = 0.472 p = 0.001

Table 53: Summary of MOs in relation to different technologies

No correlation	0.250-0.49	0.5-0.749	0.750-1

In the present thesis perceived utility as a CMO-R is assumed to have the most impact on technology use; the two factors of usefulness and functionality had the highest significant correlation with frequency of technology use. These results support the literature on technology use by older adults, which suggests that utility is the primary factor for usage (Lunsford and Burnett, 1992; Leventhal, 1997; Laukkanen *et al.*, 2007; Slegers *et al.*, 2009; Buse, 2010). The diary data continues to support the various literatures by showing that a high utility of a device outweighs negative barriers to technology use such as safety and privacy issues (Melenhorst & Bouwhuis, 2004; Wild *et al.*, 2008). Utility in the forms of usefulness, functionality and even ease-of-use are consequently imperative to the adoption, acceptance and continual usage of technology by people over the age of 65. The implications of these findings are vital for practitioners designing devices for this age group, who may wish to focus on how to

make a device useful, functional and easy-to-use and base any market research on these elements. Moreover, from a policy perspective the knowledge that utility is the largest motivator for use may be useful when devising schemes to encourage the use of in-home monitoring, assistive technology use or online services such as NHS direct.

Using the qualitative data, further deductions concerning the actual use of technology can be made in reference to the function of devices within older adult's lives. The findings revealed that there were three categories of use; communication, information searching and entertainment/leisure pursuits, which is in correspondence with previous literature focussing on technology use by this age group (Wagner, Hassanein & Head, 2010). The largest and arguably most important usage is communication, which is often thought to be effective at reducing loneliness (Ballantyne, *et al.*, 2010) and aiding successful ageing (Rowe & Khan, 1987; 1998; Kirikvold *et al.*, 2012). Interestingly, the most prominent aspect of PIDs usage involves emails, which many would consider as being old fashioned in comparison to the social media sites available to today's Internet users. The older adults in the present study, however, very much rely on their email communication with even Kindle users utilising their device in the process of checking and sending emails. A few participants reported attempting to use social media but were of the opinion that it did not suit them, alternatively, email allowed the older adults to communicate with friends and relatives regardless of physical and geographical boundaries and on a time scale that suited. For instance, participants could choose the ideal time to communicate via the medium of email and did not feel the pressure of instant messaging or text messaging from which an immediate reply is expected. Previous suggestions as to why older adults prefer email to social media (Jones & Fox, 2009; Lenhart, 2009) mention the low technical capabilities of people over the age of 65 (Cornejo, Favela & Tentori, 2010) or how privacy may be a barrier (Xie *et al.*, 2012). The present study, however, has discovered that with technology, utility is valued as the highest motivation of usage and so if older adults viewed social media to be as useful and functional as email, then the usage of this medium would increase. For now, however, the importance lies in the fact that older adults who use technology are religiously doing so to communicate, which is aiding feelings of belonging and improving quality of life.

The other two MOs that were statistically supported were emotional attachment towards the device and perceptions of self-worth, which are both, proposed as being CMO-Ss of technology use. Firstly, emotional attachment has positive correlations with

the usefulness and functionality metrics as well as the frequency of use of the technological devices, which suggests that emotional attachment acts as a CMO-S on rate of usage. For instance, if a device is useful and functional, fulfilling the initial CMO-R of perceived utility, it can become associated with other MOs such as emotional attachment; this MO then adopts the same influence that the previous CMO-R had on the usage of a device. In this instance, emotional attachment motivates rate of usage and establishes its own removal as a punisher; the findings presented in the previous chapter support this assumption. Table 53 demonstrates that emotional attachment positively correlates with usage for Kindle, Laptop and iPad users but not for participants with Smart Phones, suggesting that it is only a motivator of use for certain technologies.

Findings from the qualitative data within the present study support the previous literature by highlighting that emotional attachment towards technologies is formulated by devices that are either interactive (Heerink, Krose, Evers & Wielinga, 2006; 2008a; 2008b; Wada & Shibata, 2007) or highly important to the participants (May, Garrett & Ballantyne, 2010). For instance, smart phones to older participants are evidentially not as important as smart phones are for younger generations (Vincent, 2006; Stelmaszewska *et al*., 2004; 2006; 2008), which is why the emotional attachment did not act as an MO for the smart phone users within the present research. Whereas, devices such as Laptops, iPads and Kindles that were used more regularly for email interaction have a higher importance and hence emotional attachment becomes a CMO-S of usage. It would be interesting for further research to expand upon and test this theory by reaffirming the relationship between emotional attachment towards devices and rate of usage but for technologies that are imperative to a person's quality of life; for example assistive technologies such as electric scooters. A comparison between devices of a high importance and devices of a low importance could create some interesting findings, whilst complimenting the aforementioned implication.

One unexpected yet important relationship that emerged between the independent variables was a significant negative correlation between emotional attachment and social belonging. For instance, the more the participant was emotionally attached towards their technology, the less socially involved they were in their surroundings. This relationship has been observed before in adolescents who are dependent upon video games (Schmit, Chauchard, Chabrol & Sejourne, 2011; Wei, Chen, Huang & Bai, 2012); the higher their dependence or attachment towards the video game, the lower

their feelings of social belonging and perceptions of self-worth. This relationship, however, has yet to be stressed within the literature of everyday devices such as PIDs and the scholarship of older adult technology use. From this implication, two recommendations should be made. Firstly, further investigation into the two variables; emotional attachment and social belonging in the context of everyday technology to observe if this pattern reoccurs. Secondly, research projects and charity organisations intending to influence technology use in the older adult community should be aware that there may be a delicate balance between a healthy usage creating connections over geographical boundaries and an over-dependence on a technology, which could in fact reduce feelings of belonging and even perceptions of self-worth. If future research deduces a similar relationship between the two variables, before technology is introduced into people's lives, the instigators should be aware of this possible negative affect of over use and dependence.

Secondly, the perceptions of self-worth metric had positive correlations with usefulness and social belonging, alongside frequency of use. This implies that perceptions of self-worth are a CMO-S of technology use; after being coupled with utility and sense of belonging, perceptions of self-worth positively impact the rate of technology usage and establish their own removal as a punisher, which would abate behaviour. The statistics support this assumption for the iPad, Smart Phone and Kindle, demonstrating positive correlations between perceptions of self-worth and frequency of use for all these devices. However, for the Laptop, there was little evidence of perceptions of self-worth acting as an MO on the frequency of use. The findings revealed that this variation between the devices is for two different reasons; firstly, if a device is highly communicative such as the smart phone, then usage is more likely to be influenced by perceptions of self-worth, which from the correlation between this metric and sense of belonging, are assumed to be enhanced by the connection that the mobile phone provides. Secondly, if a device is easy to use, for instance the Kindle, iPad or Smart Phone, then it is more likely to enhance feelings of self-worth as participants feel a sense of achievement in correctly deciphering and using their technologies. Fewer Laptop users, on the other hand, reported that their technology was easy-to-use and as such, the statistics, by displaying no positive correlation in Table 53, suggest that perceptions of self-worth are not a motivating influence on the usage of this particular device.

There are powerful implications within these findings for research projects and charities, such as SUS-IT and AgeUK, aiming to encourage technology use amongst older generations. For instance, there are copious benefits to the end result of technology use amongst older people; improving communication with family and friends, easing daily tasks such as shopping, information searching and providing means of entertainment and fun, however, all these benefits may become null and void if the device is too difficult to use. A technology that is difficult to use, as suggested by the present research alongside previous academic research (Arning & Ziefle, 2007; Mallenius, Rossi & Tuunainen, 2010), can reduce older people's technical confidence and perceptions of self-worth. Consequently, if complex technology use is encouraged without thoughtful help, teaching and guidance it may cause more harm than good and actually reduce the self-worth of the user. A strong emphasis for future research projects should therefore be on the accessibility and simplicity of a device and the teaching of technology's foibles to people over the age of 65, similar and in correspondence to the current SUS-IT project based in the UK.

The findings revealed that communicative devices such as Smart Phones enhance perceptions of self-worth by connecting people with friends and relatives; the most popular usage of the subject technologies within the present study. All of the devices, however, had access to the Internet and so it is difficult to make a distinction between the effects of communicative and non-communicative technology. This research could therefore be complimented by future investigation comparing the positive correlations between perceptions of self-worth and usage for devices that were online and devices that had no internet connection. This comparison would help to isolate perceptions of self-worth as an MO and clarify that highly communicative technology usage can be influenced by this CMO-S.

The previous chapter revealed that perceptions of self-worth had a strong positive correlation with a sense of belonging, which supports the assumption that self-worth is influenced by communication and connection with people in the surrounding environment. Unfortunately, however, the statistics did not reveal a relationship between a sense of belonging and frequency of technology use, which means that the proposition cannot completely be supported. Examining table 53, however, indicates that there is a strong positive relationship between sense of belonging and frequency of use but only for the Smart Phone users; it is therefore implied that sense of belonging only acts as a CMO-S on technology use if the device is highly communicative. Even

though the metric chosen in the present study did not reveal a relationship between sense of belonging and usage for all the technologies, the qualitative data provides sufficient evidence that technologies are continuously being used to connect people with family, friends and their surrounding environment. Moreover, using a technology sometimes creates a group mentality that the users belong to a particular section of society; for instance Kindle users against book users, Apple Mac users against PC users. The qualitative data suggested that technology can create these alliances and bring people together who are of similar collective opinions. This discovery is in compliment of the work of Karavida, Lim & Katsikas (2005) who indicate how ICT can bring people together when users attend computer groups or technology help sessions. There is clear evidence of social belonging influencing technology usage in the self-report diary data but little supportive statistics, other than for the Smart Phone, and as such further scholarship in this area is required. As previously mentioned, it would be interesting to compare the results of highly communicative devices with other uncommunicative technology to see if both social belonging and perceptions of self-worth had an impact upon the usage of these devices. Alternatively, the items within the metric of social belonging could be re-tested through further preliminary research to see if, after this alteration, the statistics supported the qualitative data. The original scale by Hagerty and Patusky (1995) contained 18 items, which were refined in the present thesis through factor analysis of both the preliminary and central survey data. This refinement may have reduced the validity of the scale and therefore, if further research on sense of belonging and technology use was instigated, it would be advised to use the full 18 item scale. This was not appropriate for the present thesis as the nature of the participants required the monthly survey to be short, easy to complete and unobtrusive.

The primary limitation, however, of the present study involves one of the scales that was chosen to measure the variables and MOs. According to Clark and Watson (1995), scale validity is more important than reliability, although reliability is still a useful and imperative tool in devising a psychological scale. The scale for enjoyment, which failed to be recognised through factor analysis of the preliminary survey data and a subsequent factor analysis of the central quantitative data, can therefore be explained by this assumption. The original scale chosen and expanded upon was an 'enjoyment' subscale of a consumer-product attachment scale developed by Schifferstein and Zwartkruis-Pelgrim (2008). As a result, a few of the items such as 'I think about this product a lot' have similar meaning and implications to items within the emotional

attachment scale; which is why, following the second factor analysis of the central research data, the 'enjoyment' items were statistically combined with the emotional attachment items. In other words, the scale chosen and expanded upon (Schifferstein & Zwartkruis-Pelgrim, 2008) was reliable after the primary factor analysis but not valid; it did not measure the enjoyment of using a technology, instead encapsulating the attachment towards using a device. Consequently, due to this limitation and a lack of a clear scale emerging from the factor analysis statistics, enjoyment was regrettably rejected as a proposition and not included in the results chapter.

With hindsight, the researcher would have chosen an enjoyment scale that stood alone, separate from an overarching measurement such as attachment, however, during the stages of preliminary investigation such a scale seemed undeveloped and lacking. There appear to be two alternative solutions; firstly, as suggested by Clark and Watson (1995), the scale could have had more items that were broader in definition and valid; actually measuring the characteristics of enjoyment. For this option, a new scale could have been developed without relying on previous scholarship, however, the issue with this option lies in the number of responses the preliminary survey received; this number would have had to be doubled. Secondly, the Pleasure-Arousal-Dominance metric (Mehrabian; 1996) could have been introduced as an alternative to enjoyment but this would have changed the nature of the study and the independent variable being observed. To supplement the present thesis and compromise for the lack of an enjoyment scale, further scholarship involving the Pleasure-Arousal-Dominance literature and technology use by older adults could be compiled. This work would extend that of Mehrabian and Blum (1996) who established that age makes one feel less in control of their activities and life circumstances and more controlled by others and the environment. In other words, the dominance part of the personality traits reduces as age increases. It would be interesting to observe how the pleasure, arousal and dominance factors influence technology use by older adults.

To support the scales of measurement for each MO, a qualitative diary technique was employed, under the radical behaviourist assumption that even methods of data collection are behaviours and can be measured or observed. For instance, completing a diary entry is behaviour and observations of the diary contents can be used to further understand and support the independent variables (e.g. MOs) that influence technology usage. Consequently, even though the scales for enjoyment and a sense of belonging may not be completely valid, there is qualitative data, analysed in a

positivist manner, to support the influence that these factors have upon the frequency of technology use.

