An interactionist framework for understanding the acceptance, rejection and use of health and care technologies

Mark David Hawker

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Department of Sociological Studies

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Abstract

My research makes an empirically informed, theoretical contribution to understanding how health and care technologies are accepted, rejected and used by older people and stroke survivors. Current research on health and care technologies such as telecare and telerehabilitation systems has not tended to investigate questions such as what the technologies mean to users, how users appropriate and interact with the technologies on a daily basis, and the significance that these technologies can have within the context of users' everyday lives. Drawing on key concepts from structural symbolic interactionism, the life course perspective and the domestication framework, my research explores the relationships between users and technologies in contexts. These relationships are negotiated through interaction, are meaningful and unfold over time as individuals navigate the life course.

A collective case study research design is adopted focusing on how users appropriate and interact with telecare and telerehabilitation systems. Two cases are supported by data from qualitative interviews with older people (n=19) and stroke survivors (n=4), respectively. Data analysis is conducted in light of an analytical framework, which draws attention to users' interpretations of the technologies, and the processes of meaning making and social interaction. These processes shape a technology's acceptance, rejection and use. Findings suggest that individuals interpret health and care technologies in different ways and that meaning is constructed through processes of appropriation and interaction. It is through interaction, with technologies and with others, that meanings are negotiated. These meanings are shaped by individuals' identities and roles, and their agency and capacity to participate in situated action. I contribute an interactionist framework that conceptualises these complex relationships. The framework provides a means of exploring and understanding the acceptance, rejection and use of health and care technologies that does not under- or over-play individual agency or the affordances and 'scripts' of these technologies.

Conference presentations

Hawker, M. D. (2015). Utilising symbolic interactionism to explore users' interpretations of technologies designed to support health and social care. *Paper presented at the 6th European Society for the Study of Symbolic Interaction Conference, 29–31 July, Salford.*

Hawker, M. D. (2015). "Maybe it's because they haven't had to rely on it, like that day I really needed it": exploring users' interpretations of technologies designed to support health and social care. *Paper presented at the British Society of Gerontology Emerging Researchers in Ageing Conference, 30 June, Newcastle.*

Hawker, M. D. (2012). The design and domestication of assistive technologies by older people being-at-home. *Paper presented at the University of Sheffield Social Science Postgraduate Researcher Conference, 30 May, Sheffield.*

Table of contents

List of tables

List of figures

"Human beings [live] in a world of meaningful objects—not in an environment of stimuli or self-constituted entities. This world is socially produced in that the meanings are fabricated through the process of social interaction. Thus, different groups come to develop different worlds—and these worlds change as the objects that compose them change in meaning."

(Blumer, 1966: 540)

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"A life course approach attempts to reconcile the fundamental interplay between individuals and the social structures that shape the choices they make."

(Hitlin and Elder, 2006: 38)

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"The domestication of technology refers to the capacity of a social group (a household, a family, but also an organisation) to appropriate technological artifacts and delivery systems into its own culture—its own spaces and times, its own aesthetic and its own functioning—to control them, and to render them more or less 'invisible' within the daily routines of daily life. Both the potential inscribed within the technology as object (and the meanings of the texts that are conveyed), as well as the resources available to the group, are material for understanding how any given transaction or set of transactions takes place."

(Silverstone, 1994: 98)

1.   Introduction

My research adopted an interdisciplinary approach to understand how individuals interact with technologies designed to support health and social care. The term 'health and care technology' is used in my research as opposed to other terms used to describe similar technologies (e.g. telehealth and telemedicine). The reason for this is due to the lack of a clear definition of terms such as 'assistive technology', 'telecare' and 'telehealth' (Doughty et al., 2007). The umbrella term 'assistive technology' is often used to describe "any product or service designed to enable independence for disabled and older people" (Foundation for Assistive Technology, 2001). This definition encompasses 'low-tech' devices such as spectacles and walking canes, as well as technologies such as stairlifts that enable mobility.

I use the term 'health and care technology' in my research to refer to: *any product or service designed to support individuals to access health and social care services remotely*. The definition encompasses technologies such as telecare systems that can be used to connect individuals to call monitoring centres and telerehabilitation systems that can be used to support home-based rehabilitation. Excluded in this definition are technologies that do not facilitate remote communication with health and care services, such as hearing aids or walking sticks. These technologies are known as 'aids and appliances' (Audit Commission, 2004).

The utilisation of health and social care technologies has become an integral part of public policy, particularly with the development of the Whole System Demonstrator programme (Bower et al., 2011). An outcome of the programme has been the evaluation of telecare and telehealth technologies in terms of cost-effectiveness and service utilisation (see, for example, Henderson et al., 2014; Steventon et al., 2013). However, the programme has been challenged in terms of its methodology and

publication bias (Greenhalgh, 2012; Oliver, 2013). Greenhalgh et al. (2012) have unpacked the issues within the field of health and care technology evaluation and propose a unified 'organising vision' that takes into account the views of designers, developers, providers, researchers and users. I contribute to this through the development of a theoretical framework that brings together components that contribute to health and care technology acceptance, rejection and use. I do this:

> *"[With] one foot planted in theoretical sources and the other in [the results] obtained from empirical research into the practice of technology and [users], the area of technology and [users] could in all likelihood contribute important and ground-breaking knowledge."* (Östlund, 2004: 59)

There are two reasons why I chose to explore how health and care technologies are domesticated. First, their adoption and use is a contemporary issue in England as well as other international countries. As the number of older people and those with chronic illness continues to rise, alongside the increased use of technologies to support health and care services, the significance of a user perspective will continue to grow. Second, current research on health and care technologies has tended to, although not exclusively, focus on how these technologies function and assumes that they will be adopted and incorporated into individuals' everyday lives straightforwardly (see Chapter 2). It is my contention that the processes of adoption and use are far from straightforward and bring into question issues of agency, identity and the negotiation of meaning through interaction.

An understanding of the processes of health and care technology adoption and use will have implications for practice as well as theory. For example, knowledge about how (and why) individuals interact with health and care technologies, including the problems that they face, could be used to improve the design and development of the technologies in the future. In addition, this knowledge could be utilised by providers of health and care services who intend to supplement existing practices with technology. It will be important for them to consider the impact that health and care technologies have on the everyday lives of individuals as well as how individuals derive benefits (or not) from the technologies beyond those that are intended. This

is particularly important for health and care technologies that require individual user interaction in order to be effective.

My research raises important questions about the nature of health and care technology interaction from the perspectives of two user groups: older people[1] and stroke survivors. I show that individual users' acceptance, rejection and use of telecare and telerehabilitation systems, respectively, are not straightforward, one-off events, but are best understood as ongoing, sustained *interactions*. These interactions are experienced over the life course as individuals age and negotiate chronic illness. Viewing health and care technology use in terms of interactions goes beyond our current understanding of their acceptance, rejection and use. This includes drawing attention to the meanings that individuals ascribe to health and care technologies and how, in turn, meanings influence how individuals can (and desire to) interact with the technologies over the life course.

1.1. Aim and research question

The aim of my research was to explore how two user groups (i.e. older people and stroke survivors) interacted with telecare and telerehabilitation systems. I sought to understand how the interpretations of these technologies were formed and negotiated. This was in reference to individuals' identities through social interaction and engagement[2] with the technologies. The question that I addressed through my research was: *how does the process of health and care technology acceptance, rejection and use occur in practice from a user's perspective?* Rather than focusing on the functionalities of health and care technologies, I argue that technologies are also symbolic and that the meanings that individuals ascribe to them influences how they are used and the extent to which they feature within individuals' everyday lives.

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[1] Bytheway (2011) conceptualises 'age' in terms of *time* and *identity*. In relation to time, an individual's chronological age becomes the focus and represents the length of time they have lived. Chronological age is marked and celebrated or is resisted or denied. In relation to identity, age is about contrasting how one looks (i.e. the biology of ageing) versus how one acts and feels. My use of the term 'older people' does not equate 'old age' with chronological age. However, it does use this characteristic as a starting point for conceptualising older people and is a pragmatic aid for recruiting individuals.

[2] The term 'engagement' is used in my research as a synonym for 'interaction'. It is used to describe actions towards objects such as the take up and use of health and care technologies. Engagement, in the sense that it is used in my research, involves negotiating meanings as "people are prepared or set to act toward objects on the basis of the meaning of the objects for them" (Blumer, 1966: 539).

Two health and care technologies were selected to address my aim and research question: a telecare (see Section 5.2.1) and telerehabilitation system (see Section 6.2.1). The reason for choosing these was due to their differences and similarities. By selecting these health and care technologies, in particular, I was able to explore the experiences of individual users to construct a novel theoretical framework (see Section 1.5).

First, a telecare system is a *responsive* social care technology that is used, predominantly, in the event of an emergency. Telecare systems are therefore designed with minimal interaction in mind and this is reflected in their small size and technological simplicity. Telerehabilitation systems, on the other and, are designed *for interaction*. Their goal is to support repetitive exercise practices and enable stroke survivors to exercise in settings such as their own homes. To this end, they include complex technologies that individuals interact with frequently over time.

Second, telecare and telerehabilitation systems are in different stages of maturity. Telecare systems emerged in the 1970s and 1980s (see, for example, Dibner et al., 1982). The aesthetics and design of telecare systems have changed little since their inception in the 1970s and 1980s (Bentley et al., 2014). Conversely, telerehabilitation systems are much more novel in their design and development. However, few telerehabilitation systems have permeated practice and those that have are used predominantly within clinical settings. Unlike telecare systems, which are available to the public through statutory and commercial providers, telerehabilitation systems are limited to research contexts because they have not yet been commercialised.

Third, telecare and telerehabilitation systems are aimed at different individual user 'types'. The former are intended for those who need to alert others for help (e.g. older people and those who are prone to falling). Telecare systems are also targeted at those living alone and who do not have regular access to family and friends. The latter, telerehabilitation systems, are targeted at individuals who have experienced a sudden biographical 'disruption' that affects their everyday lives (Bury, 1982). A stroke is caused by a bleed or blood clot in the brain, which affects cognitive functions due to the loss of blood reaching the organ. The severity of a stroke varies

but most symptoms are physical. They include blurred vision, numbness, and weakness or paralysis (NICE, 2008). Those interacting with telerehabilitation systems, therefore, may have specific cognitive and physical limitations that may alter their interactions with the technology.

The selection of telecare and telerehabilitation systems as case studies (see Chapter 3) was deliberate. Both technologies share differences and similarities in terms of their design, the settings in which they are used, and the types of individual users that they are intended for. These differences and similarities set them apart from other domestic technologies such as radios and televisions that have been the focus of much sociological research in the past (see, for example, Silverstone, 1994). Telecare and telerehabilitation systems are designed to support health and social care services that can be as critical as saving an individual's life (as in telecare systems) and to enable individuals to regain lost functionality (as in telerehabilitation systems). Interaction with these health and care technologies is therefore more critical than with domestic technologies. Health and care technologies need to be designed for *interaction* but this involves understanding what this 'interaction' entails from the perspective of technology users.

1.2.   Background of the researcher

Qualitative research can be interpreted as a 'craft', which "involves [disciplined] creativity that results in a tangible and well-made product" (Prasad, 2005: 7). While there may be agreed upon standards and intellectual traditions that can shape a research project, researchers often have an individual and particular way of approaching a research problem. This can influence the methods that they choose to generate data, the methods they choose to analyse data, and the types of visualisations they use to present findings. A researcher's approach may be implicit within their choice of research paradigm (e.g. quantitative or qualitative) or more explicit in terms of reflexive accounts that locate the researcher within a theoretical tradition. Personal reflection is therefore an important part of the research process as it helps to understand the researcher's relationship to the world and their deliberations about values in relation to research (O'Hanlon, 1994).

Given the significance of personal reflection, I provide some brief comments in this section on my relationship to the research that influenced my thinking and approach. My background is in health informatics. This is a discipline that combines an in-depth knowledge of computing with the evaluation of 'real world' applications of healthcare technologies. As Coiera (2015: xix) argues, it is "the study of how clinical knowledge is created, shape, shared and applied". However, while I had some formal qualifications in the evaluation of healthcare technologies I lacked a theoretical basis through which to support any rigorous data analysis. I therefore applied for a scholarship from the University of Sheffield for a project entitled 'Promoting Independence through Personalised INteractive technologies' or PIPIN. The scholarship was interdisciplinary and was spread across a network of three PhD students (myself included) and cross-faculty supervisors. This gave me the opportunity to discuss my research with at interdisciplinary meetings and to interact with students who had different backgrounds and research interests.

My research is interdisciplinary in nature as it brings together knowledge from sociology and health services research into a coherent whole (Choi and Pak, 2006). This was achieved by engaging with the theoretical literatures of sociology and the more pragmatic and evidence-based knowledge from health services research. However, I go beyond a multidisciplinary approach by integrating theoretical research with empirical data to produce a framework that has appeal across both disciplines. My research is both a discovery *and* application of new ways of thinking about health and care technology acceptance, rejection and use. I believe that my background gave me the freedom to explore these disciplines and to experiment with the application of concepts in a way that also pushed the boundaries of my knowledge. I was able to empathise with the concerns of both disciplines and to work within and between the boundaries set by each. I was supported to do this by my supervisory team, which spanned disciplines while remaining sympathetic to how each discipline complemented the other.

1.3.   Focus and research approach

While there are, as with all research, a number of ways of addressing an aim and research question, I adopted a qualitative research approach that prioritised the perspectives of users. My analysis focused on individuals' interpretations of telecare and telerehabilitation systems. Specific issues related to their aesthetics and design are emphasised less although these issues did also feature within individuals' accounts. While it is recognised that the design of the technologies may influence how they are interpreted and used, it is argued that focusing exclusively on their design will neglect the processes through which individuals construct and negotiate the meaning of technologies. And, conversely, focusing exclusively on use without an appreciation of their design will also be less effective. The process and significance of design is therefore seen as related to the process of use but it is the *relationship* between design and use that I am interested in[3].

1.4.   Theoretical approach

The first area that my analytical framework draws upon is structural symbolic interactionism, in the form of three arguments (see Section 3.2). The first argument is that technologies are *meaningful*. Meanings are constructed and negotiated by individuals through *social interaction*, involving *interpretation* and *definition*:

> *"Ascertaining the meaning of the actions or remarks of the other person, and conveying indications to another person as to how he is to act." (Blumer, 1966: 537)*

A focus on social (symbolic) interaction implies that the meanings of technologies are not intrinsic to, or embedded within, objects. The second argument is that everyday life involves interactions and relationships between individuals located within societies. This means that individual agency is not entirely 'free' but is influenced by the roles and identities that individuals adopt as they negotiate everyday life. Older

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[3] This relationship between design and use is described by Sørensen (2006: 57) in the following way: "Technologies should [not simply] be seen as innocent and completely malleable [artefacts]. Rather, the domestication argument is that technologies should be seen as under-determined and not undetermined. Designers inscribe visions and actions into artefacts, and they are probably successful in shaping users' actions quite often. However, this may only be clarified through empirical analysis of actual use". Knowledge about the use of a technology can be used to improve the future design of the technology and so the relationship is cyclical rather than linear.

people and stroke survivors, in particular, exemplify this second argument because of the cognitive and physical changes that they experience and how they adapt to them over the life course. This may involve entering into social relationships of dependency, as draw upon support to continue living at home.

The third argument is that health and care technologies are not *purely* symbolic objects. Both telecare and telerehabilitation systems are *physical* objects that are designed with particular functions in mind (e.g. reaching help quickly in an emergency and self-rehabilitation in the home). While (structural) symbolic interactionism prioritises the symbolic, my analytical framework also recognises the *physicality* of objects.

There are tensions between those who advocate the work of Blumer (1969) and those who adopt a 'social structural' perspective on symbolic interactionism (see, for example, Stryker, 1980). Stryker (1988) suggests that Blumer (1969) overemphasises [4] the active construction of everyday life to the detriment of 'predictive' theory. Blumer (1969) takes meanings as truly emergent phenomena that are constructed and negotiated through social interaction. This means, following the argument of Stryker (1988), that the social researcher can only develop 'after-the-fact' understandings of action. On the other hand, Stryker (1988) advocates a more 'constrained' view of interaction and meaning making, and the stability of meanings over time. However, rather than focus on the different metatheoretical positions of Blumer and Stryker, I draw upon concepts from both. I do this by maintaining a focus on social interaction while affirming the utility of a priori theory and the constraining influence of social structures.

Blumer (1969) is used to provide an abstract and conceptual understanding of social interaction through which to explore and understand health and care technology acceptance, rejection and use. As Becker (1988: 19) argues, Blumer provides "students (and the field) a basic approach ... the basic set of ideas that underlay (that

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[4] This is debated by Fine (1992) who argues it is a misreading; symbolic interactionism does not presuppose an indeterminate social system.

had to underlay) almost any theoretical position a sociologist might take". Stryker (1988) draws attention to constraints and limitations on individual action. He argues:

> *"Actors' perspectives, the definitions of situations they call into play that are critical to the course and the content of interaction, are not unconstrained [contra Blumer]. Both the meanings that are possible to invoke in the course of defining situations, as well as the particular meanings from the range of possible meanings that are likely to be invoked, are not random events. They are, on the contrary, subject to the constraints of extant social and cultural systems. Further, there is some reasonable stability over time to the meanings attached to social objects. For practical purposes these do not change willy-nilly or from moment to moment in a way that signifies great change in behavioral outcomes."* (Stryker, 1988: 36–37)

The recognition that action and meaning making can be constrained and limited is drawn upon when thinking about individuals who have health and social care needs (i.e. older people and stroke survivors). For these individuals, a structural symbolic interactionist approach locates them within social networks of dependency, help and support that are experienced within households. This means that actions are understood in relation to institutions such as age, power and sex (Stryker, 1988). Stryker (2008) proposes that action can be understood in relation to identities and roles, and how these are constructed and negotiated by individuals through social interaction (see Section 3.2).

The second area that my analytical framework draws upon is the life course perspective, which highlights issues of changing agency and identities (see Section 3.3), and capacity (see Section 3.7). The life course perspective focuses mostly on how everyday lives are influenced and shaped through changes in roles and identities, and events that produce a lasting shift in an individual's everyday life (Hutchison, 2011). Agency, within the life course perspective, is about making future-oriented and reasoned choices that are within the constraints of individual capacity and social structures (Elder, 1994). Incorporating concepts of agency and capacity from the life course perspective 'grounds' the experiences of individuals and their interactions with health and care technologies. Life course experiences do not *determine* action but are drawn upon as a *resource* by individuals through which to negotiate situations.

In relation to understanding action, the life course perspective draws attention to the significance of time, context and process (Elder, 1994). Life course perspectives emphasise how individuals: 1) define and understand situations; 2) find meanings and reasons to act; and, 3) act in accordance with available resources (Lindström and Eriksson, 2005). These situations, meanings and resources are subject to change. This is rooted in the changing capacities of individuals as they age as well as changes in social relationships. Elder (1994), for example, emphasises the significance of 'linked lives' across the life course and how they can enable or constrain action. The life course perspective complements structural symbolic interactionism by grounding individual agency and action within a biographical 'career'.

The third area that my analytical framework draws upon is sociological approaches to user-technology relations (see Section 3.5) and the domestication framework (see Section 3.6). My analytical framework extends each approach (i.e. social constructivist, semiotic, feminist and domestication) in different ways while maintaining some of the arguments made by each.

In the third chapter, the three areas (i.e. structural symbolic interactionism, the life course perspective and sociological approaches to user-technology relations) are incorporated into an analytical framework. The analytical framework encapsulates the materiality and symbolism of health and care technologies, and the embodied and meaningful nature and significance of the life course.

The framework highlights the relationships between individuals, health and care technologies and society. By individuals I am referring to the 'end users' of health and care technologies (i.e. older people as telecare systems' users and stroke survivors as telerehabilitation systems' users). While these individuals may have different goals and motivations to use health and care technologies, the notion of 'individual' is conceptualised in terms of self, identities and roles (see Section 3.2). The term 'society' is used to represent those involved directly in the care and support of individual end users (e.g. family and friends) as well as those outside of an individual's caring network who they may have social interactions with. For the first case study, this includes the call monitoring centre operators involved in providing help and

support to individuals. For the second case study, society also encapsulates the research team providing the telerehabilitation system who interacted with the user. Across both cases, 'society' refers to those who are involved in social interactions with the individual end user and may therefore influence the meaning of a health and care technology as well as how it is used.

The 'core' of the framework is the individual, which refers to users of health and care technologies that are conceptualised in terms of self, identities, and roles. These elements (i.e. self, identities and roles) are shaped by, and shaping of, social interactions that may include individuals associated directly with the user (i.e. formal and informal carers) or those involved more broadly in the delivery of health and social care services (e.g. call monitoring centre staff). Individual actions towards, and interpretations of, health and care technologies are embedded within these dynamic relationships, which are made meaningful through interaction.

My analytical framework is explored empirically using two case studies of health and care technologies. A theoretical framework is the outcome of this analysis, which proposes a nuanced understanding of technology acceptance, rejection and use.

1.5.   Overview of research contribution

To address my research aim and question, I developed a theoretical framework through empirical research on health and care technology acceptance, rejection and use. The theoretical framework draws attention to the *interactions* between individuals and health and care technologies within social contexts. This is not a 'new' idea in and of itself, as researchers such as Strathern (1992: xi–xii) talk about the 'mirror of technology':

> *"[Information technologies] are in the main electronically based; all require activation, but what is activated are their already programmed functions. Such technologies are also circuited; they entail a routing of messages through their components. … In short, [technologies] work when they are active. A circuit exists only when it is switched on; but all a person can switch on is the circuit. And this existential condition has a significant implication. The devices exist as technology by virtue of being activated. So technology is never completely controlled or subdued (domesticated) because a condition of its existence is its active*

relationship with the users of it. And this ongoing relationship means that the users can never completely consume it. Rather, the technology is persistently there, summoning response."