In summary, of the older people who have adopted technologies in the present study, the participants who have the least experience with domestic and PID technology, are the ones who are more likely to continue using or increase their usage of their device. The early adopters or participants, who have previous experience with technology, are more likely to decrease the usage of their device. This observation has important implications for policy makers or practitioners creating devices for a 'greying market' (Kohlbacher & Hang, 2007). For policy makers, it implies that when encouraging less experienced individuals to use a technology, once this technology is adopted it will generally be used at a constant or increasing rate. However, for more experienced technology users it is more difficult to encourage continuous usage, perhaps these individuals have higher expectations of a device, and as such the technology must produce higher levels of utility. This awareness is also important for practitioners developing products for older adults; for early adopters utility is imperative to guarantee usage and brand loyalty whilst for late adopters other factors are important such as the emotional attachment towards the device, how easy the technology is to use and as such the self-worth that it produces.

3. A radical behaviourist perspective on technology adoption

Extending the technology acceptance and adoption literature by providing a radical behaviourist perspective on post-purchase consumption by the older adult consumer market, focussing on the motivation of usage.

Previous technology acceptance and adoption literature has been dominated by two prevalent models; TAM and DIT. TAM is concerned with attitudes towards a technology and intention to use (Davis *et al.*, 1989) whilst DIT suggests that technology adoption is a process of communication and social influence (Rogers, 2003). Neither, however, has been developed from a radical behaviourist perspective nor do they focus primarily on the post-purchase behaviour of the consumer. DIT, within its stages of adoption refers to an evaluation phase, which is after the acquisition of the innovation but behaviour within this phase is rarely a topic of interest. A radical behaviourist perspective allows the behaviour of older adults in the post-purchase phase to be explored in detail; providing an understanding of the environmental impacts on technology usage and influence of MOs on frequency of use.

A novel perspective breaks the dominance of the two leading models, however, to move completely away from both outlooks would be to deny valuable theory and research. As such, the present contribution to technology adoption and acceptance, builds on previous TAM and DIT based literature to develop a radical behaviourist view of post-purchase technology usage. Consequently, the proposed MO variables resemble independent variables from both models but provide an alternative theory to intention and attitude based research (Ajzen & Fishbein, 1980; Davis *et al*., 1989; Ajzen, 1991) and innovation literature (Rogers, 2003). For instance, one of the utility measures that emerged from the factor analysis was usefulness, which is similar to the *perceived usefulness* variable within the TAM. However, instead of representing consumers' attitudes towards the usefulness of the technology, a psychological scale has been developed to measure the actual usefulness of the device within the environment. This metric was then used to test the relationship that device usefulness had with the frequency of usage during the early months of technology use post-purchase. Sense of belonging and perceptions of self-worth, are however, more reminiscent of Roger's (2003) DIT model as he argues that depending on which stage people adopt an innovation, they have different motivations and concerns; for instance early adopters are motivated more by the utility and economic value of a device whilst late adopters strive more to adopt so that they feel like they belong within society, which is where a sense of belonging as a motivation of technology use emerged. Moreover, innovators adopt to fuel their self-esteem with the knowledge that by adopting an innovation first they are succeeding within society; this motivation is similar to the proposed MO perceptions of self-worth.

One radical behaviourist application of the technology adoption literature was in 1994 when Foxall applied his proposed operant classes of consumer behaviour; accomplishment, accumulation, hedonism and maintenance to Roger's (2003) bell curve of adopter categories. The last proposition of the present thesis therefore sought to apply the longitudinal survey data to this amalgamation of consumer behaviour operant classes with the DIT adopter categories. The findings supported Foxall's (1994) propositions that early adopters would be more influenced by utility factors whilst late adopters would be motivated to use technology by perceptions of self-worth and emotional attachment. Laggards demonstrated a low correlation between usefulness and usage but supported the assumption that this adoption category were subject to low utilitarian and low informational reinforcement. Unfortunately there were no innovators amongst the participants, which made it difficult to support Foxall's (1994)

proposal that innovators are subject to high informational and high utilitarian reinforcement. In the context of the proposed MOs, this adoption group would be motivated by utility, a sense of belonging and perceptions of self-worth but currently there is not enough evidence to support this.

The contribution of the present thesis therefore lies in applying a different theoretical perspective to the technology acceptance and adoption literature. By studying previous academic research in this area, 5 variables were proposed as influencing technology usage within the following months after acquisition of the device. Three of the proposed MOs were supported by both the qualitative and quantitative data and these are; the utility of the device, emotional attachment towards the device and perceptions of self-worth associated with using the technology. Unfortunately, the scale for enjoyment failed to emerge successfully from the factor analysis of the items in both the preliminary study and the longitudinal survey and as such, this variable could not be sufficiently tested as a CMO-R on technology use. The final proposed MO was a sense of belonging associated with using technology, which was only supported by the Smart Phone quantitative data but had support from the qualitative data for all the subject technologies. In summation, a radical behaviourist perspective of technology adoption in the stages of post-purchase predicts that the utility of a device, the emotional attachment towards it and the perceptions of self-worth created from communication qualities and ease-of-use are all motivating influences of use. As previously discussed, further research is required to completely support a sense of belonging as a CMO-S but there is evidence that this variable also influences rate of use.

The predominant limitation to this contribution is that these MOs were introduced from literature on technology use by older adults and were supported by data gathered from people over the age of 65. As such, there is no evidence that these independent variables would influence technology usage for other populations. To validate these findings as contributing to technology acceptance and adoption literature, the empirical strategy would have to be re-applied to people of varying ages using variations of domestic technology or specifically PIDs. A comparison between motivation of usage for older adults and younger adults would not only provide interesting results on generational differences between the age groups but would also generate a rich set of data that could be used to enhance the understanding of post-purchase technology use from a radical behaviourist perspective.

The chosen population produces other limitations that can be rectified with the same solution as above; expanding the research to apply the same empirical strategy to a variation of people of all ages; from experienced technology users to novices. Currently the population although a good range of ages between 65 and 88 are limited in respect that firstly, anyone younger than 65 has been excluded, secondly, participants were recruited from U3A organisations and as such, their education levels are above average, which may have had an influence on the results. Although qualifications varied from O-levels to Doctorates, the U3A members all had a desire to learn, which may have influenced their ability to use a technology. Finally, the participants had acquired their own technology which suggests that very few would be entirely new to PIDs. A further interesting comparison for extended scholarship would therefore be between technology users and non-technology users from communities other than U3A organisations, which would also complement proposition 6, by expanding upon the experience measure used to decipher which adopter category each participant belonged to.

4. The Behavioural Perspective Model and Motivating Operations

Updating the BPM research to incorporate MOs into the conceptual model and discover their motivating impact upon post-purchase behaviour in the context of technology use by people over the age of 65.

Foxall (1992; 1994; 1995) developed the BPM as a tool for researchers to explore, predict and even control consumer behaviour using a radical behaviourist perspective. He leaned towards this paradigm shift in consumer behaviour due to the then on-going battle between traditional purely quantitative positivist methods and more modern methods of hermeneutic interpretation. To solve this squabble, Foxall (1994; 1995) proposed radical behaviourism, as the approach predominantly uses quantitative methods unless these are not applicable to the behaviour of measurement, in which instance qualitative methods are encouraged as long as they are interpreted as observations and analysed quantitatively. Consequently, through the BPM, which is a consumer behaviour empirical tool based on Skinner's (1953; 1957) three term contingency, Foxall gave consumer researchers a practical compromise.

The model has been used successfully as an empirical tool since 1997 but with a philosophical phase emerging from 2003 onwards, Foxall (2007) has been striving for new thought to challenge the model and new ideas to be integrated. As the radical behaviourist ontological position is pragmatic; one truth may replace another if it

explains more of the nature of the universe (Foxall, 1995; Moore, 2011); there is a constant desire for reinterpretations and contentions to the model through the fear that it may become stale with overuse and assumptions of superiority. The argument for the inclusion of MOs into the BPM is therefore an attempt by Fagerstrom *et al.* (2010) to introduce a concept that was acknowledged by Skinner (1980) as the *third variable* and reintroduced into behavioural psychology in 1982 by Jack Michael (1982; 1988; 1993; 2000; 2004).With the exception of Fagerstrom *et al.* (2010) it is yet to be included in the consumer behaviour literature. This is where the third and final contribution emerged; by using the collated data on technology use by older adults, this thesis intended to incorporate MOs into the BPM.

The primary step to the inclusion of MOs into the BPM is the distinction between discriminative and motivating antecedents in the consumer behaviour setting (Fagerstrom *et al.*, 2010). An S^d is the availability of the behaviour; in other words, the external environment and learning history making the behaviour accessible. In the context of post-purchase technology use, an S^d would be how easy-to-use the technology is in relation to the consumer's experience with that particular device or one similar. An MO on the other hand alters how much the consumer wants to use a technology; this can be anything from the desire to communicate to how the device portrays affluence. Unlike the majority of consumer behaviour, the post-purchase decision to use a technology is less based on S^d s and more based on the motivations as the consumer situation and learning history generally remains constant unless the consumer develops user problems or the device fails to work. Consequently, the post-adoption use of technology is a prime example of how MOs can be included into the BPM literature.

After establishing the difference between the S^d s, known within the BPM as *learning history* and *consumer behaviour setting* in the *consumer situation*, and MOs; literature based on the consumer situation was thoroughly assessed as means of developing potential MOs. These MOs were based on previous technology adoption and acceptance literature alongside research specifically focussing on older adult's use of ICT. They had to have the potential qualities of an MO not an S^d by altering both the rate of response and the value of responding. The proposed MOs were then validated with the diary data in chapter 3 and tested using the quantitative longitudinal survey data in chapter 4. The MOs were measured in context of their behaviour altering affect and consequently, in relation to the frequency of technology use. Moreover, their

removal from the behavioural equation had to act as a punisher and produce evidence of a reduction in usage. The MOs that fulfilled these criteria were utility, emotional attachment and perceptions of self-worth whilst a sense of belonging only acted as an MO for Smart Phone users.

The difficultly later lay in incorporating the proposed and tested MOs into the already acclaimed BPM. Considering that an MO influences both the behaviour and the value of responding, it was through the impact that each MO had on Foxall's (1992; 1993; 1994) proposed schedules of reinforcement that the incorporation could inaugurate. Consequently, alongside indicating the characteristics of Rogers' (2003) adoption categories for older adults, proposition 6 also took the primary paces to include MOs into the BPM framework. The findings in the previous chapter revealed that for low informational and high utilitarian reinforcement (hedonistic consumers) the primary MO was utility (usefulness and functionality). Whereas for accumulation consumers with low utilitarian and high informational reinforcement, utility had less influence over usage whilst emotional attachment and perceptions of self-worth had more. Finally for maintenance consumers who rely on low levels of both utilitarian and informational reinforcement, as expected MOs were sparse, with the exception of a low usefulness correlation. These results suggest that MOs could be incorporated into the BPM under the presumption that they alter the rate of behaviour and the value of responding. The following diagram depicts how MOs would be incorporated for the present consumer behaviour of technology use:

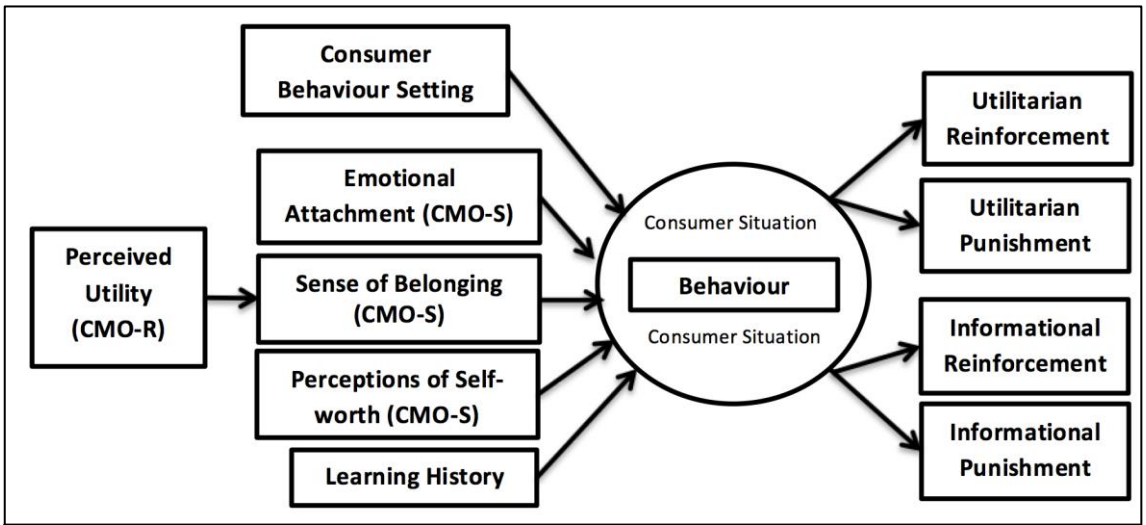

Figure 18: Incorporation of MOs into the BPM

For different consumer behaviours, however, a simple label of *Motivating Operations* could be included. To validate the effect of MOs on alternative consumer behaviours to post-purchase technology use, further MOs would have to be proposed and tested in relation to the rate of response and the consumer operant classes. Moreover, before MOs are entirely included within the BPM, additional research needs to be conducted on clarifying the distinctions between *learning history*, *consumer behaviour setting* and the proposed *motivating operations* and the affects that each of these have on the behaviour within the consumer situation.

Considering that the present thesis is measuring post-purchase consumer behaviour over a 6 month period within the consumer's real-life situation as opposed to within controlled settings, there was of course one major limitation to the data collation and analysis. As suggested by O'Reilly *et al.* (2006a; 2006b; 2007a; 2007b), MOs should be developed firstly with a functional analysis, then measured by systematically applying the EOs and AOs in a controlled environment and finally the AOs should be applied in an attempt to reduce the target behaviour. The present empirical strategy, however, differs slightly from O'Reilly *et al.*'s (2006a; 2006b; 2007a; 2007b) suggestions; firstly the functional analysis takes the form of a literature review and preliminary qualitative data collection from self-report diaries. Secondly, EOs and AOs are not systematically applied but observed through the variations in the chosen technologies' functions. Finally, considering the behaviour of interest is beneficial to the lives of the participants, the AOs were not applied until extinction occurred. Alternatively, there was a group of participants whose technology use reduced and ceased and this group was examined in-depth to decipher the AOs influencing this lower rate-of-response. Research on MOs often focusses on problem behaviour (Call *et al.*, 2005), behaviour disorders (Smith and Iwata, 1997) and self-injury (Smith *et al.*, 1995) in an attempt to reduce or even terminate the harmful actions, however by exploring the influence of EOs on a beneficial behaviour within a natural consumer setting, this method has had to be altered. Unfortunately, during the empirical strategy alteration, the MOs have not been isolated from one another and systematically applied. Consequently, to create the effect of isolation and compliment the findings of the present thesis, the same empirical strategy should be applied to a larger variation of technology users all with different devices. As previously mentioned in this chapter, by comparing the results of offline and online, interactive and non-interactive and important and unimportant technologies it should become more apparent which types of technology are subject to which MOs.

5. A behavioural analysis of post-adoption technology use by older adults

This thesis has sought to examine the post-purchase technology use of people over the age of 65 from a radical behaviourist perspective. The primary objective has been to develop and test MOs that evoke or abate this behaviour in order to; firstly, better understand what influences an older adult to use the technologies they own; secondly, to comprehend the process of technology use after the initial adoption of the device; and thirdly, to combine MOs within the consumer behaviour and BPM research.

With 16.4% of the UK population being over the age of 65 in 2011 and this figure only continuing to rise (Office of National Statistics, 2012a; Warburton, Ng & Shardlow, 2013) it is important to understand the characteristics, desires and needs of this often under-studied section of society. This thesis is not assuming that all adults older than 65 have health problems, however, with this section of society increasing, the health demands are also accumulating. Currently, the problems with an ever expanding ageing population are threefold involving pressures on the NHS managing the physical and mental health of older adults (Tadd et al., 2011; Steptoe, Demakakos & de Oliveira, 2012; Porock et al., 2013), strains on informal and formal carers (Hileman, Lackey & Hassanein, 1992; Jones & Peters, 1992; Schulz & Beach, 1999; Arno, Levine & Memmott, 1999; Walker & Luszcz, 2009; Suanet, Van Groenou & Van Tilburg, 2012) and the mental and physical disabilities placed on the ageing community (Savikko et al. 2005; Victor et al. 2005; Steed et al. 2007; Drennan, et al., 2008; Kirkvold et al., 2012). Technology use, in various formats, has demonstrated relief to the aforementioned pressures of an ageing population (Karavidas, Lim & Katsikas, 2005; Flynn, Smith & Freese, 2006; Sum, Mathews, Hughes & Campbell, 2008; Wild *et al.*, 2008; Ballantyne *et al.*, 2010; Poland *et al.*, 2011; Hsu *et al.*, 2011; Cattan, Kime & Bagnall, 2011; Kirkvold *et al.*, 2012; Mortenson *et al.*, 2012) yet academic work examining the motivations of actual technology usage by this population is limited (Wagner, Hassanein & Head, 2010).

Considering this apparent gap in knowledge, the present thesis has sought to develop an in-depth account of the motivating influences of technology use by older adults within the post-purchase period, which compliments and extends previous academic research on technology use by older adults. Due to the behavioural approach of the thesis and novel exploration of post-purchase technology use, this topic was explored without the restrictions of previous technology acceptance and adoption models such

as TAM and DIT. As such, an interesting selection of variables (MOs) such as emotional attachment and perceptions of self-worth were tested in relation to technology use, providing a viable and comprehensive account of the behaviour. Moreover, this account demonstrates that alternative approaches to explain technology use, are not only possible but also necessary. Finally, the proposed MOs provided a detailed insight into technology use by older adults and through this application to an operant behaviour; they were successfully incorporated into the BPM.

In conclusion, this thesis demonstrates that principles of applied behaviour analysis such as MOs can be effectively applied to consumer behaviour within the context of a real-life setting. It therefore establishes that instead of behaviourism being a psychological paradigm of the past, its use to understand the complex behaviours of human experience can both compliment and expand previous scholarship from dominant models and perspectives. The pragmatic ontology of radical behaviourism strives for further truths to be discovered and previous positions to be rethought in an attempt explain more about the nature of the universe. As such, by incorporating MOs into the BPM, this thesis sought to explain more about the nature of consumer behaviour within the context of post-adoption technology use amongst the older adult population.

BIBLIOGRAPHY

Adams, K. B. (2004). Changing investment in activities and interests in elders'lives: theory and measurement. *The International Journal of Aging and Human Development*, *58*(2), 87-108.

Ainsworth, M. S. (1979). Infant–mother attachment. *American psychologist*,*34*(10), 932.

Ajzen, I. (1985). *From intentions to actions: A theory of planned behavior* (pp. 11-39). Springer Berlin Heidelberg.

Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, *50*(2), 179-211.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behaviour.*Englewood Cliffs, NJ: Prentice-Hall

Alaszewski, A. (2006). Diaries as a source of suffering narratives: A critical commentary. *Health, risk & society*, *8*(1), 43-58.

Alhadeff, D. A. (1982). *Microeconomics and Human Behaviour: Towards a New Synthesis of Economics and Psychology*. London: University of California Pr.

Anestis, M. D., Anestis, J. C., & Lilienfeld, S. O. (2011). When it comes to evaluating psychodynamic therapy, the devil is in the details. *The American Psychologist,* 66(2), 149-51.

Arai, Y., Kumamoto, K., Washio, M., Ueda, T., Miura, H., Kudo, K., (2004). Factors related to feelings of burden among caregivers looking after impaired elderly in Japan under the Long-Term Care insurance system. *Psychiatry and clinical neurosciences* ,58(4), 396–402.

Arning, K., Ziefle, M., (2007). Understanding age differences in PDA acceptance and performance. *Computers in Human Behavior* 23(6), 2904–2927.

Arning, K., & Ziefle, M. (2008). Development and validation of a computer expertise questionnaire for older adults. *Behaviour & information technology*, *27*(4), 325-329.

Arning, K., & Ziefle, M. (2009). Effects of age, cognitive, and personal factors on PDA menu navigation performance. *Behaviour & Information Technology*, *28*(3), 251-268.

Arno, P.S., Levine, C., Memmott, M.M., (1999). The economic value of informal caregiving. *Health Affairs* 18(2), 182–188.

Babkin, B. P., & Babkin, B. P. (1949). *Pavlov: A biography.* Chicago: University of Chicago Press.

Baer, D. M., & Schwartz, I. S. (1991). If reliance on epidemiology were to become epidemic, we would need to assess its social validity. *Journal of applied behavior analysis*, *24*(2), 231-234.

Baer, D. M., Wolf, M. M., & Risley, T. R. (1968). Some current dimensions of applied behavior analysis 1. *Journal of applied behavior analysis*, *1*(1), 91-97.

Bagozzi, R. P. (2007). The Legacy of the Technology Acceptance Model and a Proposal for a Paradigm Shift. *Journal of the association for information systems*, *8*(4), 3.

Bailey, J. S., & Burch, M. R. (Eds.). (2002). *Research methods in applied behavior analysis*. London: Sage.

Bain, R. (1937). Technology and state government. *American Sociological Review*, *2*(6), 860-874.

Ball, D. A., & Tasaki, L. H. (1992). The role and measurement of attachment in consumer behavior. *Journal of Consumer Psychology*, *1*(2), 155-172.

Ballantyne A., Trenwith L., Zubrinich S. & Corlis M. (2010) 'I feel less lonely': what older people say about participating in a social networking website. *Quality in Ageing & Older Adults,* 11(3), 25–35

Baltes, P. B., & Baltes, M. M. (1990). Psychological perspectives on successful aging: The model of selective optimization with compensation. *Successful aging: Perspectives from the behavioral sciences*, *1*, 1-34.

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological review*, *84*(2), 191.

Barak, B., & Schiffman, L. G. (1981). Cognitive age: a nonchronological age variable. *Advances in consumer research*, *8*(1), 602-606.

Bargh, J. A., & Morsella, E. (2008). The unconscious mind. *Perspectives on psychological science*, *3*(1), 73-79.

Barker, R. G. (1968). *Ecological psychology: Concepts and methods for studying the environment of human behavior*. Stanford University Press.

Barnett, A.J., (2013). The Psychoanalytic Review: 100 years of history. *The Psychoanalytic Review,* 100(1), 1–56.

Bartlett, T., (2012). *A New Twist in the Sad Saga of Little Albert*. The Chronicle of Higher Education. Available at: < http://chronicle.com/blogs/percolator/a-new-twist-in-the-sad-saga-of-little-albert/28423> [accessed 17 July 2013]

Baum, W. M. (2005). *Understanding behaviorism: Behavior, culture, and evolution* (2nd ed.). Malden, MA: Blackwell Publishing.

Bazerman, M. H., & Moore, D. A. (2008). *Judgment in managerial decision making*. New York: Wiley.

Beck, H. P., Levinson, S., & Irons, G. (2009). Finding little Albert: A journey to John B. Watson's infant laboratory. *American Psychologist*, *64*(7), 605.

Berkowsky, R. W., Cotton, S. R., Yost, E. A., & Winstead, V. P. (2013). Attitudes Towards and Limitations to ICT Use in Assisted and Independent Living Communities:

Findings from a Specially-Designed Technological Intervention. *Educational gerontology*, *39*(11), 797-811.

Bhattacherjee, A., & Sanford, C. (2006). Influence processes for information technology acceptance: an elaboration likelihood model. *MIS quarterly*, 30(4), 805-825.

Bicard, D. F., Lott, V., Mills, J., Bicard, S., & Baylot-Casey, L. (2012). Effects of text messaged self-monitoring on class attendance and punctuality of at-risk college student athletes. *Journal of applied behavior analysis*, *45*(1), 205-210.

Blackman, D. (1984). The current status of behaviourism and learning theory in psychology. In Fontana, D. (Ed.) *Behaviourism and learning theory in education*. Edinburgh: Scottish Academic Press, 46-78.

Bolger, N., Davis, A., & Rafaeli, E. (2003). Diary methods: Capturing life as it is lived. *Annual review of psychology*, *54*(1), 579-616.

Boring, E. G., Gardner, L., (1967). A history of psychology in autobiography. *The Century Psychology Series*, 5, 449-475. Connecticut: Appleton-Century-Crofts.

Bowlby, J. (1969). *Attachment and loss v. 3* (Vol. 1). New York: Basic Books.

Brewer, J. (2003). Content analysis. In Miller R. & Brewer J. (Eds.) *The AZ of social research*. London: Sage, 43-45.

Brothers, K. J., Krantz, P. J., & McClannahan, L. E. (1994). Office paper recycling: A function of container proximity. *Journal of Applied Behavior Analysis*, *27*(1), 153-160.

Buchanan, J. A., Christenson, A., Houlihan, D., & Ostrom, C. (2011). The role of behavior analysis in the rehabilitation of persons with dementia. *Behavior therapy*, *42*(1), 9-21.

Buckley, K. W. (1989). *Mechanical man: John Broadus Watson and the beginnings of behaviorism*. New York: Guilford Press.

Burrell, G., & Morgan, G. (1994). *Sociological paradigms and organisational analysis*. London: Heinemann.

Buse, C.E., (2010). E-scaping the ageing body? Computer technologies and embodiment in later life. *Ageing and Society* 30(6), 987–1009.

Call, N.A., Wacker, D.P., Ringdahl, J.E., Boelter, E.W., (2005). Combined Antecedent Variables as Motivating operations within Functional Analyses. *Journal of Applied Behavior Analysis* 38(3), 385–389.

Carpenter, B. D., & Buday, S. (2007). Computer use among older adults in a naturally occurring retirement community. *Computers in Human Behavior*, *23*(6), 3012-3024.

Carroll, B.A., Ahuvia, A.C., (2006). Some antecedents and outcomes of brand love. *Marketing Letter*s 17(2), 79–89.

Carstensen, L.L., (1992). Social and emotional patterns in adulthood: support for socioemotional selectivity theory. *Psychology and aging* 7(3), 331.

Carstensen, L. L. (1995). Evidence for a life-span theory of socioemotional selectivity. *Current directions in psychological science*, *4*(5), 151-156.

Carter, S. L., (2010). *The Social Validity Manual: A Guide to Subjective Evaluation of Behavior Interventions in Applied Behavior Analysis.* Oxford: Elsevier

Cattan, M. (2002). *Supporting older people to overcome social isolation and loneliness*. London: Help the Aged.