Strathern (1992), however, does not provide empirical data to support the hypothesis of how a 'mirror of technology' works. I utilised concepts from structural symbolic interactionism, the life course perspective and the domestication framework (see Chapter 3) that were explored through two empirical case studies of telecare and telerehabilitation systems. The contribution that my theoretical framework makes is a focus on the *situated* nature of technology acceptance, rejection and use, and the role of meaning making that influences and shapes action. What this means is that the acceptance, rejection and use of health and care technologies is not a 'one-off' event but is negotiated over time through interaction: what works for one individual at one moment in time may change as they use the technology and receive a positive response (or not). In addition, my framework draws attention to how agency and capacity change over time and can be challenged by the negative effects of ageing and chronic illnesses such as stroke. Therefore, as individuals age and live with chronic illness, their interactions with health and care technologies may also change.

Beyond the notion of 'switching on' an information technology, my research goes on to show that 'activation' is also about interpretation and meaning, and how meanings are constructed and negotiated through social interaction by individual users in situations. This means that activation is about the *moment* of 'switching on' a health and care technology but is also an *ongoing* relationship. It is through this ongoing relationship between individuals, technologies and contexts that acceptance, rejection and use is experienced: activation is an *interactive* process. It is through the interactive process of activation that the meaning of health and care technologies is both constructed and negotiated through social interactions over time. This extends the work of Strathern (1992) by suggesting that technologies are 'circuited' but are also *meaningful*.

1.6. Outline of chapters

The second chapter presents my literature reviews on telecare and telerehabilitation systems designed for use within the home. The chapter is divided into two sections that focus on each technology separately. A systematic approach to the literature reviews is adopted, which is influenced by the 'systematic review' methodology that is prevalent within one of my 'home' disciplines, health services research (Grant and Booth, 2009). However, rather than simply producing a systematic review of each technology, I use this chapter to draw out key themes that encapsulate current knowledge about who uses these technologies and how these technologies are used in practice. In doing so, I am able to identify the gap that my research addresses and the need for an interdisciplinary approach to user-technology relations.

The third chapter focuses on constructing an analytical framework that is used as a perspective to inform my data generation and analysis activities. This chapter puts forward a sociological perspective on the relationship between individuals and technologies that is inspired by structural symbolic interactionism, the life course perspective and approaches to user-technology relations (e.g. social constructivism, semiotics and the domestication framework). Incorporating elements from the literature review, the analytical framework provides a baseline through which to extend current research by placing the individual user's perspective at the centre through focusing on the significance of social interaction and processes of meaning making. The analytical framework is also presented in diagrammatic form to aid comprehension (see Section 3.8).

The fourth chapter discusses the methodology that was designed to generate data to address my research question. I adopted a case study approach and drew upon a range of sources in order to explore how a telecare system and a telerehabilitation were used in practice, and the meanings that individuals ascribed to these technologies. Documents, interview transcripts and notes from observations were analysed thematically in relation to my analytical framework, which focused on issues of agency, identity and the negotiation of meaning through interaction. I also discuss some of the practical issues that I faced such as how to access and recruit older

people and stroke survivors, as well as ethical issues that were pertinent to these particular individuals such as informed consent and competence.

The fifth and sixth chapters present each of my cases (i.e. a telecare and a telerehabilitation system). Both chapters present an overview of the technology and the characteristics of the research participants that were recruited. The fifth chapter on telecare systems focuses on the appropriation of the technology and how telecare systems featured within the context of individuals' everyday lives. Beyond current research on telecare systems, I identified four interpretations that were constructed by individual users. These interpretations go beyond current research by suggesting that telecare systems are not just seen as technologies to access help and support in an emergency (see Section 5.3.2). I argue that users of telecare systems interpret them in different ways with respect to changing life course situations.

The sixth chapter presents the case of a telerehabilitation system that, in contrast to the fifth chapter, focuses on how individuals incorporate the technology into their everyday lives. I begin this chapter by looking at how a research project that designed and developed a telerehabilitation system imagined users (i.e. stroke survivors). I draw upon the research project's documentation and how knowledge was incorporated into the technology's design. As Silverstone and Haddon (1996) and Woolgar (1991: 59) argue, designers inscribe visions of users into products that "[define] the identity of putative users, and [set] constraints upon their likely future actions". However, beyond current research on telerehabilitation systems, which tends to adopt a technological determinist standpoint by characterising individuals as 'ideal users', my case study of a telerehabilitation system highlights the significance of the user to the process of technology interaction. This includes the ways in which individual users interpret the technology and how it is incorporated into their everyday lives.

The final two chapters present a theoretical framework of health and care technology interaction, and draw attention to the contribution that my research makes as well as its limitations. In the discussion chapter, I construct a theoretical framework that highlights the significance of the *process* of interaction to how

individuals negotiate health and care technology acceptance, rejection and use. This goes beyond current thinking by emphasising the ongoing nature of acceptance, rejection and use, and how this relates to the individual user. In the conclusion chapter, I address my research question and present recommendations both in terms of further research as well as implications for the future design, development and provision of health and care technologies.

1.7. Conclusion

The provision of technologies to support health and social care has increased due to the ageing population and the rising costs of support services. While health and care technologies are designed to promote independence there is a need to understand what impact they have on individuals' everyday lives and whether they *do* promote independence from the perspective of individual users. In this chapter, I outlined my approach to understanding how users accept, reject and use health and care technologies. This approach emphasises the significance of social interaction and processes of meaning making, which tend to be underappreciated in current research (see Chapter 2). I contribute a theoretical framework that is informed by two empirical case studies of health and care technology use in practice. In doing so, I further knowledge about how individuals interact with health and care technologies and the components of interaction that are most influential in their acceptance.

2. Reviews of the literature on telecare and telerehabilitation systems

2.1. Introduction

This chapter presents literature reviews of the two technologies that I chose as case studies for my research. The first literature review focuses on telecare systems and their acceptance, rejection, and use by older people living at home. This first literature review focuses on factors that influence users' ownership and use of telecare systems extracted from an established evidence base. It also highlights areas that have received less attention within current research. The second literature review focuses on the design, development, and use of telerehabilitation systems by stroke survivors[1]. Unlike telecare systems, telerehabilitation systems are not available currently to users outside research projects and so the focus of the included studies is on the design and development of the technology. In addition, unlike telecare systems, telerehabilitation systems are designed for frequent use to help improve stroke survivors' motor functions: these technologies are designed for users to interact with over time.

Given the differences between telecare and telerehabilitation systems, this chapter is divided into two separate sections. The two sections are organised in a structured format, which constructs a framework for review before discussing the findings. This framework is informed by previous literature reviews and concepts related to user-centredness. At the end of each section is a discussion of the implications of the literature review for my research. Discussions take an overview of the findings and attempt to present them in a way that is conducive to further analysis and

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[1] While there are a wide range of telerehabilitation systems available I chose to focus on those designed for stroke survivors. This decision is explored further in the fourth chapter, which discusses my methodology.

exploration (see Chapter 3). Finally, at the end of this chapter, key themes are drawn from *both* literature reviews. These key themes are then used to help inform an analytical framework that is developed in the third chapter. This framework incorporates several concepts from social science that are applied in a qualitative, case study research design (see Chapter 4). Through my empirical research, a theoretical framework is developed in the final chapter that extends current research on telecare systems and telerehabilitation systems. It is anticipated that both researchers of health and care technologies as well as designers and developers who are interested in producing 'user-centred' innovations could utilise this theoretical framework.

2.2. Current research on the ownership and use of telecare systems

2.2.1. Framework of the literature review

2.2.1.1. Aim

This literature review summarises current research on the ownership and use of telecare systems from the perspectives of users (e.g. older people). It then uses this research to identify the factors that lead to the acceptance and rejection of telecare systems by users within the context of their everyday lives. This does not include research that is focused on policy-level implications of telecare systems (e.g. cost effectiveness studies) or studies that do not employ an empirical approach to data generation such as those discussing ethics.

2.2.1.2. Design

The general approach was that of a 'scoping review' (Arksey and O'Malley, 2005). This approach to the literature review ensures wide coverage of a topic while simultaneously utilising systematic review methods to ensure that the search is replicable in the future. The literature review itself focuses on studies addressing users' acceptance and rejection of telecare systems. For the purposes of the review, the term 'telecare system' is a primary search term, although a range of other search terms proved necessary to capture all relevant studies (e.g. the use of the terms

'personal alarms' and 'personal emergency response systems' in the USA). In addition, historical terms used to refer to telecare systems were applied to identify studies that were published pre-2000 when the terminology was updated[2]. While many of these search terms only elicited one or two usable studies, it was important to include the search terms to ensure coverage of issues from a global perspective.

2.2.1.3. Search methods

Relevant studies were identified using the following databases of publications: ASSIA, CINAHL, IBSS, MEDLINE, PsycINFO, Scopus, Social Services Abstracts and Sociological Abstracts. These databases were selected as they indexed a range of relevant journals. Several keywords were used that included synonyms for telecare systems (e.g. community alarm systems, personal alarms and personal emergency response systems), and related to ownership and use (e.g. accept, adopt and resist). Wildcard characters were used to capture studies that used other terminology (e.g. accept*, adopt* and resist*). Search results were not limited by the year they were published but were restricted to the English language.

2.2.1.4. Search outcome

The search yielded a total of 238 abstracts, which were then printed and reviewed. A total of 206 articles were excluded as they did not focus on telecare systems or include user perspectives. The 32 articles that remained were read in full in order to determine their relevance. A further 20 articles were then excluded as they focused on other health and care technologies such as telehealth systems. Citations from the remaining twelve articles were searched to identify thirteen additional studies (Breen, 1992; Davies and Mulley, 1993; de San Miguel and Lewin, 2008; Dibner et al., 1982; Fisk, 1989; Fisk, 1995; Fisk, 1997; Levine and Tideiksaar, 1995; Mann et al., 2005; Porter, 2003; Riseborough, 1997; Thornton, 1993; Thornton and Mountain, 1992). Taking this into account, the literature review comprises 25 studies that focus on the ownership and use of telecare systems (see Table 2.1, below).

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[2] These historical terms included 'community alarms', 'dispersed alarms' and 'social alarms', and were identified by consulting a published volume on telecare systems that provided useful background information on the technology's development (Fisk, 2003).

First author	Year	Location	Publication	Methods	Analysis
Boström	2011	Sweden	Journal article	Focus groups	Thematic
Bowes	2013	UK	Journal article	Interviews	Thematic
[+] Breen	1992	UK	Book chapter	Review	N/A
[+] Davies	1993	UK	Journal article	Survey	Descriptive statistics and narrative
[+] de San Miguel	2008	Australia	Journal article	Survey	Descriptive statistics and narrative
[+] Dibner	1982	USA	Journal article	Survey	Descriptive statistics and narrative
Fallis	2008	Canada	Journal article	Survey	Descriptive statistics and narrative
[+] Fisk	1989	UK	Book	Review	N/A
[+] Fisk	1995	Canada and UK	Journal article	Interviews	Descriptive statistics and narrative
[+] Fisk	1997	UK	Review article	Review	N/A
Fisk	1998	UK	Review article	Review	N/A
Greenhalgh	2013	UK	Journal article	Ethnography	Phenomenology
[+] Levine	1995	USA	Journal article	Survey	Descriptive statistics and narrative
[+] Mann	2005	USA	Journal article	Survey	Descriptive statistics and narrative
Mort	2013	Spain and UK	Journal article	Ethnography	Thematic
Nyman	2014	UK	Journal article	Cross-sectional analysis	Descriptive statistics
[+] Porter	2003	USA	Journal article	Interviews	Phenomenology
Porter	2005	USA	Journal article	Interviews	Phenomenology
Porter	2002	USA	Journal article	Interviews	Phenomenology
Porter	2012	USA	Journal article	Interviews	Phenomenology
Porter	2013	USA	Journal article	Interviews	Phenomenology
[+] Riseborough	1997	UK	Report	Mixed	Descriptive statistics and narrative
Sugarhood	2014	UK	Journal article	Interviews	Thematic
[+] Thornton	1993	UK	Review article	Review	N/A
[+] Thornton	1992	UK	Report	Mixed	Descriptive statistics and narrative

Table 2.1: Studies included in the literature review for telecare systems (n=25). This includes thirteen studies identified through citation searches that are denoted with a [+] symbol for clarity.

Mendeley Desktop reference management software was used to organise the results of the literature review and to store journal articles that could then be annotated.

2.2.1.5. Quality appraisal

The purpose of a scoping review is not to determine whether studies provide generalisable, good quality or robust findings (Arksey and O'Malley, 2005). To this end, quality criteria were not applied and therefore this is reflected in the diversity of studies that were included (e.g. books, journal articles and reports).

2.2.1.6. Data extraction and collation

Data from each of the studies were extracted and input into a spreadsheet. The data that were extracted included details of the study's aim, research design and sample characteristics. Results were summarised using a 'meaning condensation' approach (Brinkmann and Kvale, 2015), which enabled large amounts of data to be condensed into synopses that were relevant to the review aim. The benefit of extracting data in this way was that comparisons could be made between- and within-studies. The drawback of extracting data in this way was that contextual information was removed, which meant that articles had to be revisited in order to extract additional information. This meant that the data extraction and collation processes were highly iterative and evolved throughout the development of the literature review.

The heterogeneous nature of the data meant that it was not appropriate to use statistical techniques for collation. Instead, a thematic analysis (Braun and Clarke, 2006) was conducted utilising existing knowledge on the use and non-use of assistive technologies. Research on the use of assistive technologies by older people has an established history[3]. This research has identified several factors that contribute to the ownership and use of assistive technologies e.g. factors related to the user; factors related to the technology; factors related to the user's environment; and, factors related to the intervention or service (Wessels et al., 2003). These factors were used to inform the process of collation and helped identify several factors that related to the ownership and use of telecare systems.

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[3] Hocking, 1999; Kraskowsky and Finlayson, 2003; Pape et al., 2002; Peek et al., 2014; Phillips and Zhao, 1993; Wessels et al., 2003; Wielandt and Strong, 2000; and, Wielandt et al., 2006.

2.2.2. Results

2.2.2.1. Included studies

The final body of literature for review comprised 25 studies (see Table 2.1). Eleven studies were published pre-2000 and fourteen were published post-2000. Studies published pre-2000 often provided a review of previous studies, with only six studies presenting empirical results (Davies and Mulley, 1993; Dibner et al., 1982; Fisk, 1995; Levine and Tideiksaar, 1995; Riseborough, 1997; Thornton and Mountain, 1992). In terms of location, the studies were conducted across five countries: Australia, Canada, Sweden, United Kingdom and United States of America. This highlights a Western bias, although this reflects the provision of these care technologies within other countries (Fisk, 2003).

Included studies focused typically on the perspectives of those who had used telecare systems and thus results reflected the experiences of actual, rather than potential, users. Each of the studies focused on different, but complementary, aspects of ownership and use. Key themes across all studies included (not) wearing button alarms, knowing when to activate a button alarm or decisions related to not activating a button alarm, and perceptions of the service offered by providers. Across all of the studies, research participants were referred to as 'older people' and were over the age of 60, and this influenced how telecare systems were described. In particular, telecare systems were described as technologies to be worn at all times and used in emergencies (e.g. in the event of a fall). However, a number of factors influence whether telecare systems are owned and used, and the remainder of this section focuses on describing them.

2.2.2.2. Factors related to the user

The included studies showed that personal characteristics such as age, sex and health status are associated with the ownership of telecare systems. First, those aged 85+ are more likely to own a telecare system than those aged between 65 and 74 (Nyman and Victor, 2014). Second, there is no relationship between sex and the ownership of a telecare system (Nyman and Victor, 2014). However, the included studies tended to focus on the use of telecare systems by females rather than males.

Third, those with a propensity towards falling are more likely to own a telecare system than those who do not (Nyman and Victor, 2014). In addition, individuals with cognitive impairments, lower quality of life scores and those that have problems with performing (instrumental) activities of daily living are more likely to own a telecare system (Nyman and Victor, 2014). However, health status alone does not predict ownership as non-users report that lack of knowledge and 'perceived need' can influence ownership (Mann et al., 2005). This is also supported by the work of Porter and Ganong (2002) who found that ownership of a telecare system involves contemplation both of one's perceived health status and the potential benefit that the care technology may afford. In this case, ownership of a telecare system may be delayed until an individual feels that they are 'ready' to appropriate one.

In addition to age, sex and health status, the studies showed that household composition influences the ownership of a telecare system. Nyman and Victor (2014) found that, for those living alone and with others, difficulties performing (instrumental) activities of daily living increased the likelihood of owning a telecare system. However, this was dependent on the age of users as those living alone appeared to be older (85+) in comparison to those living with others (75 to 84). In addition, for those living with others, feelings of control were associated with ownership of a telecare system as those who felt less in control[4] of their everyday lives were more likely to own the care technology (Nyman and Victor, 2014). However, none of the studies that included those living with others (see, for example, Davies and Mulley, 1993; Fisk, 1995; Greenhalgh et al., 2013; Mann et al., 2005) explored why these particular users may be younger or how the relationships between these users and those that they were living with may influence their feelings of control.

The expectations that users have of themselves and of assistive technologies, as well as the expectations that others have of users' performance, are claimed to influence ownership and use (Wessels et al., 2003). This can be seen in relation to telecare

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[4] 'Control' relates to the CASP-19 quality of life questionnaire, which is measured using a four-point Likert scale comprising four questions: 1) "my age prevents me from doing the things I would like to do"; "I feel that what happens to me is out of my control"; "I feel free to plan for the future"; and, "I feel left out of things" (Wiggins et al., 2007: 63).

systems in three ways. First, users may resist telecare systems if they lack a 'perceived need' (Mann et al., 2005). In this sense, potential users believe in their ability to manage on their own without the help of a telecare system: potential users feel that they are 'getting by fine without it' (Porter and Ganong, 2002). Conversely, users may draw upon a telecare system in order to contribute positively to their identity as an active, older person (Bowes and McColgan, 2013). However, the included studies have not addressed this personal factor beyond suggesting that users expect to 'age well' with the support of telecare systems (Boström et al., 2011).

Second, users expect telecare systems to function and work in particular ways, and to deliver specific benefits. For example, there is an expectation that pressing a button alarm will increase access to help and support; Fallis et al. (2008) found that users' expectations of the service offered by their telecare systems provider was associated with feelings of satisfaction. However, in some cases, communications may break down and this can create feelings of anxiety, fear and insecurity (Boström et al., 2011), which can prevent users from activating a button alarm when needed, as they do not think that anyone will answer.

Following appropriation, and beyond service-level expectations, telecare systems may not deliver the benefits desired by users. For example, working outside of the home (Boström et al., 2011), improving the 'lived experience' of impairment (Greenhalgh et al., 2013), or addressing wider social issues such as ageism and community violence (Bowes and McColgan, 2013). If expectations like these are not met then users may abandon telecare systems altogether or are required to develop strategies in order to accommodate the care technology (Boström et al., 2011; Sugarhood et al., 2014; Thornton, 1993). However, expectations may also influence decisions to own a telecare system such as their ability: to access help quickly; to reduce feelings of anxiety; or, to enable users to continue living at home for longer (de San Miguel and Lewin, 2008; Fisk, 1995; Porter and Lasiter, 2012; Porter et al., 2013). These expectations may then be met, or not, through use.

Third, others within a user's social network may influence the ownership and use of a telecare system; a telecare system may be appropriated for the benefit of others,

such as a family member, rather than the user (Breen, 1992). This type of involvement may influence when a button alarm is worn as it has been reported that some users have been coerced into wearing them (Mort et al., 2013; Thornton and Mountain, 1992). However, this personal factor has received little attention within the included studies. In most cases, the reason for ownership of a telecare system is implicit within the ways in which the care technology is used. For example, studies focus on the use of the technology for emergencies such as poor health or falls (Davies and Mulley, 1993; de San Miguel and Lewin, 2008; Dibner et al., 1982; Fisk, 1995; Mann et al., 2005). In addition, studies emphasise the decision-making of older people living alone instead of individuals embedded within social networks (Porter, 2003; Porter, 2005; Porter and Ganong, 2002; Porter and Lasiter, 2012; Porter et al., 2013). This suggests that expectations may influence telecare systems ownership and use although the expectations of others within a user's social network have received little attention.

A change in cognitive and physical impairment can influence whether an assistive technology is owned or used (Wessels et al., 2003). This is particularly true of telecare systems. First, cognitive and physical changes may make telecare systems more applicable to older people as an option to support them within their everyday lives. Porter and Ganong (2002), for example, identified that some potential users of telecare systems perceived that they would use one 'some time' in the future and that this was associated with perceived health status. However, further data were not available on whether these potential users went on to appropriate a telecare system. Second, studies suggest that cognitive impairments, in particular, can prevent users from remembering to wear a button alarm or keeping it 'close-to-hand' when needed (de San Miguel and Lewin, 2008; Greenhalgh et al., 2013). In addition, button alarms may be activated multiple times per day for non-emergencies or reporting incidents such as bombs in flats that were imagined by the user (Sugarhood et al., 2014). Telecare systems may be appropriated due to changes in cognitive and physical impairments although these same impairments may influence the ways in which the care technology is used.

Studies focused on the ownership and use of telecare systems highlight the significant influence of personal characteristics, expectations, and changes in cognitive and physical impairments. These studies confirm that telecare systems are owned and used typically by individuals who are older, have poorer health and who are living alone (Nyman and Victor, 2014). However, the studies have also identified that there are other users of telecare systems who are younger, have better health and are living with others. In addition, there is some evidence to suggest that expectations can play a role in the ownership and use of telecare systems. These include users' perceptions of telecare systems and their relationships with others. The studies also highlight how users' experiences of telecare systems may change over time, which is associated with cognitive and physical limitations. Taken together, these factors relate to one aspect of the use and non-use of telecare systems.