Cattan, M., Kime, N., & Bagnall, A. M. (2011). The use of telephone befriending in low level support for socially isolated older people–an evaluation. *Health & social care in the community*, *19*(2), 198-206.

Cattan, M., White, M., Bond, J., Learmouth, A., (2005). Preventing social isolation and loneliness among older people: a systematic review of health promotion interventions. *Ageing and Society* 25(1), 41–67.

Catterall, M., & Maclaran, P. (2001). Body talk: questioning the assumptions in cognitive age. *Psychology & Marketing*, *18*(10), 1117-1133.

Chakraborty, R., Vishik, C., & Rao, H. R. (2013). Privacy preserving actions of older adults on social media: Exploring the behavior of opting out of information sharing. *Decision Support Systems*, 55(4), 948-956.

Chamberlain, E., Evans, N., Neighbour, K., & Hughes, J. (2001). Equipment: Is it the answer? An audit of equipment provision. *The British Journal of Occupational Therapy*, *64*(12), 595-600.

Chevalier, A., Dommes, A., & Martins, D. (2013). The effects of ageing and website ergonomic quality on internet information searching. *Ageing and Society*, 33(6), 1009-1035.

Chomsky, N. (1959). A review of BF Skinner's Verbal Behavior. *Language*,*35*(1), 26-58.

Chung, M. C., & Hyland, M. E. (2011). *History and philosophy of psychology*. Oxford: John Wiley & Sons.

Clark, L. A., & Watson, D. (1995). Constructing validity: Basic issues in objective scale development. *Psychological assessment*, *7*(3), 309.

Clark-Carter, D. (1997). *Doing quantitative psychological research: From design to report*. Psychology Press/Erlbaum (UK) Taylor & Francis.

Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and psychological measurement*, *20*(1), 37-46.

Cohen, C.A., Colantonio, A., Vernich, L., (2002). Positive aspects of caregiving: rounding out the caregiver experience. *International Journal of Geriatric Psychiatry* 17(2), 184–188.

Coon, D., (1994). *Essentials of psychology: exploration and application.6th ed.* New York: West Publishing Company.

Cooper J.O, Heron T.E, Heward W.L., (2007). *Applied behavior analysis (2nd ed.)*. Upper Saddle River, NJ: Pearson

Cornejo, R., Favela, J., & Tentori, M. (2010). Ambient displays for integrating older adults into social networking sites. *Collaboration and Technology*, *Lecture Notes in Computer Science*, 6257, 321-336.

Cumming, E., Dean, L. R., Newell, D. S., & McCaffrey, I. (1960). Disengagement--A Tentative Theory of Aging. *Sociometry*, *23*(1), 23-35.

Czaja, S. J., & Barr, R. A. (1989). Technology and the everyday life of older adults. *The Annals of the American Academy of Political and Social Science*, 503, 127-137.

Czaja, S. J., Charness, N., Fisk, A. D., Hertzog, C., Nair, S. N., Rogers, W. A., & Sharit, J. (2006). Factors predicting the use of technology: findings from the Center for Research and Education on Aging and Technology Enhancement (CREATE). *Psychology and aging*, *21*(2), 333.

D'Autume, C., Musher-Eizenman, D., Viarme, F., Frelut, M-L. & Isnard, P., (2012). Eating behaviours and emotional symptoms in childhood obesity: A cross-sectional exploratory study using self-report questionnaires in 63 children and adolescents. *Archives de Pediatrie,* 19(8), 803-810.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management science*, *35*(8), 982-1003.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS quarterly*, 13(3), 319-340.

Dean, J., & Goodlad, R. (1998). *Supporting community participation: the role and impact of befriending*. Brighton: Pavillion.

Descubes, Y. & Truong, I. (2011). The diffusion of high-tech social innovations among senior consumers. *International days of statistics and economics, Sept 22-23: 136-143*

DeVries, J. E., Burnette, M. M., & Redmon, W. K. (1991). Aids prevention: improving nurses' compliance with glove wearing through performance feedback. *Journal of Applied Behavior Analysis*, *24*(4), 705-711.

Dixon, J., Manthorpe, J., Biggs, S., Mowlam, A., Tennant, R., Tinker, A., Mccreadie, C., (2009). Defining elder mistreatment: reflections on the United Kingdom Study of Abuse and Neglect of Older People. *Ageing and Society* 30(3), 403.

Dixon, M., Baker, J.C., Sadowski, K.A., (2011). Applying Skinner's analysis of verbal behavior to persons with dementia. *Behavior therapy* 42, 120–126.

Dobres, M. A. (2010). Archaeologies of technology. *Cambridge Journal of Economics*, *34*(1), 103-114.

Dommes, A., Chevalier, A., & Lia, S. (2011). The role of cognitive flexibility and vocabulary abilities of younger and older users in searching for information on the web. *Applied Cognitive Psychology*, *25*(5), 717-726.

Dosi, G., & Grazzi, M. (2010). On the nature of technologies: knowledge, procedures, artifacts and production inputs. *Cambridge Journal of Economics*,*34*(1), 173-184.

Drasgow, E., Halle, J. W., & Ostrosky, M. M. (1998). Effects of differential reinforcement on the generalization of a replacement mand in three children with severe language delays. *Journal of Applied Behavior Analysis*, *31*(3), 357-374.

Drennan, J., Treacy, M., Butler, M., Byrne, A., Fealy, G., Frazer, K., Irving, K., (2008). The experience of social and emotional loneliness among older people in Ireland. *Ageing and Society* 28(8), 1113.

Dykstra, P. A., Van Tilburg, T. G., & de Jong Gierveld, J. (2005). Changes in Older Adult Loneliness Results From a Seven-Year Longitudinal Study. *Research on aging*, *27*(6), 725-747.

Eastman, J.K., Iyer, R., (2005). The impact of cognitive age on Internet use of the elderly: an introduction to the public policy implications. *International Journal of Consumer Studies* 29(2), 125–136.

Edrisinha, C., O Reilly, M.F., Sigafoos, J., Lancioni, G.E., Machalicek, W., (2006). An Antecedent Perspective on Operant Contingencies. *European Journal of Behavior Analysis* 7(2), 129.

Edrisinha, C., O'Reilly, M., Sigafoos, J., Lancioni, G., & Choi, H. Y. (2011). Influence of motivating operations and discriminative stimuli on challenging behavior maintained by positive reinforcement. *Research in developmental disabilities*, *32*(2), 836-845.

Engelman, K. K., Altus, D. E., Mosier, M. C., & Mathews, R. M. (2003). Brief training to promote the use of less intrusive prompts by nursing assistants in a dementia care unit. *Journal of Applied Behavior Analysis*, *36*(1), 129-132.

Eysenck, H. J. (2004). *Decline and fall of the Freudian empire*. New Brunswick, New Jersey: Transaction Publishers.

Fagerstrøm, A., (2010). The Motivating Effect of Antecedent Stimuli on the Web Shop: A Conjoint Analysis of the Impact of Antecedent Stimuli at the Point of Online Purchase. *Journal of Organizational Behavior Management* 30(2), 199–220.

Fagerstrøm, A., Foxall, G.R., Arntzen, E., (2010). Implications of Motivating Operations for the Functional Analysis of Consumer Choice. *Journal of Organizational Behavior Management* 30(2), 110–126.

Fagerstrøm, A., & Arntzen, E., (2013). On Motivating Operations at the Point of Online Purchase Setting. *Psychological Record,* 63(2), 333–344.

Farnsworth, J., Boon, B., (2010). Analysing group dynamics within the focus group. *Qualitative Research* 10(5), 605–624.

Faulkner, P., Lawson, C., & Runde, J. (2010). Theorising technology. *Cambridge journal of economics*, *34*(1), 1-16.

Feenberg, A. (2010). Marxism and the critique of social rationality: from surplus value to the politics of technology. *Cambridge journal of economics*, *34*(1), 37-49.

Ffytche, M. (2011). Book review: Angus Nicholls and Martin Liebscher (eds) Thinking the Unconscious: Nineteenth-Century German Thought. Cambridge: Cambridge University Press, 2010. *History of the Human Sciences,* 24(3), 133-137.

Fichman, R. G., & Kemerer, C. F. (1993). Toward a Theory of the Adoption and Diffusion of Software Process Innovations. *IFIP Working Conference on Diffusion, Transfer and Implementation of Information Technology*. Pittsburg, PA, 11-13 October, pp. 23-30.

Field, A. P., (2013). *Discovering statistics using IBM SPSS statistics: and sex and drugs and rock 'n' roll.* London: Sage.

Fields, L., Travis, R., Roy, D., Yadlovker, E., Aguiar-Rocha, L. D., & Sturmey, P. (2009). Equivalence class formation: A method for teaching statistical interactions. *Journal of Applied Behavior Analysis*, *42*(3), 575-593.

Findlay, R. A. (2003). Interventions to reduce social isolation amongst older people: where is the evidence?. *Ageing and Society*, *23*(5), 647-658.

Fisher, S., & Greenberg, R. P. (1996). *Freud scientifically reappraised: Testing the theories and therapy*. New York: John Wiley & Sons.

Flynn, K. E., Smith, M. A., & Freese, J. (2006). When do older adults turn to the internet for health information? Findings from the Wisconsin Longitudinal Study. *Journal of General Internal Medicine*, *21*(12), 1295-1301.

Foxall, G.R., (1992). The consumer situation: An integrative model for research in marketing. *Journal of Marketing Management* 8(4), 383–404.

Foxall, G. R. (1993). A behaviourist perspective on purchase and consumption. *European Journal of Marketing*, *27*(8), 7-16.

Foxall, G.R., (1994). Behavior analysis and consumer psychology. *Journal of Economic Psychology* 15(1), 5–91.

Foxall, G.R., (1995). Science and interpretation in consumer research: a radical behaviourist perspective. *European Journal of Marketing* 29(9), 3–99.

Foxall, G.R., (1998). Radical behaviorist interpretation: Generating and evaluating an account of consumer behavior. *The Behavior Analyst* 21(2), 321-354.

Foxall, G. R. (1999). Putting consumer behaviour in its place: The Behavioural Perspective Model research programme. *International Journal of Management Reviews*, *1*(2), 133-158.

Foxall, G. R. (2005). *Understanding consumer choice*. London, New York: Palgrave Macmillan.

Foxall, G.R., (2007a). Explaining consumer choice: Coming to terms with intentionality. *Behavioural Processes* 75(2), 129–145.

Foxall, G.R., (2007b). Intentional behaviorism. *Behavior and Philosophy,* 35, 1–55.

Foxall, G. R. (2010a). *Interpreting consumer choice: The behavioral perspective model* (Vol. 10). Abingdon: Taylor & Francis.

Foxall, G.R., (2010b). Accounting for consumer choice: Inter-temporal decision making in behavioural perspective. *Marketing Theory* 10(4), 315–345.

Foxall, G.R., Castro, J.O., James, V.K., Yani-de-Soriano, M.M., Sigurdsson, V., (2006). Consumer behavior analysis and social marketing: The case of environmental conservation. *Behavior and Social Issues* 15(1), 101–124.

Foxall, G. R., & Greenley, G. E. (2000). Predicting and explaining responses to consumer environments: an empirical test and theoretical extension of the behavioural perspective model. *The Service Industries Journal*, *20*(2), 39-63.

Foxall, G. R., & James, V. K. (2009). The style/involvement model of consumer innovation, in Rickards, T., Runco, M. A. & Moger, S. (eds.) *The Routledge companion to creativity*, Oxford, UK: Routledge, 71-87.

Foxall, G.R., Oliveira-Castro, J.M., (2009). Intentional consequences of self-instruction. *Behavior and Philosophy, 37(1),* 87–104.

Foxall, G.R., Oliveira-Castro, J.M., James, V.K., Schrezenmaier, T.C., (2007). *The behavioral economics of brand choice*. Basingstoke: Palgrave Macmillan.

Foxall, G.R., Oliveira-Castro, J.M., James, V.K., Schrezenmaier, T.C., (2011). Consumer behaviour analysis and the behavioural perspective model. *Management Online Review (MORE)*.

Foxall, G.R., Yani-de-Soriano, M.M., (2005). Situational influences on consumers' attitudes and behavior. *Journal of Business Research* 58(4), 518–525.

Freeman, D., & Freeman, J. (2012). *Anxiety: a very short introduction* (Vol. 318). Oxford University Press.

Freud, A. (2011). *Normality and pathology in childhood: Assessments of development*. London: Karnac Books.

Freud, S. (1955). Analysis of a phobia in a five-year-old boy. In J. Strachey (Ed. & Trans.), *The standard edition of the complete psychological works of Sigmund Freud* (Vol. 10), London: Hogarth (Original work published 1909), 3-149.

Freund, A. M. (2008). Successful aging as management of resources: The role of selection, optimization, and compensation. *Research in Human Development*, *5*(2), 94-106.

Fridlund, A. J., Beck, H. P., Goldie, W. D., & Irons, G. (2012). Little Albert: A neurologically impaired child. *History of psychology*, *15*(4), 302-327.

Frolov, Y.P., (1938). *Pavlov and his school: the theory of conditioned reflexes.* London: K. Paul, Trench, Truebner & Co., ltd.