2.2.2.3. Factors related to the technology

In general, telecare systems consist of two components. The first component is a button alarm that is worn around the neck or on the wrist. Button alarm designs have changed little since their inception and include a plastic casing and a large red membrane that depreciates when pressure is applied to it. Inside the button alarm is a small radio transmitter that emits a 'pulse' when the membrane is pressed. This pulse is transmitted wirelessly and picked up by a second component, a powered 'hub', which is connected to a telephone line within the user's home. Upon activating a button alarm, a connection is made to the hub that, in turn, calls for assistance. Typically, a connection is made to a call monitoring centre that can detect which user has activated their button alarm. A voice channel is then created that is output through a speaker[5].

In order to function, users are required to wear a button alarm. However, there are a number of reasons that may prevent this, which go beyond cognitive and physical impairments that may lead individuals to forget to wear one (Greenhalgh et al., 2013; Sugarhood et al., 2014). First, users report that button alarms look 'unattractive' and 'uncomfortable' (Boström et al., 2011; Davies and Mulley, 1993; de San Miguel and

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[5] In some cases, these speakers are considered unfit for purpose if a user initiates a call in another room or is hard of hearing (Fallis et al., 2008).

Lewin, 2008; Fisk, 1995; Fisk, 1998). Second, and related to the first reason, button alarms can be perceived of as a symbol of 'decline'. As a result, button alarms are worn selectively outside of homes or when in the presence of others (Mort et al., 2013; Porter, 2005). Users are obligated to develop strategies in order to render the care technology 'invisible' within their everyday lives such as hiding a button alarm under clothing when outside of the home. In order to explain this behaviour, Bowes and McColgan (2013) draw parallels between telecare systems and other forms of 'disability equipment' that represent 'failure' to users who wish to fight against impairments for as long as possible. However, this reasoning was not voiced by any of the research participants in their study.

Third, button alarms are not worn for deliberate reasons. For example, de San Miguel and Lewin (2008) and Porter (2005) identified that users take off their button alarms when in bed or when in the shower. In these cases, users do not want to activate their button alarm accidentally or get it wet (despite the fact that button alarms are waterproof). This leads them to keep a button alarm close-to-hand but not on their person. In addition, for users who are aware of the limited range of their telecare systems, button alarms may be taken off when outside (Boström et al., 2011) although this is not universal (see, for example, de San Miguel and Lewin, 2008). Paradoxically, Porter (2005) found that button alarms were both worn and not worn when in the presence of formal or informal carers. For some users, button alarms were not worn because they felt that they were safe with their carers. However, for one user, wearing a button alarm when in the presence of a carer meant that if they were treated badly then they could summon help and support. In this respect, a telecare system was used to promote security and peace of mind.

Fourth, button alarms can be activated accidentally by users, which are referred to as 'false alarms' (Davies and Mulley, 1993; de San Miguel and Lewin, 2008; Dibner et al., 1982; Greenhalgh et al., 2013; Porter, 2003; Porter, 2005; Thornton, 1993). False alarms can lead to anxiety, embarrassment (e.g. if a carer turns up when a user is not dressed), and fear of the unexpected presence of 'voices' from the hub's speaker within the home. Porter (2005), for example, found that research participants considered that their telecare system 'had a mind of its own' and therefore resisted

wearing a button alarm because of the potential for creating a false alarm. More seriously, the avoidance of false alarms can force users to adjust their activities of daily living if they choose to continue wearing a button alarm (Thornton, 1993). While in some cases this may only involve 'trivial' changes such as not carrying objects too closely to their bodies, this involves the user modifying their behaviour to accommodate the telecare system and not the other way around.

The included studies highlight a number of factors related to the technology that may limit its potential to be worn and used. These factors relate to the design of button alarm, which is one of the main components of the care technology. Button alarms are not worn for reasons related to their appearance, meaning and sensitivity that can lead to false alarms. In addition, users may decide when to wear button alarms based upon their location, the presence of others, and knowledge that telecare systems do not work in particular contexts. Porter (2005) referred to this as a process of 'temporising' when to wear a button alarm. In addition, the process of temporising involved decisions about when to activate a button alarm, which is discussed in an upcoming section. Taken together, while button alarms may not be worn consistently, there appears to be reasons that are both outside and within the control of users' situations. These reasons reflect the agency of users but also external factors such as the public meanings associated with telecare systems.

2.2.2.4. Factors related to the user's environment

In the context of telecare systems, the user's environment refers to the location that the care technology is installed in. Historically, telecare systems or 'dispersed alarms' as they were once known, were installed in sheltered housing[6] (Fisk, 1989). As a result, studies on telecare systems adopted a 'property-based' approach whereby research participants were recruited in large numbers through local housing associations (Fisk, 1989; Fisk, 2003; Riseborough, 1997; Thornton and Mountain, 1992). More recently, studies have adopted a more 'person-based' approach that focus on users outside of sheltered housing environments such as those living at home (Fisk,

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[6] The term 'sheltered housing' refers to "groups of conventional, if small, apartments with a resident or non-resident manager who provides supervision, surveillance and emergency contact services but not personal support or care" (Peace et al., 2011: 738).

1989; Fisk, 2003). Therefore, the environment in which telecare systems are installed has changed quite considerably as the service has moved closer to community-based and domestic environments.

The included studies have devoted little attention to the environment in which telecare systems are located. This is partly because of the historic nature of the studies that focus primarily on users living in sheltered housing where the care technology is pre-installed (see, for example, Riseborough, 1997; Thornton and Mountain, 1992). As a result, there was no explicit process of installing a telecare system and locating it within a home. However, as telecare systems have moved into the home, studies have focused on the role of social networks in the ownership and use of the care technology. First, social networks may support users to adopt a telecare system. This may be based on their knowledge and understanding of the care technology and it's potential to support them in caring for a friend or family member. In some cases, this can lead to a transformation of care (Bowes and McColgan, 2013).

Second, users can be influenced by their social networks when deciding individuals to assign as 'first responders'. Porter (2003) found that deciding whom to assign as a responder was a difficult decision involving taking factors such as closeness of relationship and the distance from the user's home into account. This process can be important as it is often the responder who will be contacted following the activation of a button alarm and so must be known and trusted by users (Thornton and Mountain, 1992). However, if the user knows the responder then this may prevent them from activating a button alarm if they feel that they will be 'bothering' them, which can become particularly relevant at night (de San Miguel and Lewin, 2008; Porter, 2005). This may not be applicable to all telecare systems as some providers may offer their own means of responding to calls such as through response teams (Fisk, 1995). While not a universal service, the use of a response team may reduce some of users' anxieties in activating a button alarm and involving family and friends in responding. In addition, it may be more suitable for users who have smaller social networks (Bowes and McColgan, 2013).

Third, users can be influenced to wear a button alarm as a result of interactions with individuals within their social networks. In some situations, users may take off a button alarm when they are with others as they feel safe and secure (Porter, 2005). In other situations, users may ensure that they are seen wearing a button alarm in the presence of others (Fisk, 1995). This suggests that social networks are involved in the use of a telecare system although this is very much dependent on their relationship to the user and their expectation of the care technology. For example, Sugarhood et al. (2014) note that individuals within users' social networks may evaluate the effectiveness of a telecare system based on its cost as well as whether it creates additional work for them. In this respect, the ownership and use of a telecare system may be outside of users' control.

The included studies sought to highlight a limited number of factors related to the user's environment that influence its use. The majority of studies have been conducted on telecare systems that are pre-installed within certain environments (e.g. sheltered housing). In these instances, there is no explicit installation process as technical considerations such as the availability of electrical power sockets and telephone lines have already been taken into account. However, this installation process may be more complicated in users' own homes if they lack the necessary number of electrical power sockets or telephone lines that are not available close by. Instead, the studies have focused on the role of social networks in the adoption and use of telecare systems, which include their existing relationships with users.

2.2.2.5. Factors related to the intervention or service provision

The included studies show that the use of a telecare system goes beyond the one-off adoption of a button alarm and hub, and factors related to users and the technology. In addition to these, telecare systems connect users to call monitoring centres that handle requests such as forwarding information to nominated 'responders' (e.g. family and friends) or contacting emergency services. Thornton and Mountain (1992) describe call monitoring centres as 'intermediaries', who interpret calls and provide help and support to the best of their ability. In most cases, users are aware of the call monitoring centre's role and expect it to work, although this is not universal. If users

are unaware of what happens when they activate a button alarm then studies suggest that telecare systems are less likely to be used. However, following activation and a positive response from a call monitoring centre, users' perceptions of their telecare system can change. This suggests that the use of a telecare system is a process, which involves relationships between the users and providers of the care technology.

Telecare systems are often made available to users through statutory providers such as local authorities[7]. These local authorities advertise their services, including telecare systems, publicly as part of their responsibilities to the populations that they serve. Prior to the adoption of a telecare system, the way in which they are advertised can influence how potential users interpret them. For example, in Scotland, researchers found that where telecare systems were 'mainstreamed' by removing "some of the distinctions between older people assessed as having 'care needs' and those without" (Bowes and McColgan, 2013: 44) then this removed some of the stigma associated with the service. This enabled users to adopt telecare systems as a means of contributing positively to their identity as an older person (Bowes and McColgan, 2013). There is therefore some relationship between the meanings associated with telecare systems as advertised and users' interpretations of telecare systems as a result. However, a common interpretation of telecare systems within the included studies is as a care technology designed to access help and support in an emergency.

Research on assistive technologies suggests that when users' opinions are taken into account during the adoption process then they are more likely to be retained (Wessels et al., 2003). This particular aspect of telecare systems' appropriation has received little attention within the included studies although there are some exceptions. For example, Thornton and Mountain (1992) identified several reasons why telecare systems were adopted and these were associated with referrals related to medical reasons such as arthritis, diabetes and respiratory issues. However, this only represents one potential means of referral. In addition, studies have shown that telecare systems are often adopted for others rather than the user such as to

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[7] In recent years, the provision of telecare systems has expanded to include charities and private companies although these are not the focus of my research.

appease a family member (Breen, 1992). However, users may appropriate telecare systems without the influence of others (Levine and Tideiksaar, 1995; Mann et al., 2005). In addition, it appears that where telecare systems come pre-installed in sheltered housing then button alarms may not be worn (Davies and Mulley, 1993). Where the decision-making process has been explored within current research it has focused on an individual perspective rather than individuals embedded within social networks (Porter and Ganong, 2012; Porter et al., 2013). As Sugarhood et al. (2014) note, the adoption of a telecare system is often a shared decision between individuals and their social networks, and this continues following adoption. There is therefore insufficient evidence to address the topic of whether involving users in the adoption process is associated with the retention of telecare systems beyond a tentative answer in the affirmative.

Although research suggests that the delivery and installation of assistive technologies influences acceptance (Wessels et al., 2003) there was no evidence to suggest that this was applicable to telecare systems. The included studies did not take this particular aspect of service delivery into account when presenting the perspectives of users.

Following the adoption of an assistive technology, the provision of instructions and training can improve use (Wessels et al., 2003). In relation to telecare systems, there are mixed views regarding instruction and training, which has focused on two areas. First, users may be uninformed about the functions of a telecare system and what happens when a button alarm is activated (Boström et al., 2011; Fallis et al., 2008; Mort et al., 2013). This can lead to button alarms not being worn or activated when needed, or leads users to become suspicious of information that they think a telecare system is transmitting outside of their homes (Greenhalgh et al., 2013). In some cases, lack of knowledge about telecare systems can also limit adoption (Mann et al., 2005). This suggests that inadequate information is available to potential users to make an informed decision as to the benefits of owning a telecare system.

Second, users may be encouraged to use their telecare system for particular purposes but discouraged from using them for other purposes (Mort et al., 2013).

Local authorities perpetuate an emergency-focussed stereotype with regards to use and this is reflected in how users interpret the service (Thornton, 1993). Thornton and Mountain (1992), for example, identified 'urgent needs' such as immobilisation, when in need of personal care and mental distress as common perceptions. Additionally, studies suggest that the most common use of a telecare system is for an emergency situation e.g. in the event of a fall (Davies and Mulley, 1993; de San Miguel and Lewin, 2008; Dibner et al., 1982; Fallis et al., 2008; Fisk, 1995; Mann et al., 2005). However, even in an emergency situation, a button alarm may not be activated (Fisk, 1995; Levine and Tideiksaar, 1995; Porter, 2005). This can be due to the fact that users do not categorise their need as an emergency and do not want to 'bother' anyone as a result (de San Miguel and Lewin, 2008). In addition, it may be that users are unclear as to the purpose of their telecare system and the ways in which the service integrates with other emergency services (Riseborough, 1997; Thornton and Mountain, 1992). However, it is unclear as to how representative this perception is of all telecare systems users.

The service provided following the adoption of an assistive technology is associated with its continued use (Wessels et al., 2003). Telecare systems involve ongoing interactions between users and providers. While these interactions can be invisible, as some users may never activate their button alarm, there is an expectation that the service will work when needed. Studies suggest that a positive relationship between users and call monitoring centre staff is associated with the continued use of a telecare system, particularly following the activation of a button alarm in an emergency (de San Miguel and Lewin, 2008; Fallis et al., 2008; Fisk, 1995). This relationship is sustained by call monitoring centre staff whose role includes being patient with users, handling false alarms and providing a prompt response to requests (Boström et al., 2011; Fallis et al., 2008). The service provided after a telecare system is adopted is associated with its continued use.

The included studies suggested that users are mostly satisfied with the service offered by the providers of telecare systems. This satisfaction appears to be related to the ownership of a telecare system regardless of whether it has actually been used. For example, de San Miguel and Lewin (2008) identified four benefits of

telecare systems to users' everyday lives, which were also supported by other studies: first, users reported that telecare systems provided functional benefits such as faster access to help and support in an emergency; second, users reported that telecare systems provided psychological benefits such as reducing anxiety about falling, enhancing feelings of security and easing worries (cf. Mann et al., 2005); third, telecare systems can enable users to continue living at home for longer (cf. Fisk, 1995); and, fourth, telecare can increase users' confidence in performing activities of daily living (cf. Fisk, 1995; Mann et al., 2005). However, telecare systems were not found to have a significant impact on users' mobility or their contact with family or friends (de San Miguel and Lewin, 2008).

The included studies have highlighted the importance of involving users in the adoption process, ensuring that users know how a telecare system works, and providing a functional service. There is no clear evidence to suggest that users are always the ones who decide whether to adopt a telecare system and that individuals know how to use it. In particular, users may be unclear as to when to activate a button alarm as providers emphasise that they should only be activated 'in an emergency'. In these cases, users do not want to 'mis-use' the care technology and incur sanctions. However, the studies suggest that, following activation, users develop relationships with call monitoring centre staff that promotes use and can increase users' confidence in the service. Although telecare systems are not always used in the sense of activating a button alarm, the service behind the care technology does influence its user acceptance.

2.2.3. Discussion

Valuable lessons about the ownership and use of telecare systems can be identified from the included studies. The studies highlighted that user perspectives are well established and cover many of the factors identified by research on the use and non-use of assistive technologies (see, for example, Wessels et al., 2003). However, as telecare systems connect users to the outside world, an additional factor in their continued use is the service provided behind the technology and who responds when a button alarm is activated. This service-related factor distinguishes telecare systems

from other care technologies that do not facilitate mediated interactions between users and service providers. Therefore, regardless of use, telecare systems can be accepted or rejected based upon expectations of the service behind the care technology.

Historically, telecare systems have been designed, developed and promoted as 'emergency services' for older people at risk and living alone (Dibner et al., 1982). This interpretation informs the profile of users that telecare systems are provided to, which is based upon matching perceived 'needs' (e.g. falls response) to the affordances of the care technology to summon help and support quickly (see, for example, Mandelstam, 1997). In addition, perceived negativity towards the design of telecare systems reflects the fact that button alarms are designed to be cost-effective rather than aesthetically pleasing to the user. As statutory providers often buy telecare systems in bulk – at least in England – there is little incentive for the designers and developers of button alarms to change their practices[8] and this means that telecare systems are often engineered rather than designed (Mandelstam, 1997). As a result of the focus on telecare systems as a means of providing emergency services to older people, the included studies both reinforced and challenged the perception of users as old, 'at risk' and living alone. In many cases, the included studies found that telecare systems were owned and used by older people who were female and living alone.

The included studies suggest that there is a need to go beyond the perception that not wearing a button alarm is symptomatic of a 'deviant' user. In most cases, users are selective about when to wear a button alarm and they do so based upon their own self-reflections of their personal and social circumstances (e.g. when in the shower or with others). There are exceptions, however, such as those who forget to wear a button alarm due to cognitive impairments. In these circumstances, telecare systems are either not offered or use is managed. In addition to wearing a button alarm, there appears to be a mismatch between users' and providers' interpretations of how the care technology should be used. This includes the perception that a

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[8] Wessels et al. (2003) categorise this as an environmental factor although, in the case of telecare systems, the (lack of a) market influences the design of technologies most noticeably.

button alarm must only be activated in an emergency, with users fearing the consequences if they activate one 'incorrectly'. However, there is little evidence of the meanings that users ascribe to telecare systems and the negotiations that take place both in their appropriation and whether these meanings change over time.

Research on the use and non-use of assistive technologies suggests that meanings and meaning making play a role in two ways. First, becoming a user of an assistive technology can be influenced by how users perceive themselves and their situation (Hocking, 1999). In this sense, assistive technologies may be associated with users' perceptions of themselves as disabled, and therefore see themselves as a less valuable member of society. For example, Bowes and McColgan (2013) highlighted this in their study on telecare systems and drew tentative associations between ownership, use and users' identities (e.g. a 'failed' service user). However, across all of the other identified studies, the process of becoming a user was not discussed or limited to telecare systems that were pre-installed within sheltered housing.

Second, and related to becoming a user, the meanings that users attach to an assistive technology can influence use (Pape et al., 2002). In this sense, assistive technologies are seen as more than just functional objects but are also symbolic objects. This may be influenced by whether users think an assistive technology will help them cope with impairment and preserve a positive identity. In addition, meanings are also associated with the significance users place on autonomy and independence, and the role that telecare systems play in supporting them (Pape et al., 2002). This is an underexplored area within current research.

To extend current research there is a need to look beyond a 'compliance' model to the *active* role of users in acceptance, rejection and use.

2.3. Current research on home-based stroke telerehabilitation systems

2.3.1. Framework of the literature review

2.3.1.1. Aim

The review summarises current research on the design, development and use of telerehabilitation systems by stroke survivors. In particular, the review focuses on the 'user-centredness' (Iivari and Iivari, 2011) of current research in terms of four dimensions: 1) user[9] focus; 2) contextual awareness; 3) user involvement; and, 4) system personalisation.

2.3.1.2. Design

The general approach was that of a 'scoping review' (Arksey and O'Malley, 2005). This approach ensured wide coverage of the topic while at the same time utilising systematic review methods to ensure that the search was replicable. The review itself focused on studies addressing the design and use of telerehabilitation systems within the prototype stage of development. For the purposes of the review, the term 'telerehabilitation system' was a primary search term, and this also included the term 'robot' to identify studies focused on robotic telerehabilitation systems. In most instances, the full text of identified studies was consulted in order to determine the specific technology that was investigated. Unlike telecare systems, a variety of different technology types were identified under the umbrella term 'telerehabilitation systems'.

2.3.1.3. Search methods

Studies were identified using the following databases: ASSIA, CINAHL, IBSS, MEDLINE, PsycINFO, Scopus, Social Services Abstracts and Sociological Abstracts. These databases were selected as they indexed a broad range of journals and included conference proceedings. A number of relevant keywords were used that included

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[9] In this context, the term 'user' relates to stroke survivors although other users of telerehabilitation systems do exist such as health and social care professionals. However, these users' interactions with the technology are not the focus of my research.

synonyms for stroke (e.g. cerebrovascular accident), and that limited the search to studies focused on the upper limb (e.g. arm, hand and wrist). Wildcard characters were used to capture studies that used other terminology (e.g. robot* and tele*). Search results were not limited by the year they were published but were restricted to the English language.

2.3.1.4. Search outcome

The search yielded a total of 241 abstracts, which were printed and reviewed. A total of 199 publications were excluded, as they did not focus on telerehabilitation systems that were designed for use within users' own homes. The 42 articles that remained were then read in full in order to determine their relevance. As a result, eight articles were excluded as they did not focus on a technological intervention or were protocols. Five review articles were found (Johansson and Wild, 2011; Laver et al., 2013; Loureiro et al., 2005; Lum et al., 2012; Poli et al., 2013) and these were used to identify three additional studies through citation searching (Carey et al., 2007; Huijgen et al., 2008; Piron et al., 2009). Therefore, this literature review comprises 37 studies that focus on the design, development and use of telerehabilitation systems. The characteristics of the included studies are shown in Table 2.2.

First author	Year	Location	Publication	Context	Focus
Baran	2011	USA	Conference proceedings	Laboratory	Design
[+] Carey	2007	USA	Journal article	Household	Use
Chen	2011	USA	Conference proceedings	Laboratory	Design
Doornebosch	2007	The Netherlands	Journal article	Laboratory	Design
Durfee	2009	USA	Conference proceedings	Household	Use
Fluet	2012	USA	Journal article	Household	Use
Fluet	2014	USA	Journal article	Household	Use
[+] Huijgen	2008	The Netherlands	Journal article	Household	Use
Johansson	2011	Multiple	Review article	Household	Use
Johnson	2007	USA	Journal article	Laboratory	Design
Johnson	2010	USA	Journal article	Laboratory	Design

Jordan	2014	New Zealand	Journal article	Household	Use
Kan	2011	Canada	Journal article	Laboratory	Design
Kizonv	2006	Israel	Journal article	Mixed	Design and use
Laver	2013	Multiple	Review article	Household	Use
Linder	2013	USA	Journal article	Household	Use
Loureiro	2005	Multiple	Review article	Laboratory	Design
Lu	2011	Canada	Journal article	N/A	Requirements
Lum	2012	Multiple	Review article	Laboratory	Design
Mouawad	2011	Australia	Journal article	Household	Use
Park	2013	Korea	Conference proceedings	Laboratory	Design
Parker	2014	UK	Journal article	Household	Use
Pastor	2012	USA	Conference proceedings	Laboratory	Design
Piron	2002	Italy	Journal article	Household	Use
Piron	2004	Italy	Journal article	Household	Use
Piron	2008	Italy	Journal article	Household	Use
[+] Piron	2009	Italy	Journal article	Household	Use
Poli	2013	Multiple	Review article	Household	Use
Proffitt	2011	USA	Journal article	Household	Use
Reinkensmeyer	2002	USA	Conference proceedings	Laboratory	Design
Rodríguez-de-Pablo	2012	Spain	Conference proceedings	Laboratory	Design
Shakya	2008	USA	Conference proceedings	Laboratory	Design
Sivak	2009	USA	Journal article	Laboratory	Use
Sivan	2014	UK	Journal article	N/A	Requirements
Sugar	2007	USA	Journal article	Laboratory	Use
Sugarman	2006	Israel	Journal article	Laboratory	Design
Zhang	2011	USA	Conference proceedings	Mixed	Design and use

Table 2.2: Studies included in the literature review for telerehabilitation systems (n=37). This includes three studies identified through citation searches that are denoted with a [+] symbol for clarity.

Mendeley Desktop reference management software was used to organise journal articles that were then annotated using its built-in annotation tools.

2.3.1.5. Quality appraisal

As Section 2.2.1.5,

2.3.1.6. Data extraction and collation

As Section 2.2.1.6 but, in addition, four additional details were extracted: 1) the type of rehabilitation delivered (e.g. supervised, semi-supervised or unsupervised); 2) the context (e.g. the household or the laboratory) and the duration of any home-based evaluations; 3) any feedback from users on their experiences of using the telerehabilitation system; and, 4) the degree to which the study could be considered user-centred. This data were then used as a basis to present the results.

In order to determine the degree of user-centredness, an existing framework was adopted and refined to satisfy the review aim (Iivari and Iivari, 2011). The review framework consisted of four dimensions: user focus, context-centredness, user involvement and system personalisation. The first dimension focused on how users were identified and represented, which was determined using a 'sources of use knowledge' framework (Peine and Herrmann, 2012). The second dimension focused on the rationale for each included study and whether it contained details on the context of use. The third dimension focused on how users (i.e. stroke survivors) were involved in the research. The fourth dimension focused on system personalisation, which included the 'intelligence' of the intervention and the level of control that users had over the use of the intervention. Taken together, the four dimensions highlight the degree of user-centredness of current research on telerehabilitation systems along with areas for future improvement.

## 2.3.2. Results

2.3.2.1. Included studies

The final body of literature included for review comprised 37 studies (see Table 2.2). Five were reviews (Johansson and Wild, 2011; Laver et al., 2013; Loureiro et al., 2005;

Lum et al., 2012; Poli et al., 2013), two focused on the generation of requirements to guide the design and development of a telerehabilitation system (Lu et al., 2011; Sivan et al., 2014), and the remainder focused on the evaluation of prototype technologies. Evaluations took place across two research contexts: within a laboratory context (n=14) or within a household context (n=14). In addition, two studies presented evaluations across both contexts (Kizonv et al., 2006; Zhang et al., 2011). This enabled the researchers to test the feasibility of their telerehabilitation system and, in response to data that were generated by laboratory-based evaluations, update their design. Following these updates, the telerehabilitation systems were tested within users' homes. However, neither of the studies detailed what changes were made. In addition, no contextual information was presented that discussed the challenges faced by users once the telerehabilitation system was installed successfully.

Three categories of telerehabilitation systems could be identified from the studies: joystick-assisted (n=4), motion- or sensor-assisted (n=17), and robot-assisted (n=9). Research on joystick-assisted telerehabilitation systems utilised existing hardware that was then adapted to support the limited range of movements available to stroke survivors. In particular, commercially available joysticks (e.g. Microsoft Sidewinder) were used that connected to a desktop or laptop computer to control games or rehabilitation-focussed applications. The contribution of this research was the design and development of software that interfaced with this hardware, which researchers claimed minimised costs (Johnson et al., 2007; Johnson et al., 2010; Reinkensmeyer et al., 2002; Sugarman et al., 2006). As a result, these telerehabilitation systems were intended to support rehabilitation with minimal input from health and social care professionals. In this sense, the designers of these particular prototype technologies envisaged that users would purchase these telerehabilitation systems 'off-the-shelf' from supermarkets or other reputable establishments.

Research on motion- or sensor-based telerehabilitation systems has focused on the design and development of hardware and software components. Hardware such as Microsoft Kinect sensors (Pastor et al., 2012), motion sensors (Piron et al., 2002; Piron et al., 2004; Piron et al., 2008; Piron et al., 2009), Nintendo Wii controllers (Mouawad et al., 2011; Proffitt et al., 2011), 'sensorised' objects (Huijgen et al., 2008),

tracking technologies (Durfee et al., 2009; Jordan et al., 2014; Parker et al., 2014; Shakya and Johnson, 2008; Sivak et al., 2009), and webcams (Baran et al., 2011; Carey et al., 2007; Chen et al., 2011; Kizonv et al., 2006) were used. These telerehabilitation systems consisted of a desktop computer, visual display unit and motion- or sensor-based capture technologies (see, for example, Figure 2.1).
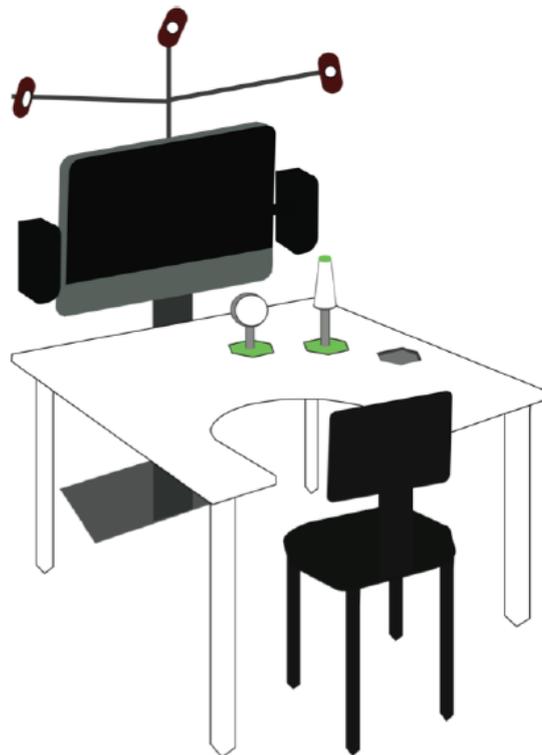
Figure 2.1: A schematic of the Home-based Adaptive Mixed Reality Rehabilitation (HAMRR) system developed by Baran et al. (2011) and Chen et al. (2011).

In some cases, a bespoke 'media centre' was developed that was installed within users' homes (Baran et al., 2011; Chen et al., 2011; Huijgen et al., 2008). As a result, research participants were recruited that had space for the intervention as well as an active Internet connection.

Research on robot-assisted telerehabilitation systems has focused on the design and development of hardware and software that can be used within a household context. This is a growing area of research within the field of telerehabilitation systems (Loureiro et al., 2005; Lum et al., 2012; Poli et al., 2013). The main difference between motion- or sensor-based and robot-assisted telerehabilitation systems is the utilisation of exoskeletons that fit over an upper limb (see, for example, Figure 2.2).

These exoskeletons are then connected to a desktop computer that captures movements and presents them on-screen. In terms of actuation, all of the identified telerehabilitation systems aimed to correct users' movements through motorised or pneumatic components (Doornebosch et al., 2007; Fluet et al., 2012; Fluet et al., 2014; Kan et al., 2011; Linder et al., 2013; Park et al., 2013; Rodríguez-de-Pablo et al., 2012; Sugar et al., 2007; Zhang et al., 2011). Four studies (Fluet et al., 2012; Fluet et al., 2014; Linder et al., 2013; Zhang et al., 2011) evaluated the use of a robot-assisted telerehabilitation system within users' homes over a period of one to two months. In all four studies, users were monitored closely for adherence to the robot-assisted rehabilitation programme.

Figure 2.2: Design of the Robotic assisted UPper Extremity Repetitive Therapy (RUPERT) system developed by Sugar et al. (2007) and Zhang et al. (2011).

Most of the included studies did not present any user perspective. Fourteen studies were identified that provided some feedback from users on their use of telerehabilitation systems. The majority of these studies presented 'usability' scores and suggested that users were 'satisfied' with using telerehabilitation systems[10]. This is in keeping with reviews on the field in general, which report high satisfaction with the technology (Johansson and Wild, 2011; Laver et al., 2013). The remainder of this

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[10] In particular, the System Usability Scale (SUS) is often used as a means of attributing a 'score' to a technology's usability based on answers to ten questions that focus on issues such as complexity, ease of learning and ease of use (Bangor et al., 2008).

section will focus on the 'user-centredness' of current research on telerehabilitation systems in order to identify the knowledge gap in which my research is situated.

2.3.2.2. User-centredness as user focus

The aim of user-centred design is to develop technologies that are tailored to the capabilities and needs of users. This is reflected in early formulations of the term, which emerged during the late 1980s (Norman, 1988). In order to design and develop technologies with user focus, therefore, prospective users need to be identified and their capabilities and needs represented (Iivari and Iivari, 2011). There are a number of ways that this knowledge can be generated and used, which ranges from 'non-representation' through to 'co-creation' (Peine and Herrmann, 2012). Non-representation refers to an approach whereby designers refer to their own practices and imaginations in order to develop a technology whereas co-creation involves integrating users within the design process to provide ongoing feedback regarding an evolving technology.

All of the included studies recognised that stroke survivors are a specific type of user. For example, recognising that stroke survivors experience difficulties with reaching to grasp and manipulate objects (see, for example, Durfee et al., 2009; Kan et al., 2011). Technologies were therefore adapted and customised to reflect the capabilities of stroke survivors whose upper limbs may be impaired. In most cases, technologies were bespoke and so design and development took this knowledge into account from their inception. However, real users were not involved in this design process until the technologies had been developed. This meant that users had relatively little influence over the direction of the design process or whose influence was restricted to suggesting minor tweaks to promote greater accessibility and usability.

Learning by using was a common means of generating knowledge from users and was identified within 29 of the included studies. Learning by using involved observing users interacting with a telerehabilitation system either within a laboratory context or within users' homes. In most cases, stroke survivors were recruited to inform these evaluations although four studies used non-impaired users instead (Baran et

al., 2011; Chen et al., 2011; Shakya and Johnson, 2008; Sivak et al., 2009) and five used a combination of both (Johnson et al., 2007; Johnson et al, 2010; Kizonv et al., 2006; Mouawad et al., 2011; Sugar et al., 2007). None of the included studies reflected upon the relative advantages and disadvantages of generating knowledge from stroke survivors themselves or through non-impaired users.

In addition to learning by using, health and social care professionals (e.g. occupational therapists and physiotherapists) were used as sources of indirect use knowledge. Lu et al. (2011), for example, surveyed 233 occupational therapists and physiotherapists to identify a list of their design requirements for robot-assisted telerehabilitation systems. In this case, these health and social care professionals acted as proxies for stroke survivors and were asked to comment on relevant issues such as their existing rehabilitation practices, the aim of rehabilitation, and sensory feedback. Similar approaches were identified in four other studies (Kan et al., 2011; Park et al., 2013; Parker et al., 2014; Rodríguez-de-Pablo et al., 2014) although indirect use knowledge was then incorporated into the design and development of an actual telerehabilitation system.

In most cases, knowledge about the capabilities of stroke survivors was used extensively. However, one study also identified the needs of stroke survivors in relation to rehabilitation. Sivan et al. (2014) interviewed nine stroke survivors and six health care professionals in order to determine the validity of the International Classification of Functioning, Disability and Health model for determining design requirements. This model focuses on the effect of impairments on body function, activity performance and participation while accounting for environmental and personal factors (WHO, 2001). Sivan et al. (2014) identified factors such as choice, convenience and motivation that may influence the acceptance of telerehabilitation systems, which were often neglected within the other included studies. Consequently, these factors could influence the longer-term use of the telerehabilitation system.

In terms of user focus, the included studies represented users in a number of ways. First, designers relied on their own knowledge of stroke survivors in order to develop

prototypes. This use knowledge was a mixture of implicit[11] and non-representation as some studies built upon previous research endeavours. Second, users were recruited to evaluate prototypes in order to determine their usability. This involved stroke survivors in most cases although non-impaired users were also recruited in order to infer usability. Third, designers worked with health and social care professionals who acted as proxies for stroke survivors. This use knowledge was then used to generate design requirements or to inform the development of prototypes. In all cases, designers were in charge of how use knowledge was utilised.

2.3.2.3. User-centredness as context-centredness

Beyond the capabilities and needs of individual users, technologies also need to be embedded within personal contexts and social networks. Exploring users' activities within these contexts as well as understanding the context of use is therefore a significant dimension of user-centredness (Iivari and Iivari, 2011). In terms of the included studies, context-centredness focused on the rationale for the design and development of telerehabilitation systems, and reflections on the context of use (e.g. households). In particular, the included studies often described the potential of telerehabilitation systems to promote intensive, repetitive training that could be performed in lieu of health and social care professionals (Johansson and Wild, 2011; Laver et al., 2013; Loureiro et al., 2005; Lum et al., 2012; Poli et al., 2013). By enabling rehabilitation to be performed within a household context, there were therefore implied cost savings in terms of reduced travel time as well as the potential for stroke survivors to self-rehabilitate. However, the majority of studies were technology-driven and focused on their ability to capture data on stroke survivors' upper limb movements.

Despite the significance of context to technology acceptance and use, it was only considered by two studies. Parker et al. (2014) found that space restrictions influenced where their telerehabilitation system could be installed. In addition, the authors found that ferromagnetic interference affected the functioning of their telerehabilitation system and this meant that users had to interact with it away from

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[11] "There is no conscious representation of users or use, but traces of earlier explicit attempts to represent users inform the construction of users and use." (Peine and Herrmann, 2012: 1503)

objects such as radiators. Parker et al. (2014) and Sivan et al. (2014) also identified that social network support influenced use, which included the willingness of informal carers to work with stroke survivors in order to incorporate a telerehabilitation system into existing rituals and routines. This need for support was often implicit within other studies, which described how formal and informal carers aided users in donning and doffing exoskeletons and helping users with hardware and software issues (see, for example, Fluet et al., 2012; Fluet et al., 2014; Zhang et al., 2011). However, none of the other included studies, particularly those that installed telerehabilitation systems within users' homes, described how they influenced rituals and routines.

Few of the included studies were 'context-centred' as they did not reflect upon the context of use. In most cases, outcomes were tested pre- and post-intervention, and it was assumed that users adhered to training programmes. Some studies concluded that users were satisfied with telerehabilitation systems (cf. Huijgen et al., 2008; Mouawad et al., 2011; Piron et al., 2008). However, it was unclear what users were satisfied with as satisfaction was measured on a numerical scale. For example, no study reflected upon what users thought about the intensity of training that they were required to complete over a period of several weeks. This reflects the technology-driven nature of most of the included studies, which sought to evaluate outcomes regardless of the impact of telerehabilitation systems on users' lives. In addition, approaches tended to neglect the significance of how individuals fit the use of telerehabilitation system into existing rituals and routines.

2.3.2.4. User-centredness as user involvement

Technologies are designed typically with particular users in mind and so potential users may be involved to some degree in the development process. This degree of user involvement may vary and can range from direct involvement through informative, consultative and participative roles (Damodaran, 1996) to indirect involvement by employing representative or surrogate users to speak on behalf of intended users (Iivari and Iivari, 2011). In terms of the included studies, research participants were often selected to represent the wider population of stroke

survivors and were involved in an informative capacity. This meant that users were observed interacting with a telerehabilitation system to determine usability. In addition, stroke survivors were recruited as consultants to provide comments and feedback on telerehabilitation systems whose designs were already advanced.

Surrogate users such as health and social care professionals were recruited in order to speak on behalf of stroke survivors. For example, Lu et al. (2011) surveyed occupational therapists and physiotherapists in order to elicit design requirements for a robot-assisted telerehabilitation system. In this instance, surrogate users were able to provide a holistic perspective on the stroke rehabilitation process and reflect upon the physiological and psychological factors that may promote or inhibit use. This approach to eliciting design requirements was also demonstrated in another study, which utilised focus groups to determine the role of feedback in producing positive rehabilitation outcomes (Parker et al., 2014). In other studies, surrogate users were recruited alongside stroke survivors in order to provide a comparative perspective on feasibility and usability (Park et al., 2013; Rodríguez-de-Pablo et al., 2013; Sugarman et al., 2006). In these instances, surrogate users acted as consultants who commented on design solutions.

None of the included studies involved users in a participative role. Stroke survivors had little to no involvement in decision-making processes with regards to the design of telerehabilitation systems. This was reflected in the methodologies of the studies, which involved recruiting users to evaluate telerehabilitation systems that were already advanced in terms of their design. In terms of recruitment, representative users were most often used and were selected based on their cognitive and physical capacities. However, despite user involvement in the evaluation process, knowledge generated was often not reported or used implicitly in order to improve future design and development.

2.3.2.5. User-centredness as system personalisation

Personalisation, in a technological context, is a design strategy that promotes the development of systems that cater for the diversity of users. A personalised system is one that is adaptable (i.e. it allows the user to customise the technology based on

their preferences) and/or adaptive (i.e. the technology updates automatically and 'learns' as a result of user interaction) (Brusilovsky, 1996; Iivari and Iivari, 2011). In some cases, a system may be both adaptable and adaptive.

In terms of telerehabilitation systems, a majority of the included studies discussed technologies that were not personalisable. In most cases, telerehabilitation systems were designed with fixed perceptions of users and were programmed to perform standardised tasks such as detecting and logging movements to an internal or remote online database. This lack of user personalisation meant that individuals' interactions with the telerehabilitation systems were limited to those envisaged by designers and health care professionals. In particular, through software that was tailored to task-oriented exercises that could be performed repetitively and at high intensity (Lu et al., 2011; Sivan et al., 2014).

Six studies were identified that discussed personalisation. Of these six studies, three (Kan et al., 2011; Park et al., 2013; Pastor et al., 2012) designed adaptive systems that collected user data and used that data to personalise exercise programmes or present feedback. For example, Kan et al. (2011) collected use data in order to issue reminders to users regarding their adherence to exercise programmes. This particular telerehabilitation system also took the capabilities of users into account when creating exercise programmes, which meant that the difficulty of activities was tailored to the user. In addition to adaptivity, three studies (Baran et al., 2011; Chen et al., 2011; Parker et al., 2014) presented telerehabilitation systems that were also adaptable. These telerehabilitation systems enabled users to create their own exercise programmes and set goals that increased motivation and involvement in self-rehabilitation. However, in all three studies, stroke survivors were aided by a health care professional, which ensured that exercise programmes and goals were achievable. While this limited the control that stroke survivors had over system personalisation it ensured that parameters were set that reflected the implicit knowledge that health care professionals had of users that could then be made explicit within the system.

2.3.3. Discussion

The field of telerehabilitation systems is diverse and this reflects the various categories of technologies that have been designed and developed (e.g. robot-assisted). However, the included studies highlight that there is a neglect of user perspectives on telerehabilitation systems despite the relative importance of stroke survivors to their sustained use.

From the data, it appears that the design and development of telerehabilitation systems has been driven primarily by the availability of technological components that enable the accurate detection and collection of movement data. In most cases, research projects have evolved over several years and involved producing multiple iterations of prototype systems that focused on implementing more accurate data capture technologies rather than focusing on the experience of users. In terms of user-centredness, feedback from users is rarely presented or is reduced to a system usability score that has little practical value to those outside of a particular research project. In addition, user satisfaction is consistently high although the reasons underlying satisfaction or dissatisfaction are not discussed[12]. This is reflected in the lack of contextual information that is presented alongside clinical data analysis.

As a result of researchers' fixation on the design and development of hardware and software components, the perspectives of stroke survivors – the intended users of telerehabilitation systems – are neglected. While stroke survivors are often involved in the design process it is to evaluate a pre-existing technology rather than to influence its development as exemplified by approaches to design based upon co-creation. This lack of user focus is reflected in the design of telerehabilitation systems themselves, which offer little in terms of system personalisation. With only a few exceptions, users have little control over how they use a telerehabilitation system and are restricted by the conceptions of designers and developers as to how they can, and should, use the technology within the context of everyday life.

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[12] This is a common phenomenon that has also been observed within the field of telemedicine whereby researchers fail to reflect upon the meaning of 'satisfaction' and what that means to the future design and development of care technologies (Mair and Whitten, 2000).

To utilise three concepts from science and technology studies, stroke survivors are constructed within current research on telerehabilitation systems as (lay) end users and, subsequently, become established as implicated actors (Oudshoorn and Pinch, 2003). As end users, stroke survivors are affected by the predominant constructions, interpretations and meanings of both rehabilitation and telerehabilitation systems as envisaged by designers, developers and health care professionals (Casper and Clarke, 1998). As lay end users, stroke survivors' influence over current and future design processes is minimal despite their involvement in evaluations (Saetnan et al., 2000). Finally, as a result of their lack of influence over design processes, stroke survivors become implicated actors who are affected directly by the actions of developers who have ultimate control over how telerehabilitation systems are designed (Clarke, 1998). This means that telerehabilitation systems are often objectified as accurate clinical data collectors rather than personalisable technologies designed to support rehabilitation.

The field of telerehabilitation systems lacks knowledge regarding how they are used in practice. Such knowledge would enhance current research by demonstrating how technologies become part of users' everyday lives and highlighting the challenges that they face in doing so. This is particularly important for the design and development of telerehabilitation systems as they are intended for sustained use over long periods of time. As such, telerehabilitation systems need to be acceptable to users in terms of ease of installation and use. Currently, researchers in most cases assume that stroke survivors will use telerehabilitation systems in predictable ways rather than use them in ways that are acceptable and meaningful to individuals' particular situations. My research sheds light on this particular aspect of telerehabilitation system use. In particular, through the application of an analytical framework and methodological approach that privileges user perspectives on the acceptance, rejection and use of telerehabilitation systems.