Frost, L., & Bondy, A. (2006). A common language: Using BF Skinner's verbal behavior for assessment and treatment of communication disabilities in SLP-ABA. *The Journal of Speech-Language Pathology and Applied Behavior Analysis*, *1*(2), 103-109.

Fung, H. H., Carstensen, L. L., & Lang, F. R. (2001). Age-related patterns in social networks among European Americans and African Americans: Implications for socioemotional selectivity across the life span. *International Journal of Aging and Human Development*, *52*(3), 185-206.

Gallagher-Thompson, D., Steffen, A. M., & Thompson, L. W. (Eds.). (2008).*Handbook of behavioral and cognitive therapies with older adults*. New York: Springer.

Gaul, S., Ziefle, M., (2009). Smart home technologies: insights into generation-specific acceptance motives, in: *HCI and Usability for e-Inclusion*. Springer, pp. 312–332.

Gaymu, J., Springer, S., (2010). Living conditions and life satisfaction of older Europeans living alone: a gender and cross-country analysis. *Ageing and Society* 30(7), 1153–1175.

Gelfand, T., & Kerr, J. (Eds.). (2013). *Freud and the History of Psychoanalysis*. London: Routledge.

Gobbens, R. J. J., Luijkx, K. G., Wijnen-Sponselee, M. T., & Schols, J. M. G. A. (2010). Towards an integral conceptual model of frailty. *The journal of nutrition, health & aging*, *14*(3), 175-181.

Gobbens, R. J., & van Assen, M. A. (2012). Frailty and its prediction of disability and health care utilization: The added value of interviews and physical measures following a self-report questionnaire. *Archives of Gerontology and Geriatrics*, *55*(2), 369-379.

Gomez, R. E. (2012). *The evolving emotional experience with portable interactive devices*. Ph.D. Thesis, Queensland University of Technology.

Gomez, R.E., Popovic, V., Blackler, A.L., (2008). Emotional interactions with portable devices in everyday contexts. *Diversity and Innovation: Design Theme Postgraduate Student Conference,* Queensland University of Technology, Brisbane, 10th September, 7-23.

Goodwin, J. C., (1999). *A History of Modern Psychology*. New York: John Wiley & Sons, Inc.

Gray, A., (2008). The social capital of older people. *Ageing and Society* 29(1), 5-31.

Greene, J., & d'Oliveira, M. (2005). *Learning to use statistical tests in psychology*. New York: McGraw-Hill International.

Grow, L. L., & Kodak, T. (2010). Recent Research On Emergent Verbal Behavior: Clinical Applications And Future Directions. *Journal of applied behavior analysis*, *43*(4), 775-778.

Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. *Handbook of qualitative research*, *2*, 163-194.

Hagerty, B. M., & Patusky, K. (1995). Developing a measure of sense of belonging. *Nursing Research*, *44*(1), 9-13.

Halkier, B., (2010). Focus groups as social enactments: integrating interaction and content in the analysis of focus group data. *Qualitative Research,* 10(1), 71–89.

Hankin, B. L., & Abela, J. R. (2011). Nonsuicidal self-injury in adolescence: Prospective rates and risk factors in a 2 ½year longitudinal study. *Psychiatry research*, *186*(1), 65-70.

Hardill, I., & Olphert, C. W. (2012). Staying connected: Exploring mobile phone use amongst older adults in the UK. *Geoforum*, *43*(6), 1306-1312.

Hardy, G. E., Barkham, M., Shapiro, D. A., Stiles, W. B., Rees, A., & Reynolds, S. (1995). Impact of Cluster C personality disorders on outcomes of contrasting brief psychotherapies for depression. *Journal of Consulting and Clinical Psychology*, *63*(6), 997.

Harrison, J. & Ryan, J., (2010). Musical taste and ageing. *Ageing and Society* 30(4), 649–669.

Hartke, R. J., Prohaska, T. R., & Furner, S. E. (1998). Older Adults and Assistive Devices Use, Multiple-Device Use, and Need. *Journal of Aging and Health*, *10*(1), 99-116.

Hedman, E., Ljótsson, B., Rück, C., Furmark, T., Carlbring, P., Lindefors, N., & Andersson, G. (2010). Internet administration of self-report measures commonly used in research on social anxiety disorder: A psychometric evaluation. *Computers in Human Behavior*, *26*(4), 736-740.

Hedman, A., Nygård, L., Almkvist, O., & Kottorp, A. (2013). Patterns of functioning in older adults with mild cognitive impairment: a two-year study focusing on everyday technology use. *Aging & mental health*, 17(6), 679-688.

Heerink, M., Krose, B., Evers, V., Wielinga, B., (2006). The influence of a robot's social abilities on acceptance by elderly users, in: *Robot and Human Interactive Communication, 2006. ROMAN 2006. The 15th IEEE International Symposium* On. pp. 521–526.

Heerink, M., Krose B.., Evers, V., Wielinga, B., (2008a). The influence of social presence on acceptance of a companion robot by older people. *Journal of Physical Agents* 2(2), 33–40.

Heerink, M., Kröse, B., Wielinga, B., Evers, V., (2008b). Enjoyment intention to use and actual use of a conversational robot by elderly people, in: *Proceedings of the 3rd ACM/IEEE International Conference on Human Robot Interaction*. pp. 113–120.

Herbert, J. D. Sharp, l. R., & Gaudiano, BA (2002). Separating fact from fiction in the etiology and treatment of autism: A scientific review of the Evidence. *Journal of Scientific Mental Health*, *1(1)*, 25-45.

Herrnstein, R. J. (1961). Relative and absolute strength of response as a function of frequency of reinforcement1, 2.*Journal of the experimental analysis of behavior*, *4*(3), 267-272.

Herrnstein, R. J. (1970). On the law of effect 1. *Journal of the experimental analysis of behavior*, *13*(2), 243-266.

Heylen, L., (2010). The older, the lonelier? Risk factors for social loneliness in old age. *Ageing and Society* 30(7), 1177–1196.

Hileman, J. W., Lackey, N. R., & Hassanein, R. S. (1992). Identifying the needs of home caregivers of patients with cancer. In *Oncology Nursing Forum*. 19(5): 771-777.

Hill, R.D., (2011). A positive aging framework for guiding geropsychology interventions. *Behavior therapy,* 42(1), 66–77.

Hirsch, T., Forlizzi, J., Hyder, E., Goetz, J., Kurtz, C., Stroback, J., (2000). The ELDer project: social, emotional, and environmental factors in the design of eldercare technologies, in: *Proceedings on the 2000 Conference on Universal Usability*. pp. 72–79.

Hoffman, L. (2010). One hundred years after Sigmund Freud's lectures in America: towards an integration of psychoanalytic theories and techniques within psychiatry. *History of Psychiatry*, *21*(4), 455-470.

Holden, M. T., & Lynch, P. (2004). Choosing the appropriate methodology: understanding research philosophy. *The marketing review*, *4*(4), 397-409.

Holden, R. J., & Karsh, B. T. (2010). The technology acceptance model: its past and its future in health care. *Journal of biomedical informatics*, *43*(1), 159-172.

Homes, S., Nugent, B.C., Augusto, J.C., (2006). Human-robot user studies in eldercare: Lessons learned, in: Smart Homes And Beyond: *Icost 2006, 4th International Conference on Smart Homes and Health Telematics*. p. 31.

Horne, P. J., & Lowe, C. F. (1993). Determinants of human performance on concurrent schedules. *Journal of the Experimental Analysis of Behavior*, *59*(1), 29-60.

Hsu, W. C., Bath, P. A., Large, S., & Williams, S. (2011). Older people's use of NHS Direct. *Age and ageing*, *40*(3), 335-340.

Huitink, C., Embregts, P. J. C. M., Veerman, J. W., & Verhoeven, L. (2011). Staff behavior toward children and adolescents in a residential facility: A self-report questionnaire. *Research in developmental disabilities*, *32*(6), 2790-2796.

Hydén, L.-C., Bülow, P., (2003). Who's talking: drawing conclusions from focus groups—some methodological considerations. *International Journal of Social Research Methodology* 6(4), 305–321.

Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1982). Toward a functional analysis of self-injury. *Analysis and intervention in developmental disabilities*, *2*(1), 3-20.

Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1994). Toward a functional analysis of self-injury. *Journal of applied behavior analysis*, *27*(2), 197-209.

Joe, J., & Demiris, G. (2013). Older adults and mobile phones for health: A review. *Journal of biomedical informatics*, *46*(5), 947-954.

Jones, S., & Fox, S. (2009). *Generations online in 2009.* Washington, DC: Pew Internet and American Life Project.

Jones, M., & Marsden, G. (2006). *Mobile interaction design*. Chichester: John Wiley & Sons.

Jones, D.A., Peters, T.J., (1992). Caring for elderly dependants: effects on the carers' quality of life. *Age and ageing* 21(6), 421–428.

Jylha, M. (2004). Old age and loneliness: cross-sectional and longitudinal analyses in the Tampere Longitudinal Study on Aging. *Canadian journal on aging*, *23(2)*, 157-168.

Kahng, S., Iwata, B. A., & Lewin, A. B. (2002). Behavioral treatment of self-injury, 1964 to 2000. *Journal Information*, *107*(3), 212-221.

Kalba, K. (2008). The adoption of mobile phones in emerging markets: Global diffusion and the rural challenge. *International Journal of Communication*, *2*, 631-661.

Karavidas, M., Lim, N. K., & Katsikas, S. L. (2005). The effects of computers on older adult users. *Computers in Human Behavior*, *21*(5), 697-711.

Kenten, C. (2010). Narrating oneself: reflections on the use of solicited diaries with diary interviews. In *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research*, 11(2), Art. 16.

Khantzian, E. J. (2012). Reflections on treating addictive disorders: a psychodynamic perspective. *The American Journal on Addictions*, *21*(3), 274-279.

Kharicha, K., Iliffe, S., Harari, D., Swift, C., Gillmann, G., & Stuck, A. E. (2007). Health risk appraisal in older people 1: are older people living alone an 'at-risk'group?. *The British Journal of General Practice*, *57*(537), 271-276.

Khvorostianov, N., Elias, N., & Nimrod, G. (2012). 'Without it I am nothing': The internet in the lives of older immigrants. *new media & society*, *14*(4), 583-599.

Kim, C. K., Han, D., & Park, S. B. (2001). The effect of brand personality and brand identification on brand loyalty: Applying the theory of social identification. *Japanese Psychological Research*, *43*(4), 195-206.

Kirkevold, M., Moyle, W., Wilkinson, C., Meyer, J., Hauge, S., (2013). Facing the challenge of adapting to a life "alone"in old age: the influence of losses. *Journal of Advanced Nursing* 69(2), 394–403.

Kirton, M. (1976). Adaptors and innovators: A description and measure. *Journal of applied psychology*, *61*(5), 622-629.

Kleine, S. S. & Baker, S. M. (2004). An Integrative Review of Material Possession Attachment. *Academy of marketing Science Review, ABI/INFORM Global,* 1-39.

Kohlbacher, F., Hang, C.C., (2007). Disruptive innovations and the greying market, in: *Industrial Engineering and Engineering Management, 2007 IEEE International Conference*, Singapore, 2-4th December, 1915–1919.

Krause, N., (2005). Traumatic events and meaning in life: exploring variations in three age cohorts. *Ageing and Society* 25(4), 501–524.

Kroes, P. (2010). Engineering and the dual nature of technical artefacts. *Cambridge journal of economics*, *34*(1), 51-62.

Kuhn, S. A. C., Lerman, D. C., Vorndran, C. M., Addison, L. (2006). Analysis of factors that affect responding in a two-response chain in children with developmental disabilities. *Journal of applied behavior analysis*, *39*(3), 263-280.

Lam, J. C., & Lee, M. K. (2006). Digital inclusiveness--Longitudinal study of Internet adoption by older adults. *Journal of Management Information Systems*,*22*(4), 177-206.

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, 33(1), 159-174.

Langthorne, P., McGill, P., (2009). A Tutorial on the Concept of the Motivating Operation and its Importance to Application. *Behavior analysis in practice* 2(2), 22-31.

LaPlante, M. P., & Kaye, H. S. (2010). Demographics and trends in wheeled mobility equipment use and accessibility in the community. *Assistive Technology*, *22*(1), 3-17.

Laraway, S., Snycerski, S., Michael, J., Poling, A., (2003). Motivating operations and terms to describe them: Some further refinements. *Journal of Applied Behavior Analysis* 36(3), 407–414.

Laukkanen, T., Sinkkonen, S., Kivijärvi, M., Laukkanen, P., (2007). Innovation resistance among mature consumers. *Journal of Consumer Marketing* 24(7), 419–427.

Lee, Y. S. (2007). *Older Adults' user Experiences With Mobile Phones: Identification Of User Clusters And User Requirements* . Doctoral dissertation, Virginia Polytechnic Institute and State University.

Lee, Y. C. (2011). m-Brand loyalty and post-adoption variations for the mobile data services: gender differences. *Computers in Human Behavior*, *27*(6), 2364-2371.

Lee, S. G., Trimi, S., & Kim, C. (2013). Innovation and imitation effects' dynamics in technology adoption. *Industrial Management & Data Systems*,*113*(6), 772-799.

Legris, P., Ingham, J., Collerette, P., (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information & management* 40(3), 191–204.

Leigland, S., (2010). Functions of Research in Radical Behaviorism for the Further Development of Behavior Analysis. *The Behavior Analyst* 33(2), 207-222.

Lenhart, A. (2009). *Adults and social network websites*. Washington , DC : Pew Internet & American Life Project

Leventhal, R. C. (1997). Aging consumers and their effects on the marketplace. *Journal of Consumer Marketing*, *14*(4), 276-281.

Liberman, R. P., & Eckman, T. (1981). Behavior therapy vs insight-oriented therapy for repeated suicide attempters. *Archives of General Psychiatry*, *38*(10), 1126-1130.

Lieberman, E. J., & Kramer, R. (Eds.). (2012). *The letters of Sigmund Freud and Otto Rank: Inside psychoanalysis*.Baltimore: Johns Hopkins University Press.

Lizardo, O. (2006). How cultural tastes shape personal networks. *American Sociological Review*, *71*(5), 778-807.

Lunsford, D.A., Burnett, M.S., (1992). Marketing product innovations to the elderly: understanding the barriers to adoption. *Journal of Consumer Marketing* 9(4), 53–62.

Mallenius, S., Rossi, M., & Tuunainen, V. K. (2007). Factors affecting the adoption and use of mobile devices and services by elderly people–results from a pilot study. In *6th Annual Global Mobility Roundtable*, Los Angeles, USA, 31st May – 2nd June.

Marcellini, F., Mollenkopf, H., Spazzafumo, L., & Ruoppila, I. (2000). Acceptance and use of technological solutions by the elderly in the outdoor environment: findings from a European survey. *Zeitschrift für Gerontologie und Geriatrie*, *33*(3), 169.

Mata, R., & Nunes, L. (2010). When less is enough: Cognitive aging, information search, and decision quality in consumer choice. *Psychology and aging*, *25*(2), 289-298.

Mathur, A., Sherman, E., & Schiffman, L. G. (1998). Opportunities for marketing travel services to new-age elderly. *Journal of Services Marketing*, *12*(4), 265-277.

May, E., Garrett, R., Ballantyne, A., (2010). Being mobile: electric mobility-scooters and their use by older people. *Ageing and Society* 30(7), 1219–1237.

McCloskey, D. W. (2006). The importance of ease of use, usefulness, and trust to online consumers: an examination of the technology acceptance model with older customers. *Journal of Organizational and End User Computing (JOEUC)*,*18*(3), 47-65.

McCreadie, C., Tinker, A., (2005). The acceptability of assistive technology to older people. *Ageing and Society* 25(1), 91–110.

McGill, P., (1999). Establishing operations: Implications for the assessment, treatment, and prevention of problem behavior. *Journal of Applied Behavior Analysis* 32(3), 393–418.

Mechanic, D., (1999). The changing elderly population and future health care needs. *Journal of urban health* 76(1), 24–38.

Mehrabian, A. (1996). Pleasure-arousal-dominance: A general framework for describing and measuring individual differences in temperament. *Current Psychology*, *14*(4), 261-292.

Mehrabian, A., & Blum, J. S. (1996). Temperament and personality as functions of age. *The International Journal of Aging and Human Development*, *42*(4), 251-269.

Mehrabian, A., & Russell, J. A. (1974). *An approach to environmental psychology*. Cambridge, MA: MIT Press.

Meister, H., Lausberg, I., Kiessling, J., von Wedel, H., Walger, M., (2002). Identifying the needs of elderly, hearing-impaired persons: the importance and utility of hearing aid attributes. *European archives of oto-rhino-laryngology* 259(10), 531–534.

Melenhorst, A. S., & Bouwhuis, D. G. (2004). When do older adults consider the internet? An exploratory study of benefit perception. *Gerontechnology*, *3*(2), 89-101.

Merz, E.-M., Huxhold, O., (2010). Wellbeing depends on social relationship characteristics: comparing different types and providers of support to older adults. *Ageing and Society* 30(5), 843–857.

Metcalfe, J. S. (2010). Technology and economic theory. *Cambridge Journal of Economics*, *34*(1), 153-171.

Michael, J., (1982). Distinguishing between discriminative and motivational functions of stimuli. *Journal of the experimental analysis of behavior* 37(1), 149–155.

Michael, J. (1988). Establishing operations and the mand. *The Analysis of Verbal Behavior*, *6(1)*, 3-9.

Michael, J., (1993). Establishing operations. *The Behavior Analyst* 16(2), 191-206.

Michael, J. (2000). Implications and refinements of the establishing operation concept. *Journal of Applied Behavior Analysis*, *33*(4), 401-410.

Michael, J. L. (2004). *Concepts and principles of behavior analysis*. Western Michigan University, Association for Behavior Analysis International.

Millward, L. J. (2006). Focus Groups. In G. M. Breakwell & S. Hammond & S. Fife-Schaw & J. A. Chris (Eds.), *Research methods in psychology* (3 ed.). London: Sage Publications.

Mitchell, M. E., Lebow, J. R., Uribe, R., Grathouse, H., & Shoger, W. (2011). Internet use, happiness, social support and introversion: A more fine grained analysis of person variables and internet activity. *Computers in Human Behavior*, *27*(5), 1857-1861.

Mitzner, T. L., Boron, J. B., Fausset, C. B., Adams, A. E., Charness, N., Czaja, S. J., Dijkstra, K., Fisk, A. D., Rogers, W. A. & Sharit, J. (2010). Older adults talk technology: Technology usage and attitudes. *Computers in Human Behavior*, *26*(6), 1710-1721.

Möller, K., Pels, J., & Saren, M. (2009). The marketing theory or theories into marketing? Plurality of research traditions and paradigms. In Maclaren, P., Saren, M., Stern, B. & Tadajewski, M. (Eds.), *The SAGE Handbook of Marketing Theory*, London: Sage Publications, 151-174.

Moody, H. R. (2006). *Aging: Concepts and controversies*. Pine Forge Press.

Moore, J. (2010). Behaviorism and the stages of scientific activity. *The Behavior Analyst*, *33*(1), 47-63.

Moore, J. (2011). SKETCH-Behaviorism. *Psychological Record*, *61*(3), 449.

Morgan, P., (2010). Towards a developmental theory of place attachment. *Journal of Environmental Psychology* 30(1), 11–22.

Morris, E. K., Todd, J. T., Midgley, B. D., Schneider S. M. & Johnson, L. M. (1990). The History of Behaviour Analsysis: Some Historiography and a Bibliography. *The Behavior Analyst* 13(2): 131-158.

Morris, A., Goodman, J., & Brading, H. (2007). Internet use and non-use: views of older users. *Universal Access in the Information Society*, *6*(1), 43-57.

Morris, M. G., & Venkatesh, V. (2000). Age differences in technology adoption decisions: Implications for a changing work force. *Personnel psychology*, *53*(2), 375-403.

Morsella, E., & Bargh, J. A. (2011). Unconscious action tendencies: Sources of 'un-integrated' action. In Decety, J. & Cacioppo, J. (Eds.), *The handbook of social neuroscience*, New York: Oxford, 335-347.

Mortenson, W. B., Demers, L., Fuhrer, M. J., Jutai, J. W., Lenker, J., & DeRuyter, F. (2012). How assistive technology use by individuals with disabilities impacts their caregivers:

A systematic review of the research evidence. *American Journal of Physical Medicine & Rehabilitation*, *91*(11), 984-998.

Moschis, G.P., (2003). Marketing to older adults: an updated overview of present knowledge and practice. *Journal of Consumer Marketing* 20(6), 516–525.

Mugge, R., Schifferstein, H.N., Schoormans, J.P., (2010). Product attachment and satisfaction: understanding consumers' post-purchase behavior. *Journal of consumer Marketing* 27(3), 271–282.

Muir, N., (2004). *Motorised Scooters and Wheelchairs : A Review of the Issues Associated with their Use by Seniors and People with Disabilities*. Injury Control Council of Western Australia Inc., Perth, Western Australia.

Mukherjee, A., & Hoyer, W. D. (2001). The effect of novel attributes on product evaluation. *Journal of Consumer Research*, *28*(3), 462-472.

Nägle, S., & Schmidt, L. (2012). Computer acceptance of older adults. *Work: A Journal of Prevention, Assessment and Rehabilitation*, *41*, 3541-3548.

Ng, C.-h. (2008). Motivation among older adults in learning computer technologies: A grounded model. *Educational Gerontology*, 34(1), 1–14.

NHS: The Information Centre (2010) *Survey of Carers in Households 2009/10.* UK: The NHS Information Centre for Health and Social Care. Available at: <http://www.esds.ac.uk/doc/6768/mrdoc/pdf/6768_survey_of_carers_in_households_2009_10_england.pdf> [accessed 07 September 2011]

Nicholson, M. (2005). *Consumer psychology as the behavourist views it: an operant analysis of consumer channel choice*. Doctoral dissertation, University of Durham.

Nicholson, M., & Xiao, S. H. (2010a). On the evolutionary bases of consumer reinforcement. *Journal of Organizational Behavior Management*, *30*(2), 127-144.

Nimrod, G., & Kleiber, D. A. (2007). Reconsidering change and continuity in later life: Toward an innovation theory of successful aging. *The International Journal of Aging and Human Development*, *65*(1), 1-22.

Nord, W. R., & Peter, J. P. (1980). A behavior modification perspective on marketing. *The Journal of Marketing*, 44(2), 36-47.

Nygren, B., Norberg, A., & Lundman, B. (2007). Inner strength as disclosed in narratives of the oldest old. *Qualitative Health Research*, *17*(8), 1060-1073.

O'Donohue, W. (2013). Epistemology and Logical Positivism. In *Clinical Psychology and the Philosophy of Science*, New York: Springer International Publishing, 23-42.

O'Donohue, W. T., & Ferguson, K. E. (2001). *The psychology of BF Skinner*. London: Sage.

O'Reilly, M. F. (1999). Effects of presession attention on the frequency of attention-maintained behavior. *Journal of Applied Behavior Analysis*, *32*(3), 371-374.

O'Reilly, M.F., Edrisinha, C., Sigafoos, J., Lancioni, G., Andrews, A., (2006a). Isolating the evocative and abative effects of an establishing operation on challenging behavior. *Behavioral Interventions* 21(3), 195–204.

O'Reilly, M., Edrisinha, C., Sigafoos, J., Lancioni, G., Cannella, H., Machalicek, W., & Langthorne, P. (2007a). Manipulating the evocative and abative effects of an establishing operation: Influences on challenging behavior during classroom instruction. *Behavioral Interventions*, *22*(2), 137-145.

O'Reilly, M., Edrisinha, C., Sigafoos, J., Lancioni, G., Machalicek, W., & Antonucci, M. (2007b). The effects of presession attention on subsequent attention-extinction and alone conditions. *Journal of applied behavior analysis*, *40*(4), 731-735.

O'Reilly, M. F., Sigafoos, J., Edrisinha, C., Lancioni, G., Cannella, H., Choi, H. Y., & Barretto, A. (2006b). A preliminary examination of the evocative effects of the establishing operation. *Journal of Applied Behavior Analysis*, *39*(2), 239-242.

OECD (2013) *Annual population data from 1950 to 2012 when available by sex and five year age groups.* OECD Stat Database. Available at: <http://stats.oecd.org/OECDStat_Metadata/ShowMetadata.ashx?Dataset=POP_FIVE_HIST&ShowOnWeb=true&Lang=en> [accessed 10 January 2013]

Office for National Statistics, (2011). *Family Spending: A report on the 2010 Living Costs and Food Survey.* UK: Office for National Statistics. Available at: <http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-229759> [accessed 28 August 2012}

Office for National Statistics, (2012a). *2011 Census – Population and Household Estimates for England and Wales, March 2011.* UK: Office for National Statistics. Available at: <http://www.ons.gov.uk/ons/rel/census/2011-census/population-and-household-estimates-for-england-and-wales/stb-e-w.html> [accessed 22 August 2012]

Office for National Statistics, (2012b). *Internet Access – Households and Individuals, 2012.* UK: Office for National Statistics. Available at: <http://www.ons.gov.uk/ons/rel/rdit2/internet-access---households-and-individuals/2012/stb-internet-access--households-and-individuals--2012.html> [accessed 28 August 2012]

Oliver D, (2010). Doddery but a little too dear? – A defence of improving care. [Online]. Available at <http://www.battleofideas.org.uk/index.php/2010/battles/5401> [Accessed 29 November 2013]

Olson, K. E., O'Brien, M. A., Rogers, W. A., & Charness, N. (2011). Diffusion of technology: Frequency of use for younger and older adults. *Ageing international*, *36*(1), 123-145.

Orimo, H., Ito, H., Suzuki, T., Araki, A., Hosoi, T., Sawabe, M., (2006). Reviewing the definition of "elderly". *Geriatrics and Gerontology International* 6(3), 149–158.

Orlikowski, W. J. (2010). The sociomateriality of organisational life: considering technology in management research. *Cambridge Journal of Economics*, *34*(1), 125-141.

Ortega, J. V., Iwata, B. A., Nogales-Gonzalez, C., & Frades, B. (2012). Assessment of preference for edible and leisure items in individuals with dementia. *Journal of applied behaviour analysis*, *45*(4), 839-844.