2.4.   Conclusion

In this chapter, I presented two literature reviews on telecare and telerehabilitation systems. In terms of telecare systems, the literature review focused on the

identification of factors related to acceptance, rejection and use. In terms of telerehabilitation systems, the literature review focused on the design and development of the technology with regards to the concept of user-centredness. While both literature reviews were conducted separately, a number of key themes can be drawn from them that are addressed by my research.

First, both literatures demonstrate that designers, developers and service providers inscribe the technologies with specific meanings. This includes perceptions of 'appropriate' and meaningful use, which users must negotiate through the process of use. Current research on telecare systems emphasises this aspect more than current research on telerehabilitation systems. However, even this research does not tend to reflect upon the meanings that users ascribe to both the technologies following their appropriation. Both literatures suggest that technologies are inscribed with functionalities and meanings prior to their appropriation but focus less on what happens after users appropriate them.

Second, both literatures emphasise how users are required to adapt to the technologies. However, current research tends to downplay the significance of how users adapt the technologies to suit their situations. This is most pronounced in the case of telerehabilitation systems, which require the active engagement of stroke survivors. However, little has been discussed with regards to how users incorporate the technologies into their everyday lives even over short periods of time. As current research on telecare systems has shown, there are a number of factors that can influence use. This illustrates the complexity of technology acceptance, rejection and use. Such complexity is taken into account within approaches to user-technology relations developed by research within science and technology studies that emphasise the mutual shaping of users and technologies (see, for example, Bijker and Law, 1992; Lie and Sørensen, 1996; MacKenzie and Wajcman, 1999), which is discussed in the next chapter.

Third, both literatures make reference to how personal and social factors influence the acceptance and use of technologies, which includes the availability of social networks of support (e.g. family and friends). This is most explicit in terms of

research on telecare systems that has highlighted how age, health status and household composition influence ownership and use. In terms of telerehabilitation systems, current research has focused on how stroke survivors' cognitive and physical limitations influence design although relatively little has been written about how these same limitations affect use. In most cases, stroke survivors' use of telerehabilitation systems has been supervised by a health care professional. There is therefore the potential to explore how these healthcare technologies are used in 'unsupervised' contexts such as the home.

What is missing from current research on telecare and telerehabilitation systems is a focus on the *relationships* between users and these health and care technologies, and how these relationships are negotiated within contexts such as the home. This includes questions such as how individuals negotiate health and care technologies after they have been appropriated and how the meanings of these technologies may change through use and as individuals navigate the life course. There is an opportunity to explore the ongoing relationships between users and technologies rather than focus on the influence of personal and social factors that *determine* acceptance, rejection and use. This is not to downplay the significance of these factors but to frame them in such a way as to demonstrate *interactive* relationships.

Insights from both literature reviews are combined to develop an analytical framework of health and care technology acceptance, rejection and use. This work is presented in the next chapter, which discusses the analytical framework that I developed and used to explore two separate case studies on telecare and telerehabilitation systems.

3. Analytical framework for exploring individual interactions with health and care technologies

3.1. Introduction

The focus of my research is on how health and care technologies are interpreted and used within the everyday lives[1] of individuals, which are shaped by life course transitions[2] such as those associated with ageing or life events like stroke. Current research identified in the previous chapter tended not to emphasise the significance of these life course transitions, which can influence the capacities of individuals who are negotiating changes in identity and self-perception. This is most pronounced within current research on telerehabilitation systems, which neglects the meanings that individuals ascribe to the technology and the ways in which individuals negotiate and transform their functionalities[3]. In contrast, current research on telecare systems has focused more on individuals' experiences through the application of

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[1] This term is taken to mean: "the ordinary ways [individuals] experience daily living, how they manage both successes and failures, and on the manner they construct their pasts and futures in relation to present events and developments" (Gubrium and Holstein, 2000: 3).

[2] The term 'transition' is akin to the notion of career, which stems from Hughes (1937: 410) who describes them as "points at which one's life touches the social order". Careers are particularly important from an individual perspective, as they constitute "the moving perspective in which the person sees his life as a whole and interprets the meaning of his various attributes, actions, and the things that happen to him" (Hughes, 1937: 413). In terms of the life course, careers involve the negotiation of changes in cognitive and physical ability, and the ways in which individuals experience and overcome these changes.

[3] This reflects the outcomes-based approach to evaluations within the field of telerehabilitation systems. Outcomes-based research is concerned with establishing causal relationships between interventions and observed changes. As Jutai et al. (2005: 294) note, outcomes-based research is the "systematic study of the effects produced by [technologies] in the lives of users". This type of research is relevant to the commissioners of health and social care services as well as health and social care professionals who use the technologies. However, evaluations of 'assistive' technologies based upon the identification of 'outcomes' have been criticised (Greenhalgh and Russell, 2010). For example, outcomes-based research tends to control for the settings in which technologies are used and therefore fails to account for *why* change occurs (Greenhalgh and Russell, 2010).

approaches based upon phenomenology[4] (see, for example, Greenhalgh et al., 2013). However, these phenomenological approaches have focused on *individual* action rather than how action is influenced through *social* interaction[5], and how the meanings that individuals ascribe to technologies may influence their actions.

The meanings that individuals ascribe to health and care technologies can have a significant influence on use (Gramstad et al., 2014). For example, researchers have found that individuals may interpret 'assistive' technologies as a means of preparing for the future, and provide them with comfort and reassurance regardless of use (Gramstad et al., 2014). What this research suggests is that individuals negotiate the acceptance of technologies within the context of everyday life, and this process of meaning making has an influence on use beyond that which is intended by designers, developers and providers. Approaches that draw attention to meaning and symbolism seek to shed light on this process by going beyond a functional account of particular technologies to consider how they are interpreted and used.

3.2.   Adopting a structural symbolic interactionist approach

A structural symbolic interactionist approach (Stryker, 1980) can address this lack of emphasis on the symbolism of technologies through its focus on the processes of meaning making from the perspective of individuals. As a theoretical approach, structural symbolic interactionism works within a broad symbolic interactionist framework (Blumer, 1966; Blumer, 1969), which argues that meaning is a product of social interaction and requires interpretation to stimulate action (Dennis, 2011). As Blumer (1969: 2) argues in his conceptualisation of symbolic interactionism: 1) "human beings act toward things on the basis of the meanings that the things have for them"; 2) "the meaning of such things is derived from, or arises out of, the social

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[4] Phenomenology is "the science (*logos*) of relating consciousness to *phenomena* (things as they appear to us) rather than to *pragmata* (things as they are)" (Carel, 2011: 34). There are a number of phenomenological traditions (e.g. existential, hermeneutic and transcendental) but a common goal is the study of 'lifeworlds' as they are immediately experienced, pre-reflectively, rather than how lifeworlds are conceptualised, theorised or reflected upon (Adams and van Manen, 2008).

[5] Social interaction "is about [negotiation]. … in order to explain action adequately, we must try to understand the situation from the actor's point of view. More specifically, we must attempt to understand his interpretations — that is, his changing cognitions" (Law, 1974: 165).

interaction that one has with one's fellows"; and, 3) "meanings are handled in, and modified through, an interpretative process used by the person in dealing with the things he encounters". This implies that the meanings of objects, such as technologies, are not intrinsic to, and embedded within, the objects themselves but are constructed, negotiated and renegotiated by individuals through processes of social interaction.

Structural symbolic interactionism takes a distinctive approach within the symbolic interactionist framework through its emphasis on structure [6], which is conceptualised as "patterned interactions and relationships, emphasizing the durability of such patterns, resistance to change, and capacity to reproduce themselves" (Stryker, 2008: 19). Society is defined in terms of social interactions that take place between groups, which can be differentiated by characteristics such as age, class and gender (Stryker, 2008). Individuals are born into societies where social relationships are made more or less likely based upon different backgrounds and resources. In terms of my own research, 'society' is taken to relate primarily to the caring networks involved in providing support to individual users of health and care technologies. However, it also relates to society more broadly who may influence how an individual perceives themselves and their use of a health and care technology (e.g. in the case of feeling stigmatised).

Social structures are influential in that they shape self[7] and, in turn, self influences action (Stryker and Burke, 2000). As Stryker (2008: 19) notes, the argument is that "society shapes self shapes social interaction". This means that individuals do not act with agency outside of structure but that "structure operates to constrain the conceptions of self, the definitions of the situation, and the behavioral opportunities

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[6] There are numerous approaches to structure and agency within the field of sociology. Giddens (1984), for example, argues that agency is both constrained and enabled by social structures (e.g. rules and resources), and that social structures are mediated through the agency of reflexive individuals. Another way to conceptualise the relationship between agency and structure is through the notion of process. Abrams (1982), for example, argues that over time actions become institutions and, in turn, institutions are changes through action. While these approaches are instructive, symbolic interactionism focuses more on the interpretive aspects of agency and how, through social interaction, structures are both constructed and reconstructed.

[7] The notion of 'self' was developed by Mead (1934) as a means of drawing attention to the unique nature of human beings as actors who are an object to themselves. As Blumer (1966: 535) summarises, "the possession of a self provides the human being with a mechanism of self-interaction with which to meet the world—a mechanism that is used in forming and guiding his conduct".

and repertoires that bound and guide the interaction that takes place" (Stryker, 1980:52). Therefore, within the context of structural symbolic interactionism, the relationship between individuals and society is seen as reciprocal: although society is claimed to pre-exist individuals, social interaction, in turn, shapes society.

The reciprocal relationship between individuals and society is conceptualised through the notion of 'roles'. In this context, roles are defined as "expectations and meanings that are attached to positions located [within] social structure" (Appelrouth and Edles, 2008: 478): for example, the role of father, mother or grandparent. I use the term 'role' to refer primarily[8] to being an 'end user' of a health and care technology. That is, an older person who uses a telecare system or a stroke survivor who uses a telerehabilitation system. These roles have associated actions and expectations that are inscribed within the design of a health and care technology, and are also manifest in the social interactions that individuals have with others such as family and friends. For example, the role of technology end user may come with an expectation that an individual will wear a button alarm for the technology to be seen as effective. Individuals may negotiate and subvert these expectations, as technological designs do not determine, but can inform, action (see Section 3.5).

While roles are constructed socially, which means that they may change over time, the argument is that they enable individuals to align their behaviour with expectations and enable them to evaluate the behaviour of others in relation to expectations (Burke and Reitzes, 1981). As Stryker (1980: 62) argues, "actors take the role of others to anticipate the consequences of possible patterns of action they can initiate and they take the role of others to monitor the results of their actions". As a result of this emphasis on roles and role-taking[9], structural symbolic interactionists

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[8] Individuals may also have other roles such as 'patient' that represents their relationships with health and care services. However, I am focusing on individuals' relationships to a health and care technology, and how that involves expectations and meanings that are negotiated through social interaction.

[9] Stryker (1988) criticises Blumer (1966) for his lack of attention to the role of social structures. However, Blumer (1966: 543) does in fact recognise the significance of roles and social structure but situates their existence within the context of symbolic interactionism more broadly: "there are such matters as social roles, status positions, rank orders, bureaucratic organizations, relations between institutions, differential authority arrangements, social codes, norms, values, and the like. And they are very important. But their importance does not lie in an alleged determination of action nor in an alleged existence as parts of a self-operating societal system. Instead, they are important only as they enter into the process of interpretation and definition out of which joint actions are formed". That is,

aim to understand how role expectations are interpreted, negotiated and renegotiated by individuals. In doing so, they argue that there is an association between action and the performance of roles (Burke and Reitzes, 1981).

From a structural symbolic interactionist perspective, the relationship between action and role performance is conceptualised in terms of 'identity', 'identity salience' and 'commitment' (Serpe, 1987; Stryker, 1980)[10]. In this context, 'identity' is defined as the "meanings one attributes to oneself in a role (and that others attribute to one)" (Burke and Reitzes, 1981: 84) such as 'older person' or 'stroke survivor'; 'identity salience' is the "probability ... of a given identity being invoked in a variety of situations" (Stryker, 1968: 560); and, 'commitment' relates to the extent to which action is dependent on being a particular kind of individual as "one is committed to being that kind of person" (Stryker, 1980: 61). More fully, commitment refers to "the relations to others formed as a function of acting on choices, such that changing the pattern of choice requires changing the pattern of relationships to others. ... In this sense, commitment is measured by the 'costs' of giving up meaningful relations to others should alternative courses of action be pursued" (Stryker, 1968: 560). Given its emphasis on the *social* nature of identity, the structural symbolic interactionist framework focuses on the formation and reformation of identity with respect to the social structures that influence how individuals present themselves to others.

The social nature of identity also relates to the embedding of a health and care technology within existing relationships. Issues of control, power and resistance may be pertinent to exploring and understanding how individuals negotiate identity. Pritchard and Brittain (2015) argue that technologies such as telecare systems have the potential to dehumanise by reducing individual autonomy and perceived control over their everyday lives, and create situations where individuals are stigmatised for

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roles and role taking do not determine action but are part of the ways in which individuals define situations and act collectively.

[10] This has parallels with the term 'impression management', where impression management refers to "the verbal and nonverbal practices we employ in an attempt to present an acceptable image of our self to others" (Appelrouth and Edles, 2008: 480). This is developed from dramaturgical theory, which argues that individuals act in ways that attempt to manage the impressions that others might gain of them through 'front stage' and 'back stage' performances (Goffman, 1959). Within the context of my research, the back stage could relate to users' homes whereas the front stage refers literally to the world beyond individuals' front doors.

wearing a button alarm. Technologies can "shift perceptions of self, but also change how other people view them" (Pritchard and Brittain, 2015: 129). While individual resistance is possible by not wearing a button alarm, subversion is relative to the social context of use and may be influenced by others such as family and friends (Pritchard and Brittain, 2015). This research suggests that identity can be influenced by the appropriation and use of a health and care technology, which may manifest itself through perceived changes in control or expressions of power, and resistance to technology in light of individual agency.

Reflecting back on the focus of my research, which is to understand how technologies are located and used within the context of individuals' everyday lives, a structural symbolic interactionist approach draws attention to two key arguments regarding the relationship between technologies and individuals. First, the meaning of a technology is negotiated through social interaction and is therefore not intrinsic to the technology itself. Second, individuals are located within social networks that influence and shape the roles they adopt and the ways in which they present themselves to others. In turn, through identity salience and an individual's commitment to certain identities, action can be understood by investigating the choices and performances that individuals make (Burke and Reitzes, 1981; Serpe, 1987; Stryker, 2008). However, this general conceptualisation leaves open two further questions that are addressed in the remainder of this chapter: the influence of life course transitions on individual agency and identity, and the ways in which a structural symbolic can be applied to a specific study of technology acceptance, rejection and use. An analytical framework is presented at the end of this chapter after addressing both of these questions in turn.

3.3.   A life course perspective: agency and identity

While identities remain relatively stable over time, transitions and life events can influence the everyday lives of individuals (Wells and Stryker, 1988). Given this, I utilise the life course perspective in order to supplement a structural symbolic interactionism framework by highlighting the *temporal* aspects of agency and identity. As Hutchison (2011: 8) notes, life course perspectives "[look] at how

chronological age, relationships, common life transitions, and social change shape people's lives from birth to death". A life course perspective draws attention to how lives are shaped through changes in roles and identities (i.e. transitions), and events that produce a lasting shift in the life course trajectory (Hutchison, 2011). For example, through transitions from employment to retirement and the changes that can emerge as a result. Becoming a user of a health and care technology could also be considered part of a life course transition.

Life course perspectives draw attention to individual agency while emphasising how social structures (e.g. gender, race and social class) and institutional structures and policies influence and shape the opportunities that are available to individuals (Elder, 1994; Stowe and Cooney, 2015). Individuals act *within* structures. However, working within a structural symbolic interactionist framework, it must be recognised that social structures such as gender and race do not exist 'out there' but are negotiated and shaped through social interaction. A life course approach within a structural symbolic interactionist framework therefore emphasises "how individuals set goals, take action, and create meanings within – and often despite – the parameters of social contexts, and even how individuals may change those parameters through their own actions" (Settersten and Gannon, 2005: 36). What this means is that individuals are agents able to influence and give meaning to their social worlds but these individuals are also influenced by structures.

The onset of chronic illness and stroke are examples of transitions that may influence significantly individual agency and the ability to exercise control over everyday life (Hitlin and Elder, 2007). From a functional perspective, life events such as chronic illness and stroke can make it difficult for individuals to perform everyday activities such as cleaning, cooking and dressing due to the effects of hemiparesis. In these circumstances, individuals may be required to draw on formal and informal carers as a source of help and support. For many stroke survivors, adjusting to everyday life post-stroke is therefore a lifelong process bringing together personal as well as social resources in order to promote recovery (Sarre et al., 2014). As Charmaz (1995) notes, adjusting to an impaired body involves coming to terms with impairments and working to live *with* them without living solely *for* them. However, transitions such as

chronic illness and stroke not only present functional challenges but also are associated with how individuals perceive themselves and their identities (Ellis-Hill and Horn, 2000; Ellis-Hill et al., 2000).

A key dimension of stroke recovery is associated with reconciling body and self through the construction of 'identity goals' whereby individuals strive to attain a 'preferred identity' (Charmaz, 1987). These preferred identities relate to how individuals wish to define themselves, and the means through which they can influence and implement positive changes in order to attain a desired future identity (Charmaz, 1995). From a structural symbolic interactionist perspective, this emphasises the role of meaning making within the life course and how action is shaped by a desire to meet identity goals that are, in turn, influenced by transitions and significant life events such as stroke (Charmaz, 1995). This introduces a future-oriented aspect to agency, which is reflected within life course approaches (Hitlin and Elder, 2007).

The life course perspective complements a structural symbolic interactionist framework by highlighting the significance of cognitive and physical change against the backdrop of transitions and life events (e.g. stroke). These transitions and life events can alter fundamentally the everyday lives of individuals due to the fact that they may alter an individual's capacity to participate in activities while also drawing individuals into networks of social relationships with others (e.g. formal and informal carers). This can influence and shape how individuals see themselves (i.e. identities and roles) but also provide individuals with an impetus to instigate change within their everyday lives.

Agency, within the life course perspective, is therefore about making future-oriented and reasoned choices that are within the constraints of social structures (Elder, 1994). For example, research suggests that individuals draw upon different resources (e.g. technologies, or formal and informal carers) in order to maintain connections to their homes and local communities (Peace et al., 2011). Maintaining control over one's life, therefore, becomes a significant goal for many older people and stroke survivors. For these individuals, opportunities for action (e.g. utilising certain technologies)

become especially meaningful in light of reduced capacities and a limited time horizon (Lang and Carstensen, 2002).

3.4. Dimensions of a structural symbolic interactionist approach to technology acceptance, rejection and use

While structural symbolic interactionism highlights the significance of roles and the relationship between individuals and society, it has not been applied to the study of processes through which objects such as technologies are made meaningful. In addition, structural symbolic interactionism tends not to focus on how technologies are used within everyday life. The remainder of this chapter addresses this gap through the creation of an analytical framework of technology acceptance, rejection and use. This is achieved in three sequential steps. First, five dimensions of a structural symbolic interactionist approach are presented. Second, the five dimensions are used to appraise existing approaches to user-technology relations (i.e. social constructivist, semiotic and feminist). Third, the 'domestication framework' (Lie and Sørensen, 1996; Silverstone, 1994; Silverstone et al., 1992) is introduced as a means of addressing some of the shortcomings identified with existing approaches to user-technology relations. In particular, the domestication framework draws attention to the processes through which technologies become functional and meaningful within the context of individuals' everyday lives. However, applications of the domestication framework tend to neglect how individuals, as well as technologies, change over time, and the influence that these changes have on individual agency and identity (see the previous section).

The structural symbolic interactionist approach I utilise is built upon five dimensions. These dimensions are used as 'sensitising' concepts (Blumer, 1954) to explore the relationship between individuals and technologies, and the processes through which meanings are constructed. First, individuals act in ways that express an identity, which relates to commitments and the salience of that identity. This means that identities are seen as social and provide an individual with "a standpoint or frame of reference in which to interpret both the social situation and his or her own actions

or potential actions" (Burke and Reitzes, 1981: 84). This means that actions are judged as appropriate or not in relation to an identity, which change over time through social interaction and self-interaction (Burke and Reitzes, 1981). Action is therefore understood as goal-directed: individuals act in order to match (or not) the meanings associated with a situation with those expected of a given identity standard (Burke and Reitzes, 1981; Stryker and Burke, 2000). This introduces an interpretive dimension to action whereby individuals are conceptualised as active in the decision-making process (i.e. the acceptance, rejection and use of particular technologies). Therefore, technology acceptance, rejection and use must be understood in relation to identity.

Secondly, ageing and chronic illness can have a significant influence on an individual's sense of identity. As well as affecting cognitive and physical capacity (e.g. dementia, decreases in strength or, in the case of stroke survivors, hemiparesis) and an individual's ability to act with agency, ageing and chronic illness can create a sense of disjuncture between body and self (Bytheway, 2011; Ellis-Hill and Horn, 2000; Ellis-Hill et al., 2000). For example, Satink et al. (2013) identify that managing discontinuity is often associated with post-stroke recovery and that managing discontinuity challenges stroke survivors to regain previous roles or to adapt to new roles as a consequence. Over time, stroke survivors are required to adopt an active role in their recovery and rehabilitation in order to achieve the most progress to some form of 'normality', and so there is also a strong emphasis on social relationships with others (Satink et al., 2013).