Page, S., Keady, J., (2009). Sharing stories: a meta-ethnographic analysis of 12 autobiographies written by people with dementia between 1989 and 2007. *Ageing and Society* 30(3), 511-526.

Patterson, A. (2005). Processes, relationships, settings, products and consumers: the case for qualitative diary research. *Qualitative Market Research: An International Journal*, *8*(2), 142-156.

Pavlou, P.A., (2003). Consumer acceptance of electronic commerce: integrating trust and risk with the technology acceptance model. *International journal of electronic commerce* 7(3), 101–134.

Peacock, S. E., & Künemund, H. (2007). Senior citizens and Internet technology. *European journal of ageing*, *4*(4), 191-200.

Petursdottir, A.I., (2013). Editorial: Verbal Behavior and Motivating Operations. *The Analysis of verbal behavior* 29(1), 1-2.

Pineño, O. (2013). ArduiPod Box: A low-cost and open-source Skinner box using an iPod Touch and an Arduino microcontroller. *Behavior research methods*, 46(1), 196-205.

Poland, M. P., Nugent, C. D., Wang, H., & Chen, L. (2011). Pure random search for ambient sensor distribution optimisation in a smart home environment. *Technology and Health Care*, *19*(3), 137-160.

Pollack, M.E., Brown, L., Colbry, D., Orosz, C., Peintner, B., Ramakrishnan, S., Engberg, S., Matthews, J.T., Dunbar-Jacob, J., McCarthy, C.E., (2002). Pearl: A mobile robotic assistant for the elderly, in: *Workshop on Automation as a Caregiver: the role of Intelligent Technology in Elder Care (AAAI),* August, 85–91.

Popper, K. R. (1963). *Conjectures and refutations* (Vol. 28). London: Routledge & Kegan Paul.

Porock, D., Clissett, P., Harwood, R. H., & Gladman, J. R. (2013) Disruption, control and coping: responses of and to the person with dementia in hospital. *Ageing and Society*, 1-27.

Rachman, A. W. (2004). Beyond Neutrality: The Curative Function of the Analyst Self-Disclosure in the Psychoanalytic Situation. In Reppen, J., Tucker, J. & Schulman, M. A. (Eds) *Way beyond Freud: Postmodern psychoanalysis observed*, London: Open Gate Press, 218-237.

Ramanau, R., Hosein, A., & Jones, C., (2010). Learning and living technologies: a longitudinal study of first-year students' expectations and experiences in the use of ICT. In: *7th International Conference on Networked Learning*, 3-4 May, Aalborg, Denmark, 627–634.

Reker, G. T. (1997). Personal meaning, optimism, and choice: Existential predictors of depression in community and institutional elderly. *The Gerontologist*, *37*(6), 709-716.

Remenyi, D., Williams, B., Money, A., & Swartz, E. (2005). *Doing Research in Business and Management: An Introduction to Process and Method.* London: Sage Publications.

Renaud, K., Van Biljon, J., (2008). Predicting technology acceptance and adoption by the elderly: a qualitative study, in: *Proceedings of the 2008 Annual Research Conference of the South African Institute of Computer Scientists and Information Technologists on IT Research in Developing Countries: Riding the Wave of Technology*, 210–219.

Richter, J. G., Becker, A., Koch, T., Nixdorf, M., Willers, R., Monser, R., Schacher, B., Alten, R., Specker, C. & Schneider, M. (2008). Self-assessments of patients via Tablet PC in routine patient care: comparison with standardised paper questionnaires. *Annals of the rheumatic diseases*, *67*(12), 1739-1741.

Rogers, E. M. (2003). *Diffusion of innovations - 5th Edition.* New York: Simon and Schuster.

Rosenberg, M. (1989). *Society and the adolescent self-image (rev)*. Middleton, CT: Wesleyan University Press.

Rosenthal, R. L. (2008). Older computer-literate women: Their motivations, obstacles, and paths to success. *Educational Gerontology*, *34*(7), 610-626.

Rothschild, M. L., & Gaidis, W. C. (1981). Behavioral learning theory: its relevance to marketing and promotions. *The Journal of Marketing*, 45(2), 70-78.

Royal College of Psychiatrists, (RCP), (2005). *Who cares wins*. London: RCP.

Rowe, J. W., & Kahn, R. L. (1987). Human aging: usual and successful. *Science*, *237*(4811), 143-149.

Rowe, J. W., & Kahn, R. L. (1998). Successful aging: The MacArthur foundation study. *New York: Pantheon*.

Saeed, K. A., & Abdinnour, S. (2011). Understanding post-adoption IS usage stages: an empirical assessment of self-service information systems. *Information Systems Journal*, 23(3), 219-244.

Sallai, G. (2012). Defining infocommunications and related terms. *Acta Polytechnica Hungarica*, *9*(6), 5-15.

Savikko, N., Routasalo, P., Tilvis, R. S., Strandberg, T. E., & Pitkälä, K. H. (2005). Predictors and subjective causes of loneliness in an aged population. *Archives of gerontology and geriatrics*, *41*(3): 223-233.

Schatzberg, E. (2006). Technik comes to America: Changing meanings of technology before 1930. *Technology and Culture*, *47*(3), 486-512.

Scheithauer, M. C., & Tiger, J. H. (2012). A computer-based program to teach braille reading to sighted individuals. *Journal of applied behavior analysis*, *45*(2), 315-327.

Schepers, J., Wetzels, M., (2007). A meta-analysis of the technology acceptance model: Investigating subjective norm and moderation effects. *Information & Management* 44(1), 90–103.

Scherer, M. J., & Glueckauf, R. (2005). Assessing the Benefits of Assistive Technologies for Activities and Participation. *Rehabilitation Psychology*, *50*(2), 132-144.

Scherger, S., Nazroo, J., Higgs, P., (2010). Leisure activities and retirement: do structures of inequality change in old age? *Ageing and Society* 31(1), 146–172.

Schifferstein, H.N., Zwartkruis-Pelgrim, E.P., (2008). Consumer-product attachment: Measurement and design implications. *International Journal of Design* 2(3), 1–13.

Schiffman, L.G., (1972). Perceived risk in new product trial by elderly consumers. *Journal of Marketing Research* 9(1), 106–108.

Schiffman, L. G., & Sherman, E. (1991). Value orientations of new-age elderly: the coming of an ageless market. *Journal of business research*, *22*(2), 187-194.

Schlinger, H. D. (2008). Listening is behaving verbally. *The Behavior Analyst*,*31*(2), 145-161.

Schlinger Jr, H. D. (2008). The long good-bye: Why BF Skinner's Verbal Behavior is alive and well on the 50th anniversary of its publication. *The Psychological Record*, *58*(3), 1.

Schmit, S., Chauchard, E., Chabrol, H., & Sejourne, N. (2011). [Evaluation of the characteristics of addiction to online video games among adolescents and young adults]. *L'Encephale*, *37*(3), 217-223.

Schnittker, J. (2007). Look (Closely) at All the Lonely People Age and the Social Psychology of Social Support. *Journal of Aging and Health*, *19*(4), 659-682.

Schreier, M. (2012). *Qualitative content analysis in practice*. London: Sage Publications.

Schulz, R., Beach, S.R., (1999). Caregiving as a risk factor for mortality. *JAMA: the journal of the American Medical Association* 282(23), 2215–2219.

Schulz, R., Newsom, J., Mittelmark, M., Burton, L., Hirsch, C., Jackson, S., (1997). Health effects of caregiving: the caregiver health effects study: an ancillary study of the Cardiovascular Health Study. *Annals of Behavioral Medicine* 19(2), 110–116.

Selwyn, N. (2004). The information aged: A qualitative study of older adults' use of information and communications technology. *Journal of Aging Studies*, *18*(4), 369-384.

Selwyn, N., Gorard, S., Furlong, J., & Madden, L. (2003). Older adults' use of information and communications technology in everyday life. *Ageing and Society*, *23*(5), 561-582.

Seth, A.K., (1999). Evolving behavioural choice: An investigation into Herrnstein's matching law, in: *Advances in Artificial Life*. Springer, pp. 225–235.

Shamdasani, S. (2012). *CG Jung: A biography in books*. New York: W.W. Norton & Co.

Shaver, P.R., Mikulincer, M., (2005). Attachment theory and research: Resurrection of the psychodynamic approach to personality. *Journal of Research in Personality* 39, 22–45.

Shedler, J. (2010). The efficacy of psychodynamic psychotherapy. *American Psychologist*, *65*(2), 98-109.

Sherman, E., Schiffman, L.G., Mathur, A., (2001). The influence of gender on the new-age elderly's consumption orientation. *Psychology & Marketing* 18(10), 1073–1089.

Sidman, M. (2011). Can an understanding of basic research facilitate the effectiveness of practitioners? Reflections and personal perspectives. *Journal of applied behavior analysis*, *44*(4), 973-991.

Skinner, B.F., (1953). *Science and human behavior*. London: Collier-Macmillan.

Skinner, B.F., (1957). *Verbal behavior*. New York: Appleton-Century-Crofts.

Skinner, B.F., (1969). *Contingencies of reinforcement: a theoretical analysis.* Englewood Cliffs, N.J.: Prentice-Hall.

Skinner, B.F., (1974). *About behaviourism.* London: Cape.

Skinner, B.F., (1980). The experimental analysis of operant behaviour: A history. In Rieber, R.W. & Salzinger, K. (Eds.), *Pyschology: Theoretical-historical perspectives*. New York: Academic Press, 191-202.

Skinner, B. F. (1984). Coming to terms with private events. *Behavioral and Brain Sciences*, *7*(04), 572-581.

Slegers, K., Van Boxtel, M.P.J., Jolles, J., (2009). The efficiency of using everyday technological devices by older adults: the role of cognitive functions. *Ageing and Society* 29(2), 309-325.

Smith, L.D., (1986). *Behaviourism and logial positivism: a reassessment of the alliance.* Stanford: Stanford University Press.

Smith, R.G., Iwata, B.A., (1997). Antecedent influences on behavior disorders. *Journal of Applied Behavior Analysis* 30(2), 343–375.

Smith, R.G., Iwata, B.A., Goh, H.-L., Shore, B.A., (1995). Analysis of establishing operations for self-injury maintained by escape. *Journal of Applied Behavior Analysis* 28(4), 515–535.

Staats, A. W. (1975). Social behaviorism. Oxford, England: Dorsey.

Steed, L., Boldy, D., Grenade, L., & Iredell, H. (2007). The demographics of loneliness among older people in Perth, Western Australia. *Australasian Journal on Ageing*, *26*(2), 81-86.

Stelmaszewska, H., Fields, B., & Blandford, A. (2004). Conceptualising user hedonic experience. *Proc ECCE-12, living and working with technology. EACE, York*, 83-89.

Stelmaszewska, H., Fields, B., & Blandford, A. (2006). Camera phone use in social context. In *Proceedings of HCI* (Vol. 2).

Stelmaszewska, H., Fields, B., & Blandford, A. (2008). The roles of time, place, value and relationships in collocated photo sharing with camera phones. In *Proceedings of the 22nd*

British HCI Group Annual Conference on People and Computers: Culture, Creativity, Interaction-Volume 1, British Computer Society, Liverpool, UK, 1-5 September, 141-150.

Steptoe, A., Demakakos, P., de Oliveira, C., (2012). 4. The Psychological Well-Being, Health and Functioning of Older People in England. In: Banks, J and Nazroo, J and Steptoe, A, (Eds.) *The dynamics of ageing: Evidence from the English Longitudinal Study of Ageing 2002-10 (Wave 5).* The Institute for Fiscal Studies: London, 98 - 182.

Stewart-Steinberg, S. (2012). *Impious Fidelity: Anna Freud, Psychoanalysis, Politics*. Cornell University Press.

Stoltz, P., Udén, G., Willman, A., (2004). Support for family carers who care for an elderly person at home–a systematic literature review. *Scandinavian Journal of Caring Sciences* 18(2), 111–119.

Sturmey, P. (2002). Mental retardation and concurrent psychiatric disorder: assessment and treatment. *Current Opinion in Psychiatry*, *15*(5), 489-495.

Suanet, B., Van Groenou, M.B., Van Tilburg, T., (2011). Informal and formal home-care use among older adults in Europe: can cross-national differences be explained by societal context and composition? *Ageing and Society* 32(3), 491–515.

Sum, S., Mathews, R. M., Hughes, I., & Campbell, A. (2008). Internet use and loneliness in older adults. *CyberPsychology & Behavior*, *11*(2), 208-211.

Sundberg, M. L., & Partington, J. W. (1998). *Teaching language to children with autism or other developmental disabilities*. Danville, CA: Behavior Analysts, Incorporated.

Sundberg, M. L., & Michael, J. (2001). The benefits of Skinner's analysis of verbal behavior for children with autism. *Behavior Modification*, *25*(5), 698-724.

Sundberg, M. L. (2013). Thirty Points About Motivation From Skinner's Book Verbal Behavior. *The Analysis of verbal behavior*, *29*(1), 13.

Sung, J., Christensen, H.I., Grinter, R.E., (2009). Robots in the wild: understanding long-term use, in: *Human-Robot Interaction (HRI), 2009 4th ACM/IEEE International Conference*, 45–52.

Szasz, T. S. (2011). *The myth of mental illness: Foundations of a theory of personal conduct*. London: HarperCollins.

Tadd, W., Hillman, A., Calnan, S., Calnan, M., Bayer, T., & Read, S. (2011). Dignity in Practice: An exploration of the care of older adults in acute NHS Trusts. *NIHR Service Delivery and Organisation Programme.* Project 08/1819/218. NETSCC – SDO: Southampton

Thayer, S. E., & Ray, S. (2006). Online communication preferences across age, gender, and duration of Internet use. *CyberPsychology & Behavior*, *9*(4), 432-440.

Thompson, R. H., Iwata, B. A., Conners, J., & Roscoe, E. M. (1999). Effects of reinforcement for alternative behavior during punishment of self-injury. *Journal of Applied Behavior Analysis*, *32*(3), 317-328.

Thorndike, E. L. (1898). Animal intelligence: An experimental study of the associative processes in animals. *Psychological Monographs: General and Applied*, *2*(4), i-109.

Tiikkainen, P., Leskinen, E., & Heikkinen, R. L. (2008). Predictors of perceived togetherness in very old men and women: A 5-year follow-up study. *Archives of gerontology and Geriatrics*, *46*(3), 387-399.

Topper, D. R. (2013). Exit, Mach; or, the Perils of Positivism. In *How Einstein Created Relativity out of Physics and Astronomy* New York: Springer, 207-213.

Trahan, M. A., Kahng, S., Fisher, A. B., & Hausman, N. L. (2011). Behavior-analytic research on dementia in older adults. *Journal of applied behavior analysis*, *44*(3), 687-691.

Turner, M., Kitchenham, B., Brereton,P., Charters, S. & Budgen, D., (2010). Does the technology acceptance model predict actual use? A systematic literature review. *Information and Software Technology* 52(5), 463-479.

Van der Heijden, H. (2004). User acceptance of hedonic information systems. *MIS quarterly*, 28(4), 695-704.

Van Houten, R., Malenfant, J. L., Austin, J., Lebbon, A. (2005). The effects of a seatbelt-gearshift delay prompt on the seatbelt use of motorists who do not regularly wear seatbelts. *Journal of applied behavior analysis*, *38*(2), 195-203.

Vargas, J. S. (1990). BF Skinner—the last few days. *Journal of Applied Behavior Analysis*, *23*(4), 409-410.

Venkatesh, V., (2000). Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Information systems research* 11(4), 342–365.

Venkatesh, V., Bala, H., (2008). Technology acceptance model 3 and a research agenda on interventions. *Decision sciences* 39(2), 273–315.

Venkatesh, V., & Brown, S. A. (2001). A longitudinal investigation of personal computers in homes: adoption determinants and emerging challenges. *MIS quarterly*, 25(1), 71-102.

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: four longitudinal field studies. *Management science*, *46*(2), 186-204.

Venkatesh, V., Morris, M.G., Davis, G.B., Davis, F.D., (2003). User acceptance of information technology: Toward a unified view. *MIS quarterly,* 27(3), 425–478.

Victor, C. R., Scambler, S. J., Bowling, A. N. N., & Bond, J. (2005). The prevalence of, and risk factors for, loneliness in later life: a survey of older people in Great Britain. *Ageing and Society*, *25*(3), 357-375.

Villar, F., (2011). Successful ageing and development: the contribution of generativity in older age. *Ageing and Society* 32(7), 1087–1105.

Vincent, J., (2006). Emotional attachment and mobile phones. *Knowledge, Technology & Policy* 19(1), 39–44.

Virués-Ortega, J. (2006). The case against BF Skinner 45 years later: An encounter with N. Chomsky. *The Behavior Analyst*, *29*(2), 243.

Vitell, S.J., Lumpkin, J.R., Rawwas, M.Y., (1991). Consumer ethics: an investigation of the ethical beliefs of elderly consumers. *Journal of Business Ethics* 10(5), 365–375.

Vlachos, P.A., Theotokis, A., Pramatari, K., Vrechopoulos, A., (2010). Consumer-retailer emotional attachment: Some antecedents and the moderating role of attachment anxiety. *European Journal of Marketing* 44, 1478–1499.

Wada, K., Shibata, T., (2007). Living With Seal Robots; Its Sociopsychological and Physiological Influences on the Elderly at a Care House. *IEEE Transactions on Robotics* 23(5), 972–980.

Wagner, N., Hassanein, K., & Head, M. (2010). Computer use by older adults: A multi-disciplinary review. *Computers in Human Behavior*, *26*(5), 870-882.

Walker, R.B., Luszcz, M.A., (2009). The health and relationship dynamics of late-life couples: a systematic review of the literature. *Ageing and Society* 29(3), 455-480.

Warburton, J., Ng, S.H., Shardlow, S.M., (2012). Social inclusion in an ageing world: introduction to the special issue. *Ageing and Society* 33(1), 1–15.

Watson, J. B. (1913). Psychology as the Behaviorist Views it. *Psychological review*, *20*(2), 158-177.

Watson, J. B., & Rayner, R. (1920). Conditioned emotional reactions. *Journal of Experimental Psychology*, *3*(1), 1-14.

Wei, H. T., Chen, M. H., Huang, P. C., & Bai, Y. M. (2012). The association between online gaming, social phobia, and depression: an internet survey. *BMC psychiatry*, *12*(1), 92.

Weiss, R. S. (1973). Loneliness: The experience of emotional and social isolation. Cambridge, US: MIT Press.

Wells, J.D., Campbell, D.E., Valacich, J.S., Featherman, M., (2010). The effect of perceived novelty on the adoption of information technology innovations: a risk/reward perspective. *Decision Sciences* 41(4), 813–843.

Wheeler, L., & Reis, H. T. (1991). Self-Recording of Everyday Life Events: Origins, Types, and Uses. *Journal of personality*, *59*(3), 339-354.

White, A. & Weatherall, J., (2000). A grounded theory analysis of older adults and information technology. *Educational Gerontology*, *26*(4), 371-386.

Wielandt, T., & Strong, J. (2000). Compliance with prescribed adaptive equipment: a literature review. *The British Journal of Occupational Therapy*, *63*(2), 65-75.

Wild, K., Boise, L., Lundell, J., & Foucek, A. (2008). Unobtrusive in-home monitoring of cognitive and physical health: Reactions and perceptions of older adults. *Journal of Applied Gerontology*, *27*(2), 181-200.

Wilkinson, S. (2004). 10 Focus group reseach. In Silverman, D. (Ed) *Qualitative research: Theory, method and practice*, London: Sage Publications Ltd, 177-198.

Wolpe, J., & Rachman, S. (1960). Psychoanalytic "evidence": A critique based on Freud's case of Little Hans. *The Journal of Nervous and Mental Disease*, *130*(8), 135-148.

Worsdell, A. S., Iwata, B. A., Conners, J., Kahng, S. W., & Thompson, R. H. (2000). Relative influences of establishing operations and reinforcement contingencies on self-injurious behavior during functional analyses. *Journal of Applied Behavior Analysis*, *33*(4), 451-461.

Wyatt, W. J., Hawkins, R. P., & Davis, P. (1986). Behaviorism: Are reports of its death exaggerated?. *The Behavior Analyst*, *9*(1), 101-105.

Xiao, H. (2006). *Intellectual property theft and illicit consumer behaviour: A psychology of counterfeit buying*. Doctoral dissertation, University of Durham.

Xie, B., Watkins, I., Golbeck, J., & Huang, M. (2012). Understanding and changing older adults' perceptions and learning of social media. *Educational gerontology*, *38*(4), 282-296.

Yamakawa, P., Rees, G. H., Manuel Salas, J., & Alva, N. (2013). The diffusion of mobile telephones: An empirical analysis for Peru. *Telecommunications Policy*, *37*(6), 594-606.

Yermekbayeva, D., (2011). *An Offer They Cannot Refuse: A Behavioural Approach to Stimulating Consumer Demand for Innovations in the Telecommunications Sector*. Doctoral dissertation, Durham University.

Yim, C.K., Tse, D.K., Chan, K.W., (2008). Strengthening customer loyalty through intimacy and passion: roles of customer-firm affection and customer-staff relationships in services. *Journal of Marketing Research* 45(6), 741–756.

Young, J., Hawkins, R., Sharlin, E., Igarashi, T., (2008). Toward acceptable domestic robots: Lessons learned from social psychology. *Journal of Social Robotics manuscript,* 1.

Zaphiris, P., Kurniawan, S., & Ghiawadwala, M. (2007). A systematic approach to the development of research-based web design guidelines for older people. *Universal Access in the Information Society*, *6*(1), 59-75.

Zarantonello, L., & Luomala, H. T. (2011). Dear Mr Chocolate: constructing a typology of contextualized chocolate consumption experiences through qualitative diary research. *Qualitative Market Research: An International Journal*, *14*(1), 55-82.

Zhong, B. (2013). From smartphones to iPad: Power users' disposition toward mobile media devices. *Computers in Human Behavior*, *29*(4), 1742-1748.

Ziefle, M., Bay, S., & Schwade, A. (2006). On keys' meanings and modes: the impact of different key solutions on children's efficiency using a mobile phone.*Behaviour & Information Technology*, *25*(5), 413-431.

Zimmer, Z. & Chappell, N.L., (1999). Receptivity to new technology among older adults. *Disability and Rehabilitation,* 21(5-6), 222-230.

APPENDIX 1

SAMPLE SURVEY - KINDLE

General Questions

This page is just for general profile questions. All answers are anonymous. Please answer all multiple choice questions with an 'x'. For open-ended questions, please type the answer in the appropriate text box.

1. What is your sex?

Male	
Female	

2. What age are you?

3. What currently is your legal marital or same-sex civil partnership status?

Never married and never registered a same-sex civil partnership	
Married	
Separated, but still legally married	
Divorced	
Widowed	
In a registered same-sex civil partnership	
Separated, but still legally in a same-sex civil partnership	
Formerly in a same-sex civil partnership which is now legally dissolved	
Surviving partner from a same-sex civil partnership	
Rather not say	

4. What, at this moment, is your highest qualification?

5. How long have you owned your Kindle?

1 -7 Days	
1-4 Weeks	
1-2 Months	
2-4 Months	
4-6 Months	
6-8 Months	
8-10 Months	
10-12 Months	
Over 12 Months	

6. How often do you use your Kindle?

Less than once a month	
Once a month	
2-3 times a month	
Once a week	
2-5 times a week	
Once a day	
2-3 times a day	
4 or more times a day	

7. When it comes to technology, how would you describe yourself?

Very experience	
Experienced	
Slightly experienced	
Slightly inexperienced	
Inexperienced	
Very inexperienced	

Section One - Usefulness

This is section one of six sections. All questions have five possible answers: Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree. Please answer all questions as honestly as possible. Everything is anonymous.

8. My Kindle is there for emergencies only

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

9. My Kindle is very useful

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

10. I dislike using my Kindle

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

11. I very rarely use my Kindle

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

12. I probably only use my Kindle once a week

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

13. I am uninterested by my Kindle

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

14. My Kindle is very practical in its daily use

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

Section Two - Functionality

15. My Kindle helps me get everything done quicker

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

16. My Kindle makes me more independent

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

17. Thanks to my Kindle I save a lot of time

Strongly Agree	
Agree	

Neutral	
Disagree	
Strongly Disagree	

18. With a Kindle, I feel confident about my future

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

19. I find my Kindle easy to use

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

20. Having a Kindle does not make me feel safe

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

21. My Kindle makes life easier for me

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

Section Three – Personalisation

22. Probably people who know me might sometimes think of my Kindle when they think of me

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

23. I think about my Kindle a lot

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

24. My Kindle reminds me of who I am

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

25. I very rarely have my Kindle on my mind

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

26. My Kindle represents who I am

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

27. My Kindle has no connection to my personality

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

28. My Kindle inspires strong emotions in me

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

29. My Kindle evidences my taste, interest or knowledge

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

Section Four – Emotional Attachment

30. If someone praised my Kindle, I would feel somewhat praised myself

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

31. I would feel touched if someone complimented my Kindle

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

32. If someone ridiculed my Kindle, I really wouldn't care

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

33. If somebody made fun of my Kindle, I would get angry

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

34. I like to boast about my Kindle

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

35. If somebody destroyed my Kindle, I would feel like I've lost a bit of myself

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

36. If I no longer had my Kindle, I would feel empty inside

Strongly Agree	
Agree	
Neutral	
Disagree	

Strongly Disagree	

37. I have very strong feelings about my Kindle

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

Section Five – Sense of Belonging

38. I feel like a square peg in a round hole

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

39. I would describe myself as a misfit

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

40. I feel part of mainstream society

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

41. I never feel left out

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

42. This world is strange to me

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

43. I've always been a do-er not a watcher

Strongly Agree	

Agree	
Neutral	
Disagree	
Strongly Disagree	

44. I often feel like I have to change the way I behave in public

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

45. I always feel comfortable around my peers

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

Section Six – Perceptions of Self-worth

46. Lots of people value me

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

47. I feel that I can't do anything right

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

48. I take a positive attitude towards myself

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

49. I often think that I'm worthless

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

50. I feel valuable in society

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

51. I feel that I am a person of worth, at least on an equal plane with others

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

52. All in all, I am inclined to feel that I am a failure

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

53. On the whole, I am satisfied with myself

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

APPENDIX 2

Source: Greene & D'Oliveira (2005)