An emphasis on activity and self-management can bring with it changes in role expectations as well as increased dependence on others in order to facilitate the management of everyday life. As Bandura (2006) argues, agency can also be facilitated through interdependencies that enable individuals to exercise control in spite of cognitive and physical limitations. This is particularly significant for my research as it highlights the complexity of individuals' everyday lives. Interdependencies are the means through which they negotiate everyday life with regards to drawing on networks of social relations in order to promote change or maintain continuity.

Third, individuals act towards technologies based upon the meanings that the objects have for them, which is negotiated through social interaction (Blumer, 1969). The meaning of an object, therefore, is not intrinsic to the object itself but "arises from how the person is initially prepared to act toward it" (Blumer, 1966: 539). This means that objects may take on different meanings for individuals and that these meanings are chosen and negotiated through social interaction. For example, Gohal and Prasad (2000) utilised symbolic interactionism within their study on group decision support systems (GDSS). This enabled them to argue that the interpretations of the technology shaped how individuals interacted with it and how it was experienced. As a result, through their research, Gohal and Prasad (2000) were able to present an original account of why GDSS were used or not used that was grounded in the interpretations of individuals themselves. As Gohal and Prasad (2000: 509) argue, this was achieved by shifting the focus from "technology to an emphasis on human interaction, one that embraces the reasons underlying past inconsistencies rather than attempting to overcome them".

This has parallels with my research on technology, as the majority of current research (see the previous chapter) has emphasised the functional aspects of the technology's use (i.e. how they are used) but has not focused on the symbolic properties of technologies (i.e. why they are used by individuals or not). As Gramstad et al. (2014: 494) argue, the acceptance or rejection of assistive technologies "is not only related to their functionality but also to the meaning attached to them by [users]". This argument recognises that while technologies may be utilised primarily for their functionalities, these functionalities are made meaningful through use and their interpretations are shaped through social interaction within contexts.

Fourth, the meaning of a technology is derived through social interaction and is most fully understood with reference to the relationships *between* the technology, individuals and contexts (Snow, 2001). This draws attention to the interactions between these components that does not over- and underplay their influence on individual action. This is particularly relevant to health and care technologies because, just as individuals have different capacities based upon factors such as cognitive and physical limitations, technologies can constrain the ways that they are

used through their design and intended functionalities (i.e. affordances). As Hutchby (2001: 447) argues, "ignoring the different affordances which constrain both the possible meanings and the possible uses of technologies denies us the opportunity of empirically analysing precisely what the 'effects' and 'constraints' associated with technological forms are".

The meaning of a technology involves individual agency through which individuals define their own relationship to the technology. This acknowledges the 'content' of the technology (its materiality) and an awareness of structural constraints (e.g. health, illness and identity) that may challenge an individual's ability to alter significantly the meaning of a technology. Technologies are understood to be "artefacts [that] may be both shaped by and shaping of the practices humans use in interaction with, around and through them" (Hutchby, 2001: 444). This is particularly important as it suggests not only that the functions of a technology may enable or constrain action but that it is within the *relationship* between technologies and individuals that such affordances are lived out: while affordances can be designed into an artefact, it is through their use and individual interaction that affordances are negotiated (Hutchby, 2001).

Fifth, meanings are constructed, managed and transformed through an interpretive process through which individuals make sense of technologies with respect to their roles, and structural constraints and opportunities (Blumer, 1969; Stryker, 1980). The acceptance and use of technologies is not an inevitable outcome but is negotiated by individuals within their social networks as the technologies are introduced into their homes and are integrated into individuals' existing rituals, routines and practices (Rodeschini, 2011). This includes transforming the meanings that are ascribed to technologies by their designers, developers and providers in order for individuals to make the objects their own. Therefore, in contrast to ethnomethodological approaches[11] to user-technology relations that may focus exclusively on practices

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[11] Dennis (2011) draws attention to the differences between symbolic interactionism and ethnomethodology in terms of how they conceptualise meaning, individuals and contexts. In terms of meaning, "ethnomethodologists, [agree] with symbolic interactionists that meanings are generated in social interaction. Where they differ is in their insistence that those meanings are always contingent and subject to revision, correction, change, and replacement. Instead of focusing on what interpretations are made, then, ethnomethodologists emphasize the ways in which meaning is

(see, for example, Hughes et al., 1993; Sommerville et al., 1993), a structural symbolic interactionist approach focuses on "how events and situations are interpreted through individual 'sense making' processes" (Prasad, 1993: 104). In terms of health and care technologies, this relates to how individuals interpret the objects in light of identities and the expectations of others in relation to particular identity commitments.

Taken together, the five dimensions provide a foundation through which to explore and understand the processes of meaning making associated with the acceptance, rejection and use of technologies. The dimensions emphasise the role of identity and meaning, and how identity and meaning shape interpretations of technologies and the ways in which they may be used. The dimensions also draw attention to how this process involves relationships between individual agencies, the affordances of technologies and social structures. This is relevant to understanding the perspectives of older people and stroke survivors whose everyday lives are punctuated by health and social care issues. For these individuals, their experiences of technologies may be shaped through social interactions with others as well as transitions and life events. In this respect, there is a need to understand how the introduction and use of technologies affect and shape existing social relationships and facilitate social interaction. This, I argue, requires an analytical framework that highlights the agency of individuals and the process of meaning making in relation to technology acceptance, rejection and use.

3.5. Appraisal of sociological approaches to user-technology relations with respect to structural symbolic interactionism

The structural symbolic interactionist approach discussed above locates individuals within a framework that draws attention to the relationships between action, roles, identities, interpretation, meaning and (social) interaction. Agency is seen as

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produced, recognized, and transformed during an interaction" (Dennis, 2011: 351). In terms of individuals, ethnomethodologists reject the symbolic interactionist notion that individuals possess a self and instead focus on the interactional processes that produce actors (Dennis, 2011). In terms of context, ethnomethodologists focus more on how contexts are created and sustained in order to establish the features that are relevant to sustaining interaction (Dennis, 2011).

structured and is associated with identities that may be influenced by transitions and life events that take place over the individual life course, for example, through the onset of chronic illness or stroke. However, structural symbolic interactionist approaches have not been utilised to understand the relationships between health and care technologies and individuals, and the processes of meaning making that lead to technology acceptance, rejection and use. This raises questions such as: where does the 'user' fit within the process of technological change? Can individuals be constructed by designers and developers in such a way that acceptance is guaranteed? And, can individual end users of technologies act with agency or are their actions 'configured'? These questions will now be addressed in light of my structural symbolic interactionist approach.

Structural symbolic interactionism has received relatively little attention within research on user-technology relations. This is despite attempts to utilise symbolic interactionism within studies of product use, where researchers argue that individuals utilise products in order to facilitate action (Solomon, 1983). An example presented by Solomon (1983) is the case of actors who are unfamiliar with a new part who rely on 'prompters' to support their acting. In addition, while symbolic interactionism has been used to explore technology use within organisations (see, for example, Gohal and Prasad, 2000; Prasad, 1993; Schlosser, 2002) it has not been applied to technology use within the home. As a result of this neglect, there is an opportunity to utilise a structural symbolic interactionist approach in a novel way in relation to technology acceptance, rejection and use. This is achieved in my research by drawing on various sociological approaches to technology to construct a framework that can be explored and refined through empirical analysis.

In general, sociological approaches to technological change reject technological determinism. Technological determinism emphasises: 1) that technological change follows a path of its own and is independent of human action; and, 2) that changing technology brings with it social changes (MacKenzie, 1999). Instead, approaches within the sociology of technology (of which there are numerous strands) emphasise the 'social' nature of design, development and use (Mackay and Gillespie, 1992; Williams and Edge, 1996). As Williams and Edge (1996: 866) note, these sociological

approaches "show that technology does not develop according to an inner technical logic but is instead a social product, patterned by the conditions of its creation and use". Three approaches to user-technology relations (i.e. social constructivist, semiotic and feminist) are discussed in this section in order to situate the approach that is adopted within my research. While a number of other approaches to user-technology relations do exist (e.g. Technology Acceptance Model[12] or TAM), the three approaches that were chosen represent the approaches most relevant to my research and my argument.

In contrast to technological determinism, proponents of social constructivism argue that technologies do not determine human action but that human action shapes technologies. In this sense, the aesthetics, meanings and uses of a technology may develop in different ways as designers and developers make choices in relation to the content of a technology and the processes through which technologies are manufactured. Design and development is therefore seen as 'multi-directional' process involving choice and negotiation between 'relevant social groups' (Mackay and Gillespie, 1992; Pinch and Bijker, 1984). In this context, the term social group refers to "institutions and organizations (such as the military or some specific industrial company), as well as organized or unorganized groups of individuals" (Pinch and Bijker, 1984: 414). Throughout the process of design and development, these social groups interpret a technology in different ways, which is fed back into the process. However, over time, a predominant meaning and use of a technology emerges, and the technology is released into the market. This process is particularly relevant to health and care technologies whose functionalities and meanings are constructed around the provision of health and social care services, and goals such as the promotion of individual choice and independence.

Social constructivism tends to focus on the design and development of technologies and not what happens after individuals adopt a technology. This neglect has led to criticisms of the approach for its failure to take individual user perspectives into

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[12] The Technology Acceptance Model (TAM) proposes two concepts, perceived usefulness and perceived ease of use, which are seen as key determinants of technology acceptance (Venkatesh and Bala, 2008). TAM is used in order to 'predict' the use of technologies through an exploration and understanding of these two constructs.

account (Mackay and Gillespie, 1992; Winner, 1993). This criticism has been addressed within later conceptualisations of social constructivism through the recognition that individuals can influence the design and interpretation of technologies through 'novel use'. For example, utilising cars as hay rakes and pickup trucks (Kline and Pinch, 1996). However, within a broad social constructivist approach, neither the individual nor the technology is prioritised in terms of agency. An individual's capacity to modify the functions of technologies and to negotiate the meanings associated with technologies is therefore downplayed.

Given the issue of agency, semiotic approaches provide a means of exploring the relationship between individuals and technologies through the metaphors of technology as 'texts' or 'scripts'. Like social constructivism, semiotic approaches emphasise the ways in which technologies are designed and developed. However, semiotic approaches focus on how design and development processes construct and shape individuals' abilities to modify the functionalities and meanings of technologies, rather than the negotiations that take place between social groups (Oudshoorn and Pinch, 2003). For example, Woolgar (1991) conceptualises technologies as texts and individuals as 'readers' to draw attention to how use is shaped through design and development processes. This is achieved through a process of 'configuration' whereby designers and developers define "the identity of putative users, and [set] constraints upon their likely future actions" (Woolgar, 1991: 59). What this means is that designers and developers are able to influence the actions of individuals through the ways in which a technology is constructed. However, while the metaphor of technology as text opens up the issue of agency in terms of individuals' abilities to interpret technologies it raises the question of the extent to which use can be configured through design and development processes (Dutton, 1999).

In terms of configuring the user, design is seen as a process through which ideas about the 'user', and their perceived capabilities, are incorporated into a technology's hardware and software. This creates a particular relationship between individual and technology that is embodied in a technology's affordances (i.e. the physical properties that influence how an object can be used). On this view, a technology's acceptance is determined by assessing an individual's ability to negotiate the

technology's affordances. For example, their ability to activate a button alarm or put on an orthotic device. This leaves little room for creative technology use and also neglects the changing nature of the individual in terms of life course transitions and their influence on agency and identity.

Beyond the notion of configuration and perceiving of technologies as text, the concept of 'script' draws attention to the agency of individuals and how technologies constrain or enable action, and how technologies facilitate relationships (Akrich, 1992; Akrich and Latour, 1992). As Akrich (1992: 208) argues, "like a film script, technical objects define a framework of action together with the actors and the space in which they are supposed to act". Similar to the concept of configuration, which argues that images of individuals are incorporated into the design of technologies, scripts comprise assumptions about individuals (e.g. interests, motives and skills) that then become materialised within technologies. As a result, technologies are said to contain scripts that "attribute and delegate specific competencies, actions, and responsibilities to users and technological artifacts" (Oudshoorn and Pinch, 2003: 9). In contrast to the notion of configuring the user, the concept of script conceptualises designers, developers and individual users as active agents in the construction of a technology. Therefore individuals are able to 'resist' technologies and able to develop their own relationships with them. However, the focus is most often on the perspectives of designers and developers rather than the perspectives of individual users themselves (Oudshoorn and Pinch, 2003).

Semiotic approaches to health and care technologies have gained currency in recent years by addressing the aforementioned lack of focus on individual user perspectives. This follows from the adoption of the script concept within feminist approaches to user-technology relations, which emphasise the importance of studying the inscription of gender into technologies to improve our understanding of how technologies invite or inhibit performances of gender identities and social relationships (Oudshoorn and Pinch, 2003). Peine and Neven (2011), for example, have developed the notion of 'age scripts' to draw attention to how designers and developers inscribe visions of ageing within products. As a consequence, they argue, health and care technologies may constrain the actions of individuals if stereotypical

images of older people are utilised that do not consider how individuals experience ageing over time (Peine and Neven, 2011). Semiotic approaches are therefore useful particularly in engaging designers and developers as they highlight the ways in which their actions and assumptions influence how health and care technologies are interpreted and used, and that these processes may evolve over time.

Semiotic approaches tend to focus on how the designers and developers of technologies influence the actions of individual users rather than how individual users influence and shape technologies. For example, the notion of configuration can imply that the only option for intended users of technologies is to accept or reject the predefined meaning and use of a technology (Oudshoorn and Pinch, 2003). As a result, individuals are granted too little agency to negotiate and transform the functionality and meaning of technologies to meet their needs. In addition, semiotic approaches tend to conceptualise the 'user' as a technical actor who will interact with a technology in a functional way to meet a need. However, as Dutton (1999), Mackay et al. (2000) and Silverstone and Haddon (1996) argue, individuals do not always conform to this 'ideal type' as they act as consumers embedded within networks of social relations. That is, individuals negotiate the functionalities and meanings of technologies within the context of their everyday lives (Silverstone, 1994). This is pertinent to a structural symbolic interactionist approach as it recognises that health and care technology users do not adopt a single identity that can be 'configured' but exhibit multiple identities that are employed in situations.

Feminist approaches to user-technology relations[13] take up the issue of identity through their emphasis on the consequences of technologies from an individual user's perspective. Therefore, unlike social constructivist and semiotic approaches that take technologies as their primary unit of analysis, feminist approaches explore

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[13] There are a number of feminist approaches to technology. Cockburn and Ormrod (1993) focus on the production and consumption of the microwave oven, and how these processes reproduce masculine and feminine stereotypes. Wajcman (1991) focuses more on how women are stereotyped as technologically incompetent and are invisible within discussions about technology. Wajcman (1991) argues that there is a male bias in the definition of technology and how it is produced, where the definition of technology is taken to mean: 'know-how'; what individuals 'do' with technologies; and, their physical components. This definition is used to reflect upon how technologies are socially shaped to argue: "we need to analyse the specific social interests that structure the knowledge and practice of particular kinds of technology" (Wajcman, 1991: 162).

the consequences of technology use for women in particular (see, for example, Casper and Clarke, 1998; Clarke, 1998; Saetnan et al., 2000). In addition, feminist approaches highlight the role of other individuals within an individual's social network and how these individuals enable or constrain technology consumption. For example, Cowan (1987) drew attention to how individuals are embedded within social networks (e.g. across household, retail, production and governmental domains) and that these configurations influence how and when technologies are adopted through her conceptualisation of the 'consumption junction'.

As Cowan (1987: 263) argues, the consumption junction is "the place and time at which the consumer makes choices between competing technologies". This emphasis on choice and social network construction is extended by Bakardjieva (2006), who argues that technologies and individuals are mutually constitutive: individuals embedded within social networks enable the use of technologies through the creation and adoption of roles such as the 'warm expert' (Bakardjieva, 2005); and, technologies themselves facilitate social interaction through their ability to facilitate and mediate communication. Bakardjieva (2006) and Cowan (1987) focus more on the material properties of technologies and constitution of social networks that emerge as a result of technology adoption and use rather than how technologies are constructed as meaningful objects (Silverstone, 1994).

The three approaches discussed above provide a number of insights into the relationship between technologies and individuals. However, the approaches discussed tend to focus on the design of technologies rather than the relationships between design and use (Button, 1996; Pfaffenberger, 1988). In doing so, individuals' interactions with technologies are often not prioritised. This leaves open questions of the negotiations that take place regarding the appropriation of technologies and, subsequently, what happens to technologies once they are brought into the context of individuals' everyday lives. There is therefore a need for a theoretical approach that maintains the affordances of technologies and the agency of individuals, which explores the "social relations from which technology arises, and in which technology is vitally embedded" (Pfaffenberger, 1988: 281). One such approach is the domestication framework, which aims to transcend the binary division between

design and use by emphasising how design influences use but also how individual agency and meaning-making has an influence on the acceptance, rejection and use of technologies (Lie and Sørensen, 1996; Silverstone, 1994; Silverstone et al., 1992).

3.6.   The domestication framework: an emphasis on agency, context and meaning

In the previous section, a number of approaches to user-technology relations were introduced and discussed (i.e. social constructivist, semiotic and feminist). While all of these approaches emphasise different aspects of the relationship between the design and use of technologies, the approaches do not highlight how technologies are often made meaningful within the everyday lives of individuals. As Button (1996) and Pfaffenberger (1988) argue, the approaches tend to neglect the social interactions that take place through design *and* use. Addressing this criticism therefore requires an approach to user-technology relations that brings together agency, context and meaning. One such approach is the domestication framework (Lie and Sørensen, 1996; Silverstone, 1994; Silverstone et al., 1992), which argues that:

> *"Technologies should [not simply] be seen as innocent and completely malleable [artefacts]. Rather, the domestication argument is that technologies should be seen as under-determined and not undetermined. Designers inscribe visions and actions into artefacts, and they are probably successful in shaping users' actions quite often. However, this may only be clarified through empirical analysis of actual use." (Sørensen, 2006: 57)*

Domestication provides a framework through which to analyse the processes involved as technologies are introduced and then used within the home (Silverstone, 1994). It focuses on interpretation and the meanings that individuals construct regarding technologies, and aims to promote an understanding of the social interactions and negotiations between individuals that lead to their acceptance, rejection and use. The domestication framework argues that technologies are incorporated into the everyday lives of individuals in order to become functional and that this is not a straightforward process (Oudshoorn and Pinch, 2003). As Lie and Sørensen (1996: 17) assert, "domestication is the practical as well as emotional adaptation to technologies ... it is a process of appropriating an object to make it meaningful to one's life". This goes beyond the notion that technologies become

'stabilised' following their release (i.e. social constructivism) to argue that technologies take on 'a life of their own' following adoption.

Beyond the approaches to user-technology relations discussed in the previous section, the domestication framework locates technology use within the context of the home. Within the home, individuals order economic and social activities according to a set of beliefs and values, which are referred to as the 'moral economy of the household' (Silverstone, 1991; Silverstone et al., 1992). This concept of the moral economy[14] draws attention to the normative and symbolic interactions and negotiations that take place both within the home (between individuals) and through the ways in which these interactions and negotiations are shared with the outside world. Technologies (and other objects) are particularly significant to this process of negotiation and "to domesticate an artifact is to negotiate its meaning and practice in a dynamic, interactive manner" (Sørensen et al., 2000: 167). The domestication framework proposes that to explore the moral economy of the household involves studying the 'biographies' of technologies that enter and leave the home (Kopytoff, 1986; Silverstone et al., 1992). As Silverstone (1994: 99) notes in relation to the biographies of technologies:

> *"Objects ... have their own lives. The histories of the technologies, of the products or commodities, ... all contribute to the particularity of a technology as object and to its changing status within public and private spheres. Once across the threshold of the domestic spaces, of course, those lives continue, played out in the microsocial and cultural environments of the home. ... The particular route that each object follows as it runs its life-history from inception to obsolescence ... not only illuminates its own biography but also throws a light onto the culture and cultures through which it moves."*

Through negotiations that take place as technologies are adopted and used, the domestication framework draws attention to how functionalities and meanings may change over time. As Hynes (2009: 26) notes, technologies are "socially shaped, and

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[14] In my research, I focused on the household as the context for health and care technology interaction. While the household was conceptualised as an interactive space (cf. Silverstone, 1994), I chose not to focus on the meso-level interactions between household members. This was because it was assumed that many of those I was going to interview and observe were living alone. Had I chosen to focus more on the interactions between household members (and the outside world), the notion of the 'negotiated order' (Strauss et al., 1963; 1964) may have been useful. This concept addresses questions of how social orders are negotiated in the face of change and how social orders inform interaction processes (Maines, 1982). This concept has been applied to further understand patterns of doctor-nurse interaction (Allen, 1997; Svensson, 1996) in an institutional setting (i.e. hospital wards). While instructive, my research focused more on social structures at an individual level through the concepts of agency, identities and roles.

adoption and use are social processes". This is particularly relevant to a structural symbolic interactionist approach, which emphasises the importance of social interaction and the relationships between individuals and society in constructing and negotiating meaning (Snow, 2001). Technologies, it is therefore argued, are made meaningful through interpretation and social interaction, which takes place within the home (Silverstone, 1994). In order to capture the complexity of this process, four dimensions or 'moments' of domestication can be identified: 'appropriation', 'objectification', 'incorporation' and 'conversion' (cf. Silverstone and Haddon, 1996; Silverstone et al., 1992).

Appropriation draws attention to the deliberations that take place between individuals and members of their social networks *prior* to the adoption of a technology. Appropriation captures the "negotiations and considerations that [lead] to the acquisition of technologies" (Haddon, 2011: 312). Once a decision has been reached, technologies are then brought into the home where they either satisfy individuals' expectations or are a source of disappointment (McCracken, 1988). This is an ongoing process involving the interaction between individuals and technologies over time. Research drawing on the concept of appropriation has tended to focus on consumer goods such as televisions (Silverstone, 1994). However, beyond the individual user and their social networks, health and social care service providers often facilitate the appropriation of health and care technologies (Mandelstam, 1997). Given the involvement of health and social care service providers, health and care technologies are constructed through the lens of health and social care provision. This leaves open the question of the extent to which individuals are able to negotiate and transform the functionalities and meanings of health and care technologies beyond those constructed by the health and social care organisations that are integral to the process of appropriation.

Following appropriation, domestication approaches argue that technologies are *located* and used within the context of the home and everyday life. This involves the *spatial* location of technologies (e.g. the front room) and the *symbolic* location of technologies (e.g. hidden from view when others come around to visit or on display for all to see). *Objectification*, therefore, emphasises how technologies are displayed

and the ways in which technologies reflect the aspirations and values of those who feel comfortable with them (Csikszentmihalyi and Rochberg-Halton, 1981; Silverstone, 1994). As Silverstone (1994: 127) notes, objectification "is expressed in usage but also in the physical dispositions of objects in the spatial environment of the home".

The emphasis on space and use highlights another dimension of the domestication framework, which is *incorporation*. Incorporation focuses on the functionalities of technologies and how their use fits within the rituals and routines of everyday life. These functionalities may differ from those intended by designers, developers and producers as they may be altered through the interactions and negotiations between individuals within the home (Silverstone, 1994). The dimensions of objectification and incorporation draw attention to the negotiations that take place in relation to the function and meaning of technologies. This goes beyond the notion that technologies achieve 'closure' in the design process and highlights the need to explore their use within the context of homes. Appropriation and incorporation draw attention to the *content* and affordances of technologies that are 'real' in their materiality, which complements a purely symbolic interpretation of technologies.

The final aspect of technology acceptance, rejection and use that the domestication framework draws attention to is *conversion*. Conversion is about how individuals share their experiences of technologies with others both within and outside of the home as part of their identities (Haddon, 2006). As Silverstone (1994: 130) notes, "whereas objectification and incorporation are, principally, aspects of the internal structure of the household, conversion, like appropriation, defines the relationship between the household and the outside world". Conversion draws out the *social* aspects of technologies and how their meanings are shared between individuals through social interaction, and how this process, in turn, shapes use (Snow, 2001). This social aspect of technology use is particularly relevant to my research, which argues for an appreciation of the meaning of technology and the ways in which this meaning is constructed through social interaction. While health and care technologies are embedded within the home context, the process of conversion draws attention to how, and whether, individuals talk about the technologies with others both inside and outside of the home context.

The domestication framework draws attention to how technology acceptance and rejection is a practical *and* symbolic process (Lie and Sørensen, 1996; Sørensen et al., 2000). In terms of practice, domestication involves appropriation and the placement of technologies. It also entails the integration of a technology into the context of everyday life (Sørensen et al., 2000). For example, by drawing attention to the negotiations that take place regarding the use of a technology and how this process is managed through social interaction between individuals. In terms of symbolism, the domestication framework emphasises the meaning making processes through which individuals ascribe meanings to technologies and utilise the technologies in order to contribute to an identity, which is, in turn, presented to others. As Silverstone et al. (1992) argue it is through use that the functionalities and symbolism of technologies are subject to change, and may enable or constrain the performances of identities.

Despite drawing attention to how the capacities of *social groups* as a whole may constrain or promote domestication (see, for example, Silverstone, 1994), research utilising the domestication framework has tended to neglect how the capacities of *individuals* may influence domestication. There is therefore a need to locate the domestication framework within a life course perspective that draws attention to the capacity of individuals, which may be influenced by transitions and life events. This is discussed in the next section before turning to my analytical framework that brings the domestication framework together with structural symbolic interactionism within a life course perspective.

3.7.   Domestication and capacity in relation to a life course perspective

The domestication framework tends to focus on the capacity of a social *group* rather than the capacity of individuals within networks. Silverstone (1994: 98), for example, defines domestication as "the *capacity* of a social group [to] appropriate technological artifacts and delivery systems into its own culture – its own spaces and times, its own aesthetic and its own functioning – to control them, and to render them more or less 'invisible' within the daily routines of everyday life". This definition

is also reflected within the earliest applications of the domestication framework, which focused on information and communications technology (ICT) use among the 'young elderly' (Haddon and Silverstone, 1996). The term 'young elderly' was used within this particular research to denote a social group who were still healthy but were beginning to experience the first signs of age-related deterioration (Haddon and Silverstone, 1996).

As identified previously (see Section 3.3), older people and stroke survivors are a particular kind of social group whose capacities may be altered as a result of ageing and chronic illness. As a social group, older people and stroke survivors may share a number of common issues related to health and chronic illness. However, older people and stroke survivors are not a homogenous social group as older people and stroke survivors themselves are influenced by different life course transitions (Hutchison, 2011). An approach to capacity that draws attention to the diversity of older people and stroke survivors is therefore necessary.

Within a life course perspective, the notion of 'capacity' is a multidimensional concept and is associated with agency (Hitlin and Elder, 2006). Capacity can be associated with an individual's ability: 1) to assess and understand the situation that they are in, which is known as 'comprehensibility'; 2) to find a meaning and reason to act (e.g. an identity goal), which is known as 'meaningfulness'; and, 3) to act in accordance with the resources available to them, which is known as 'manageability' (Lindström and Eriksson, 2005). Defined another way, capacity involves the *availability* of resources (e.g. education, housing and social networks) – or accessing others who have the necessary resources – and the *capability* of individuals to utilise these resources effectively in order to instigate change (Bandura, 2006). What both of these conceptualisations draw attention to is the *social* nature of capacity, which brings together individual action and interpretation, and social interaction in terms of resource utilisation. This highlights that capacity, within a life course perspective, is 'structured' as social relations surrounding an individual, as well as the resources that are available to them, can influence the extent to which individuals are able to act with agency (Hitlin and Elder, 2006; Tausig, 2013).

This notion of capacity in terms of comprehensibility, meaningfulness and manageability links particularly well with the arguments presented in this chapter. First, it promotes the idea that individuals have agency through which to interpret their everyday lives and to act in accordance with (identity) goals. That is, action involves an assessment and understanding of a particular situation and finding a reason to act in order to influence that situation. Second, it locates technology acceptance, rejection and use within the context of individuals' everyday lives, but this goes beyond the view that capacity is solely about *individuals* but about individuals located *within* social networks that are drawn upon as a source of help and support. Whereas the domestication framework emphasises the capacity of social groups, a life course perspective draws attention to the experiences of individuals that are negotiating significant life events and transitions. These experiences could have implications both in terms of the appropriation of technologies, such as through the promotion or loss of control that they may afford, as well as in the decisions and negotiations that take place with regards to adoption, objectification and incorporation. Domestication, therefore, is seen as a *social* process within a life course perspective.

3.8. Analytical framework: structural symbolic interactionism and the domestication framework within a life course perspective

The domestication framework locates technology acceptance, rejection and use within an everyday life context. The domestication framework argues that it is within the context of everyday life that technologies become functional and meaningful (Silverstone, 1994; Silverstone, 2005). However, little research has been conducted utilising the domestication framework in relation to health and care technology use. One example is Pols (2012), who used the domestication framework to establish how individuals draw on assistive technologies to manage the care that they receive. However, little attention was paid within this research to the meanings that were constructed and negotiated through use, and how agency and capacity influenced

how individuals interacted with the technologies within a domestic context[15]. It is this particular neglected issue that my research addresses.
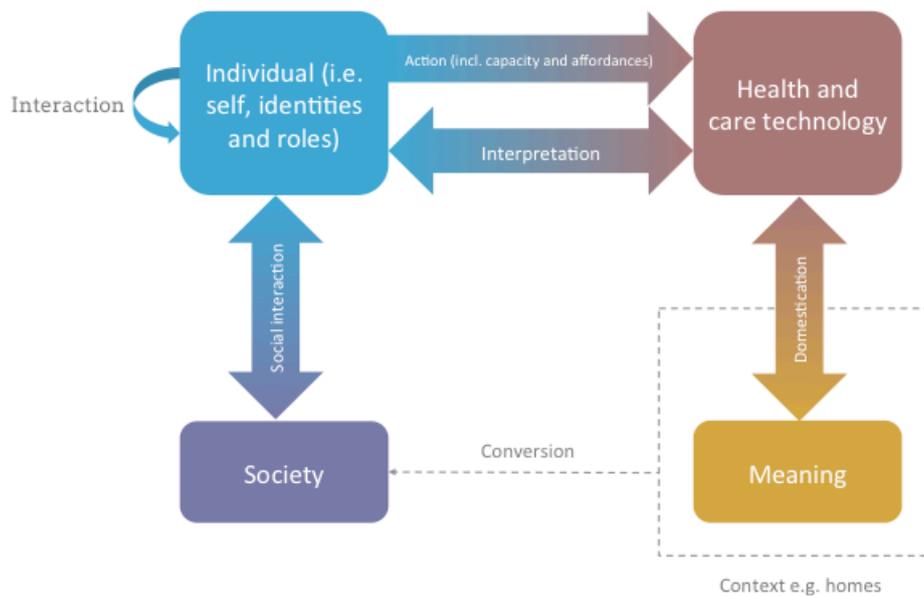
Figure 3.1: Outline of a framework of technology acceptance, rejection and use that draws upon concepts from symbolic interactionism and the domestication framework.

I devised an analytical framework for exploring the acceptance, rejection and use of technologies from an individual user's perspective (see Figure 3.1). The analytical framework builds upon the domestication framework and structural symbolic interactionist conceptualisations of agency, identity and roles (Blumer, 1969; Stryker, 1980) within a life course perspective. Structural symbolic interactionism is considered an appropriate perspective as it focuses on the views of individuals and how social interaction and the meanings that individuals ascribe to technologies influences action. This draws attention to the social dimension of technology acceptance, rejection and use, and the negotiations that take place between individuals located within society. The analytical framework emphasises the role of (social) interaction and the agency of individuals to accept, reject and use health and care technologies.

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[15] Within a symbolic interactionist framework, contexts can be seen as both 'lay' and 'professional' (Dennis, 2011). The former are constructed by individuals themselves whereas the latter are "determined by sociologists: by gathering together different kinds of interactions on the basis of their formal features, it is possible to classify them as particular 'kinds' of interactions that can then be compared and contrasted with others" (Dennis, 2011: 353). In terms of my analytical framework, the focus is on the home as a context but also as the setting through which technologies are both made meaningful and used (Silverstone, 1994).

Within the framework are a number of elements that are linked through the concepts of action, interpretation and interaction that unfold over the life course. The framework is multi-layered in that it builds upon the relationship between individuals and society by incorporating the role of technologies within that relationship. The 'core' of the framework is the individual, which refers to the end users of health and care technologies that are conceptualised in terms of self, identities, and roles, which influence the actions of individuals. These elements (i.e. self, identities and roles) are shaped by, and shaping of, social interactions within society that may include those within an individual's caring network (i.e. formal and informal carers) or those involved more broadly in the delivery of health and social care services (e.g. call monitoring centre operators). Individuals are seen as embedded within caring networks and act in relation to the expectations and meanings associated with their role as an end user of health and care technologies.

The 'outer' layer of the framework, on the right-hand side, introduces technologies that are associated with individuals in two ways. First, the functional aspects of technologies are emphasised through the concept of 'action', which incorporates the relationship between technological affordances and the capacities of individuals. The former describes the range of possible actions that are made available to individuals while the latter describes the capacity of individuals to interact with the technologies. Technologies are conceptualised as objects that are designed and developed to privilege certain actions but that these actions are subject to the capacities of individuals. Capacities may be constrained by health and social care issues as a result of transitions and life events.

Second, the symbolic aspects of technologies are highlighted by the concept of 'interpretation', which draws attention to the construction and negotiation of meanings that are illustrated by the dimensions of the domestication framework (i.e. appropriation, objectification, incorporation and conversion). These functional and symbolic aspects of technologies are then shaped through social interaction, which, in turn, are shaping of the functional and symbolic aspects of health and care technologies. The framework is cyclical in that components exist within a network of relationships (Snow, 2001). This means that health and care technology acceptance,

rejection and use are explained with reference to both their functional and symbolic aspects. In addition, it highlights the agency and capacities of individuals who are located within society who must negotiate these functional and symbolic aspects within the context of their life course.

My framework emphasises the role of interaction and interpretation, and builds upon how assistive technologies and individual users exist in relation to one another (Lie and Sørensen, 1996). Agency, context and meaning are significant in the process of technology acceptance, rejection and use, and that these components (i.e. agency, context and meaning) can be explored successfully through a structural symbolic interactionist framework. As a result, the framework suggests that action related to technologies is associated with individual users' interpretations and these are shaped through 'self' and social interaction. These processes are understood in terms of the dimensions of the domestication framework (i.e. appropriation, objectification, incorporation and conversion) that draw attention to the practical and symbolic work involved in health and care technology use. Drawing on the domestication framework elaborates upon the argument that individuals act towards health and care technologies based upon the meanings to individual users.

My framework addresses this question surrounding the construction of meaning by drawing attention to the social processes through which individuals interact with health and care technologies. This includes how individuals perceive health and care technologies but also how these perceptions may change over the life course. For example, through ageing and chronic illness that can influence an individual's capacity, identities and roles. The formation and transformation of meaning is located within the context of everyday life that, from a life course perspective, is social. What this means is that the acceptance, rejection and use of a health and care technology is not just about interpretation but interpretation in light of changes that are experienced at an individual level through interaction.

3.9.   Conclusion

The argument that my research makes is that current research on health and care technologies has not fully recognised and developed the perspectives of individual

users and the perspectives of those whose everyday lives may be shaped by transitions and life events. To address this, an analytical framework was constructed. The framework draws upon a range of sources, including structural symbolic interactionism, the life course perspective and the domestication framework. These sources draw attention to the significance of individual agency and the role of identity and social interaction in influencing and shaping individuals' experiences of technologies. Technologies are taken as both material *and* symbolic objects, which individual users negotiate and use within the context of everyday life. Rather than suggesting that all individuals are the same, this chapter argued that individuals are unique in their situations and that their interactions with technology will reflect this.

My analytical framework extends the theoretical approaches (i.e. social constructivist, semiotic, feminist and domestication) discussed in different ways while maintaining some of the arguments made by each. First, while social constructivism focuses on the relationships between social groups to achieve the 'closure' of a technology, my analytical framework opens up this process by emphasising the role of individual users. This includes the significance of the individual in constructing and negotiating the meaning of technologies through social interaction. While designers and developers may build certain functionalities into technologies, individual users may circumvent these functionalities and use them in unintended ways. However, this is not to argue that individuals have an unbounded capacity to shape health and care technologies, but that individual users *interpret* and negotiate health and care technologies in ways that are meaningful to them.

Second, drawing on semiotic approaches, my analytical framework highlights that technologies may be 'scripted' and designs may 'configure' individual users. Health and care technologies are often designed with particular functionalities in mind and this is reflected in their aesthetics. This can influence, although not determine, how individuals interact with them. For example, a button alarm is designed for individuals to wear worn around the neck or on their wrist. Conversely, telerehabilitation systems are designed for interaction and so their designs are tailored towards ease of use and to motivate. However, just because a technology is designed in a particular way does not mean it will be used this way. I therefore draw upon the concept of

affordances and interpretation that incorporate an individual user's perspective on interaction. Domestication is also utilised to highlight the meaning making processes that can alter how individuals perceive a health and care technology. Taken together, these concepts draw attention to the scripting of health and care technologies but also the capacities of individuals to interact with them over time.

Third, my analytical framework is sensitive to feminist approaches that focus on issues of identity (Casper and Clarke, 1998; Clarke, 1998; Saetnan et al., 2000) and consumption (Bakardjieva, 2006; Cowan, 1987). I do this by situating users of health and care technologies within society and contexts such as the home. These are both dynamic spaces where social interactions take place. Social interactions between individuals and others within social networks have the potential to influence individual identities and roles, and their relationships to health and care technologies. However, I go further by focusing on how the *meaning* of health and care technologies is constructed and negotiated through social interactions. This leaves open questions of how issues of identity and consumption are experienced by individuals from their perspectives as health and care technology users.

Fourth, drawing on domestication, engagement with health and care technologies is conceptualised in terms of *processes* of interaction. This includes how health and care technologies are designed, brought into the home, and are interacted with over time. My analytical framework contributes to the domestication framework by focusing on ongoing *interaction* and how action is located within contexts such as the home. Appropriation is seen as a significant process as it through appropriation that the meanings of health and care technologies are constructed and negotiated. Appropriation is not just an individual act but involves those close to individuals such as family and friends. Then, as a health and care technology is brought into the home, individuals' interpretations of the objects may change as they discover its utility through interaction. I use the domestication framework to draw attention to how meaning making is an *ongoing* process that is negotiated as individuals interact with health and care technologies. This is in relation to individual agency, capacity and identities that are experienced within the home.

In the upcoming chapters, my framework is explored through the analysis of two case studies. These case studies were selected intentionally to explore different aspects of the analytical framework. In particular, drawing attention to varying degrees of interaction and the role of design in configuring the user. The next chapter focuses on the research methodology that was employed. I then present my results chapters. The findings are then used to construct a theoretical framework of health and care technology interaction.

4.   Methodology

4.1.   Introduction

The aim of my research was to understand the role of agency, context and meaning in the acceptance, rejection and use of technologies designed to support individuals with health and social care needs. The research question that I addressed was: *how does the process of health and care technology acceptance, rejection and use occur in practice from a user's perspective?* My aim and research question followed from the previous two chapters, which identified a gap in current research with regards to understanding how and why two technologies (i.e. telecare and telerehabilitation systems) are accepted, rejected and used. In particular, the lack of research on the role of meaning and how meaning factors into users' decisions to accept, reject and interact with technologies. An analytical framework was constructed as a means of addressing this gap, which drew upon concepts from structural symbolic interactionism, the life course perspective and the domestication framework. This analytical framework provided a 'conceptual scheme of the empirical world' (Blumer, 1969) that focused on interaction, interpretation and the processes of meaning making that are assumed to contribute to the acceptance, rejection and use of health and care technologies.

This chapter presents the methodology I adopted to answer my research question. There are a number of components to this, including my justification of a case study research design and selection of cases. I discuss my planned data generation activities (i.e. document examination, qualitative interviews and observations), and approach to analysis and findings synthesis. The chapter concludes with a discussion of the anticipated issues in working within a life course perspective that may

influence the conduct and role of the researcher. These issues are important to acknowledge from both an ethical and a practical perspective.

4.1.1. A qualitative research approach

Given my emphasis on user perspectives and the relationships between users and technologies in terms of interaction, interpretation and meaning, a qualitative research approach was appropriate. While there are many 'qualitative' research traditions, it focuses generally on providing an understanding of how the social world is interpreted by individuals. Qualitative research is suited to studying the processes through which individuals make sense of their social worlds within particular contexts (Barbour, 2008; Given, 2008; Mason, 2002). As Denzin and Lincoln (2011: 3) argue "qualitative researchers study things in their natural settings, attempting to make sense of or interpret phenomena in terms of the meanings people bring to them". For my own research, this involved engaging with individuals to identify how they interpreted and used technologies within their everyday lives.

4.1.2. A case study research design

A number of approaches to qualitative research exist that each have strengths and weaknesses. Creswell (2013) argues that there are five approaches to qualitative research, which are narrative research, phenomenology, Grounded Theory, ethnography and case study. However, the approach that was best suited to my research was case study, as it focuses on the exploration of a contemporary bounded system through detailed, in-depth investigation (Creswell, 2013; Stake, 2005; Thomas, 2011; Yin, 2014). While definitions of the term 'case study' are contested, it is taken to mean "analyses of persons, events, decisions, periods, projects, policies, institutions, or other systems that are studied holistically by one or more methods" (Thomas, 2011: 514). For my research, the focus was on the relationships between individuals and technologies within their homes.

The rationale for choosing a case study research design was threefold. First, my research question focused on how individuals experienced a contemporary phenomenon of technology use. This type of question is suited to case studies as

opposed to experimental, historical or survey-based designs (Yin, 2014). Second, the focus of my research was on developing a theoretical framework. Whereas other research designs tend to reject prior theorisations, case studies utilise analytical frameworks from the outset (Meyer, 2001; Thomas, 2011). Third, case studies are instructive when the boundaries of the case are known and require further exploration (Creswell, 2013). For my research, the area of interest was how two technologies were used within the context of the household and this provided a boundary that helped to delineate the cases.

4.2. Selection and justification of cases

The selection of cases is a debate within the field of case study research. For example, Yin (2014) advocates selecting cases based upon their representativeness or 'typicality', which follows from a predominantly positivist interpretation of case studies. Stake (2005), who interprets case studies in a more interpretivist way, advocates selecting cases that provide an 'opportunity to learn' rather than focusing on their representativeness. Thomas (2011), extending Stake (2005), argues that the typicality of a case is a meaningless notion that gives the reader of a case study the wrong impression that the significance of an analysis rests in the representativeness of the case. Cases should be selected for their ability to provide an interesting, revealing or unusual insight into the phenomena under investigation (Thomas, 2011).

Given the focus on selecting interesting cases, the logic of sampling cases is different from statistical sampling, which aims to select a sample from a population in order to explore the distribution of an outcome variable. Case selection, in contrast, involves 'purposeful' or theoretical sampling in which the goal of the researcher is to choose cases that are likely to confirm or extend an emergent theory or explore the diversity of concepts (Eisenhardt, 1989). As Silverman (2013: 146) argues, case selection should not be "based on statistical grounds but derived from a particular theory which we seek to test". Hence, whereas statistical sampling concerns itself with ensuring representativeness, theoretical sampling focuses more on generating data that are rich in depth by selecting cases purposefully rather than randomly. In light of the logic of theoretical sampling, and my intention to explore the dimensions of my

analytical framework, I constructed two cases that enabled me to understand the experiences of both older people and stroke survivors who were engaging with different technologies within their everyday lives. In both cases, I was interested in engaging with users of the technologies rather than approaching older people and stroke survivors who may not have used the technologies. The characteristics of the two cases are summarised in Table 4.1.

Characteristic	Case one	Case two
Primary user	Older people	Stroke survivors
User motivation	Maintaining independence and accessing help quickly in an emergency	Restoring physical function post-stroke without the aid of a health professional (i.e. self-management)
Technological maturity	Established	Prototype
Temporal aspects of use	When needed through activating a button alarm connected to a call monitoring centre	Used for at least one hour every day for six weeks; usage monitored by a member of the research team
Context of use	Provided as part of a social care support package by request of the individual user	Provided as part of a research project signed up to by the individual user

Table 4.1: Characteristics of the two case studies selected to address my research question.

The first case that I focused on was a telecare system provided by a local authority. This first case enabled me to explore the processes through which an established technology was appropriated and was incorporated into individual users' everyday lives. I targeted individuals who already had a telecare system so that they would be able to share their experiences of use. As older people are the primary users of telecare systems, they were the social group I chose to focus on. I was not interested in individuals who did not have a telecare system or who were in the process of appropriating one. To understand the context of use, an emphasis was placed upon exploring and understanding the negotiations that took place regarding the appropriation of a telecare system. Individuals were also asked about situations when they had used their telecare system and what the technology meant to them.

The second case that I focused on was a telerehabilitation system that had been designed for use by stroke survivors. This technology exemplified an innovation likely to be produced in the future but was currently in a prototype design and

development phase. The rationale behind selecting this case was that it enabled me to explore the interactions that took place as the telerehabilitation system was installed in individual users' households and the negotiations that took place regarding its incorporation into the everyday lives of individuals over a period of time. Unlike the first case where individuals already owned the technology, the intention was to explore the ways in which the telerehabilitation system was introduced to individual users and how it was then used to support rehabilitation. To this end, recruitment centred on those who had chosen to take part in a research project exploring the use of a prototype telerehabilitation system.

Both of the cases were selected purposefully in order to shed light on different aspects of my analytical framework. The most significant difference between the cases was the context of use surrounding the technology. On the one hand, telecare systems are provided within the context of a social care system that aims to promote independence through care and support services. Within this context, telecare systems are provided to enable users to remain at home while giving them access to a responsive service should they need it. As older people are the primary users of telecare systems, their ownership and use may coincide with individuals' goals to remain independent in later life but also the desires of formal and informal care providers to support an individual (Bowes and McColgan, 2013). As 'older people' are a diverse social group, understanding how telecare systems were integrated into their everyday lives required talking about their appropriation as well as the ways in which they are used in practice.

Telerehabilitation systems, on the other hand, are part of a health care system that focuses on rehabilitation and the reduction of impairment. Individuals are expected to take an active role in their rehabilitation through their interactions with technology. A greater emphasis is therefore placed on users' engagement with technology to self-manage, and the impact this has on health-related outcomes (Jones, 2006). As a major aspect of stroke rehabilitation is adjustment to its effects, understanding where an individual is in their illness trajectory (Kirkevold, 2002) is essential for understanding their approach to technology use and its significance within their everyday lives.

The cases were chosen as they exemplified instances of technology use to support social and health care services for older people and stroke survivors, respectively. The context of use was important in both cases, as was the difference between the gradual life course changes experienced by older people as opposed to the potential for more sudden biographical changes post-stroke. The cases could be classified as 'instrumental' in that they were chosen to provide insight into technology use from an individual's perspective rather than focus on the specific nature of the technologies in question (Stake, 2005). That is, the intention was to utilise the cases in order to contribute to a general understanding of technology acceptance, rejection and use rather than focus on the constitution of the technology itself.

4.3. Data types and methods

Case studies involve the in-depth study of a phenomenon or multiple phenomena in light of the researcher's analytical framework. Due to the emphasis that a case study design places upon exploring and understanding a case, multiple methods of data generation are recommended (see, for example, Baxter and Jack, 2008; Eisenhardt, 1989; Stake, 2005). To construct my own cases, I drew upon multiple data generation methods (i.e. document analysis, qualitative interviews and observations) in order to address my research aim and question. The rationale behind utilising these multiple data sources was to 'triangulate' findings, where triangulation is a means of exploring and drawing attention to multiple perspectives on a phenomenon (Seale, 1999; Seale, 2002; Stake, 2005), rather than as a positivist approach to convergence around a singular reality[1].

My case studies focused on users' experiences of two technologies, a telecare and telerehabilitation system, and the processes through which the technologies were introduced and incorporated into users' everyday lives. The data that was required to address my research question was informed by my analytical framework and fell into three categories: 'contextual', 'demographic' and 'perceptual' data (Bloomberg and Volpe, 2008). Contextual data was required to provide background information

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[1] This is debated further by Seale (2002: 102) who argues for a constructivist reading of the term 'triangulation' that draws attention to its relevance to "providing multiple perspectives on a problem, with discrepancies between data sources being themselves 'findings'".

for each case such as the details of the technologies and the relationship between its providers and individual users. This data was considered essential as it enabled me to develop an understanding of the case prior to engaging with users and, following engagement with users, provided me with a lens through which to situate their accounts. The presentation of rich, contextual data also enables readers of each case to draw parallels with their own experiences in order to assess their potential utility.

Documents produced by the organisations involved in the provision of both technologies were a helpful source of contextual data. By drawing on these documents I was able to understand more about the technical details surrounding each technology's design, development and provision. The documents also provided me with a means of understanding how the providers of both technologies conceptualised and talked about the 'user', and the ways in which the user was configured (Woolgar, 1991). It is recognised that while there are a number of different ways of approaching documents within a qualitative research approach, my intention was to use the documents as resources and to explore the content that could be found within them (Prior, 2008). I therefore did not intend to explore how the documents came into being, as in 'archaeological' approaches, or how, within an organisational context, they were used as a resource by individuals (Prior, 2008).

There are benefits and drawbacks to using documents as a source of contextual data. A benefit of using documents is that they can be accessed (relatively) easily as retrieval may not require interaction with others. This meant that I was able to access documents early in the construction of my cases to inform other methods. However, there are two drawbacks that, when combined, can limit documents' utility. First, documents are produced for a purpose and may contain certain information while withholding other information. This can make the identification of relevant information difficult, as the researcher has no control over its content. Second, documents may be used as a tool to present a 'reality' that privileges certain information over others. This form of 'bias' can limit the utility of a document if the context of its production and use is neglected. However, given that I utilised the documents as a resource in order to inform other methods, these weaknesses were

less of a concern than would have been the case if documents were the only source of data.

Demographic data was sought from users such as their age, sex and living arrangement. While this data was not used to infer any causal associations between individual users' perspectives and their demographics it provided an overview of who was involved in the research to situate individuals' responses. As with contextual data, demographic data enables the reader of a case to assess the ways in which the findings could be applied to their own situation. Additionally, by engaging with individuals, I was able to explore their perspectives on both of the technologies and the processes through which the technologies were introduced and incorporated into individual users' everyday lives. This data was then be used to construct a representation of users' perspectives on technology acceptance, rejection and use.

It was anticipated that qualitative interviews and observations would be the most helpful methods for generating data on individual users' perceptions. Qualitative interviews enable the researcher to explore the experiences of others in order to understand more about their perspectives on the social world (Mason; 2002; Rubin and Rubin, 2012). As Brinkmann and Kvale (2015: 6) argue, the qualitative interview has "the purpose of obtaining descriptions of the life world of the interviewee in order to interpret the meaning of the described phenomena". A key dimension of the qualitative interview is its emphasis on the social production of knowledge, which involves maintaining an active relationship between the researcher and research participants (Brinkmann and Kvale, 2015; Holstein and Gubrium, 1995). The qualitative interview involves the construction or reconstruction of knowledge through an ongoing relationship between the researcher and research participants rather than the excavation of knowledge (Brinkmann and Kvale, 2015; Mason, 2002).

Observation was used as a means of supplementing data generated from qualitative interviews with individual users of the telerehabilitation system. Observations provide insight into interactions and processes that go beyond those that can be understood through verbal accounts (McNaughton Nicholls et al., 2014). In addition, observations enable the researcher to explore a phenomenon within a 'natural

setting' and to collect data that is naturally-occurring as opposed to retrospective accounts of a phenomenon such as those constructed during qualitative interviews (Mason, 2002). This is relevant to the case of engaging with a telerehabilitation system, as the affordances of the technology required the active engagement of users. Observations were therefore helpful to identify some of the challenges faced by individual users when interacting with the telerehabilitation system.

4.4. Development of interview topic guides

To ensure that there was consistency in the generation of data I developed 'topic guides' for both cases. Topic guides outline issues to be explored with research participants and act as an aide-mémoire of what should be discussed (Arthur et al., 2014). While topic guides do not prescribe what questions will be asked during a research encounter, or presuppose the direction that a research encounter may take, they help direct the researcher and ensure that they focus on generating data that are relevant to their research aim and question. This is beneficial to the researcher but also to research participants as it ensures that they are not encouraged to over-share or divulge information that is not relevant to the researcher. This can be an issue when engaging with older people who are often willing to discuss issues in detail with the aid of 'life scripts' (Lundgren, 2013).

Given that I intended to develop a theoretical framework, I addressed questions relating to research participants' interpretations and use of technologies as well as their perceptions of themselves as older people and stroke survivors. This included asking open questions regarding the technology's adoption and the ways in which it was used in everyday life. To ensure that questions focused on these issues, I consulted best practice guidelines as well as books focused on interview techniques (see, for example, Brinkmann and Kvale, 2015; Mason, 2002) I anticipated that talking about issues of identity may be difficult for some research participants and so questions relating to this issue were asked near the end of the research encounter (see Appendix A). This enabled research participants to gain some familiarity with the research so that they felt more comfortable talking about identity issues. This

particular issue is discussed by Arthur et al. (2014) and also came up in 'best practice' discussions with colleagues in health services research.

The topic guide for telecare systems centered on the reasons why individuals appropriated the technology and how it had been put to use. The aim was to explore whether others supported the appropriation of a telecare system in any way and to understand how individuals used them to negotiate everyday life. Research participants were also asked whether they wore a button alarm and, if not, the reasons why this was not the case. Questions related to the individual were then asked such as their health status and whether this had changed in recent years. This helped to contextualise individuals' experiences and perspectives, and encouraged them to talk about how a telecare system 'fit' within the dynamics of their life course. Finally, research participants were asked whether they'd recommend telecare systems and to clarify whether they saw them as 'badges of old age', which is suggested in the literature (see, for example, Pritchard and Brittain, 2015).

The topic guide for the telerehabilitation system focused on the reasons why research participants got involved in a telerehabilitation system project, and the difficulties that they have faced engaging with the technology. Drawing upon dimensions of the analytical framework (see Section 3.8), research participants were asked about the spatial and temporal negotiations they had experienced, and how these had influenced and shaped the meaning of the technology to them. The aim of these questions was to compare and contrast these user experiences with the documentation provided by the research project that designed the telerehabilitation system to identify differences. Finally, research participants were asked to talk about their experiences of stroke and the meanings that they attached to being a stroke survivor. As with those interviewed about telecare systems, these experiences of living with stroke helped to contextualise comments and to help generate shared experiences across research participants.

4.5.   Overview of research design

An instrumental case study approach was adopted to address my research aim and question. This included the selection of two cases that exemplified the acceptance,

rejection and use of technologies by older people and stroke survivors. The following table brings together the data types that were sought and the methods that were planned to generate data. In addition, the table separates out the methods for each case, as they are different due to the nature of the technologies explored. That is, users of the telecare system did not have to be observed using the technology whereas observing users of the telerehabilitation system was helpful to understand the challenges that they faced when engaging with the technology rather than relying on accounts from qualitative interviews.

Data type	Description	Method
Contextual	Description of the technology and intended functionality; conceptualisation of users	Document review
Demographic	Description of research participants such as age, sex and household status	Qualitative interviews
Perceptual		
1) A local telecare system	Research participants' descriptions and perceptions of the technology	Qualitative interviews
2) A telerehabilitation system	Research participants' descriptions and perceptions of the technology including observations of the ways in which it is used and engaged with interactively	Observations Qualitative interviews

Table 4.2: Overview of research design including mapping between data types, methods (i.e. document review, qualitative interviews and observations) in relation to cases.

Note: the ways in which each of these methods was applied and used in practice are presented in the upcoming chapters on a case-by-case basis.

Research design involves decisions about the time frame for research and how long it will last. To this end, I worked with two different time frames that were relevant to the technologies under investigation. For the first case, which focused on a technology already in use, a single research encounter with each research participant was considered a suitable approach. However, for the second case, which focused on the ongoing use of a technology, I observed and interviewed research participants over a period of six weeks, which was the timespan of the research project. I first observed the technology being installed and then interviewed users

after they had used the technology for four weeks. This ensured that research participants could provide informed reflections on its use and any challenges faced.

Given that both cases are independent of each other, I approached and recruited research participants in different ways (see Section 4.8.1). The main challenge faced was my dependence on a research project for the second case as the recruitment of research participants was outside my control. However, I managed this situation by engaging periodically with a member of the research project in order to gauge as and when they had research participants available to observe and interview. While this situation was not ideal, as it meant that I could not control for who was recruited, there was no other option as I wished to explore and understand the processes through which a novel technology was interacted with by stroke survivors.

4.6.   Planned data analysis and synthesis

The challenge throughout data generation, analysis and synthesis is to make sense of large amounts of data. Merriam (1998) argues that data generation and analysis should be a simultaneous activity to reduce the risk of repetitious, unfocused, and overwhelming data. I analysed data alongside generating data. Conducting data analysis alongside data generation had (at least) two benefits. First, it meant that interpretations remained 'current' rather than waiting for all data to be generated. Second, analysis could be used to inform data generation by emphasising the data points that were 'saturated' or needed more attention. To this end, conducting data analysis concurrently with data generation enabled themes to be identified proactively with and against my analytical framework (Green et al., 2007).

4.6.1.   Data analysis as a 'theoretical reading'

Given the development of my analytical framework, I approached data analysis as a 'theoretical reading' that involved the interpretation of meaning. A theoretical reading utilises theory in order to interpret data in an eclectic, but systematic, manner (Brinkmann and Kvale, 2015). I drew upon the concepts developed within my analytical framework (see Chapter 3) in order to explore and understand research participants' accounts of technology acceptance, rejection and use. For example, I

used the domestication framework that describes a number of dimensions to shed light on the processes of technology acceptance, rejection and use. Each of these dimensions were utilised as 'sensitising concepts' through which to organise interview transcripts and observational notes. Sensitising concepts aim to provide researchers with "a general sense of reference and guidance in approaching empirical instances. Whereas definitive concepts provide prescriptions of what to see, sensitizing concepts suggest directions along which to look" (Blumer, 1954: 7).

Utilising my analytical framework in a sensitising way involved 'coding' elements of transcripts and notes that were associated with the concepts and comparing accounts to identify areas of agreement and disagreement. As Coffey and Atkinson (1996: 29) note, this process involves "noticing relevant phenomena, collecting examples of those phenomena, and analysing those phenomena in order to find commonalities, differences, patterns and structures". By approaching data analysis in this way, the intention was to work with my analytical framework while remaining grounded in the data that had been generated and not imposing a 'reading' of the data uncritically and without warrant.

4.6.2.   Research quality and trustworthiness

In quantitative research approaches, the criteria of validity and reliability are used to assess quality and trustworthiness. 'Validity' typically refers to the extent to which research accurately reflects the concepts that the researcher attempted to measure. Conversely, if work is 'reliable', then two researchers studying the same phenomenon should make complementary observations.

The criteria for evaluating the quality and trustworthiness of qualitative research differ in that the focus is on how well the researcher has provided evidence that their analysis and descriptions represent the social reality of the situations and research participants studied (Bloomberg and Volpe, 2008). This led to the development of criteria such as confirmability, credibility, dependability, transferability, truth and relevance that can be used to assess quality and trustworthiness (Hammersley, 1992; Lincoln and Guba, 2000). These criteria build upon those found within quantitative research but draw attention to whether the researcher has represented the

accounts of research participants accurately and whether sufficient detail is provided that enables the reader to utilise findings in ways that are meaningful to their particular research questions (Bloomberg and Volpe, 2008). However, there is little guidance to enable researchers to apply such criteria to improve the quality of their research (Seale, 2002).

Beyond criterion-based approaches to quality and trustworthiness, there has been a turn towards practice-based accounting. Mason (2002) and Seale (1999) draw attention to the ways in which reflexive accounting of methodological choices (including reflecting on what issues of validity and reliability mean in practice) can support the claims made by qualitative researchers. As Mason (2002: 51) argues, a practice-based approach draws attention to the "appropriateness of your methods, the meaningful nature of your concepts [and] the degree to which your conclusions are supported by your analysis". This approach to quality and trustworthiness influenced my own practice and thinking in that I focused on the practical application of a case study research design and drew on the potential of triangulation to explore the multiple dimensions of technology acceptance, rejection and use (Baxter and Jack, 2008; Seale, 1999; Seale, 2002). Value was therefore placed on ensuring the clarity and rigorousness of the explanations of my research design and this included the selection and use of multiple methods, and an approach to data analysis utilising my analytical framework.

4.7. Anticipated issues related to researching within a life course perspective

Engaging with research participants who have experienced significant life course transitions can present challenges that influence the conduct of a research project. A number of resources were identified that highlighted the issues that may arise when involving these individuals within a research project (AGE Platform Europe, 2014; Barnes and Taylor, 2009; Damodaran et al., 2012) and when conducting specific methods such as qualitative interviews (Grenier, 2007; Lundgren, 2013; Russell, 1999; Wenger, 2001). While a number of these resources provided recommendations for large-scale research projects that involve research participants within a participatory

framework, a number of themes were extracted and are discussed in this section. These include approaching and recruiting older people and stroke survivors, managing the research encounter, and maintaining a situated approach to ethics.

4.7.1. Approaching and recruiting research participants

Engaging with users of both technologies was an essential component of my research and aided the construction of cases. A key criterion for inclusion was therefore that research participants had used one of the technologies. This was relatively straightforward for the second case as users were recruited from an existing research project[2]. In this case, all individuals participating in the research project were recruited: a census rather than a 'sample'. However, for the first case, the challenge was to ensure that research participants had experience of using a telecare system. As Barnes and Taylor (2009) and Damodaran et al. (2012) argue, research participants must be selected carefully in order to avoid embarrassment due to unsuitability for a research project. As there were no public directories of telecare systems users as a sampling frame, recruiting research participants via letter or telephone was deemed untenable and time-consuming. I therefore approached a number of local voluntary organisations working with older people in order to support recruitment. With the aid of these organisations, a purposive sample was obtained consisting of individuals that had a telecare system and who were willing to take part in my research.

Gatekeepers can be useful as they are known by research participants and so can be brokers of trust. Conversely, gatekeepers know about research participants and thus are helpful in the selection process. I approached gatekeepers via email and telephone to provide them with details of my research project and what was required of research participants (Damodaran et al., 2012). This involved identifying

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[2] While 'straightforward' in terms of identification, there are several issues with recruiting from an existing research project. First, the research project will need to be made fully aware of my intentions and my research design will need to be shared with them so that research participants are not being asked the same questions multiple times. Second, it shall need to be made clear to research participants that my research is separate from the other research project and that their involvement in my research is voluntary. Third, data must not be shared between projects to ensure research participant confidentiality and to reassure them that their responses will not be divulged to anyone without anonymisation.

the contact details of suitable local voluntary organisations and engaging with key contacts in a professional way that highlighted the need for my research and the potential benefits to the populations in question for their participation. For the first case, gatekeepers contacted me as soon as they had identified a willing research participant and I then scheduled an interview with the individual through the gatekeeper. For the second case, I attended an installation with members of the research project and discussed my research with individuals then. I provided them with an information leaflet and asked them to contact me if they wanted to participate in my research. This ensured that my research was considered completely separate to the existing research activities of the SCRIPT project.

Given that gatekeepers were used to recruit research participants for both cases there was a need to ensure that coercion was minimised. This was a concern as research participants may have felt that if they did not participate in my research then their memberships to local voluntary organisations may be affected in some way. To address this potential issue, I gave participant information leaflets (see Appendix B) to the local voluntary organisations to pass on to those that they felt could support my research so that they could make an informed choice. These participant information leaflets were presented in an accessible and readable format and focused on key questions such as why research participants had been approached and how their accounts could provide some future benefit to society (Gilhooly, 2002) I also visited the local voluntary organisations so that potential research participants could form an impression of me face-to-face and then decide accordingly (Wenger, 2001). In addition, during the research encounter, I ensured that research participants knew that they could stop the research at any time without repercussion. Cumulatively, it was anticipated that these steps would limit coercion and ensure that involvement was voluntary.

Despite the steps taken to reduce the impact of gatekeepers on my research, it is recognised that drawing on gatekeepers has a number of drawbacks. Gatekeepers may unfairly exclude some individuals from participating, withhold information from individuals about a research project, or pressurise individuals to participate in a research project (Webster et al., 2014). However, in terms of participant selection,

gatekeepers can aid the researcher in identifying competent individuals able to construct meaningful research data (Holstein and Gubrium, 1995). To this end, my aim was to utilise gatekeepers to recruit competent individuals rather than aim for a, potentially impossible, representative sample. Rather than limit the data that was generated, working with a purposive sample enriched my understanding in a way a representative sample may not have.

A further benefit of gatekeepers related to access and the fact that research participants may be suspicious of being approached by a younger male. Wenger (2001) found this was common in her own research and suggested that middle-aged women are the most likely to be accepted by research participants. However, research also suggests that trying to match the characteristics of researchers with research participants does not guarantee that issues of acceptance will be alleviated (Grenier, 2007). Given this is an issue that I could not change I conducted qualitative interviews alongside an individual trusted by research participants such as a contact person from the local voluntary organisations. It was anticipated that these individuals would not contribute to interviews but would facilitate access and the establishment of trust and rapport. In addition, I ensured that these trusted individuals kept participant responses confidential by briefing them about my expectations prior to research encounters. Although this situation was not ideal, the benefits of engaging with gatekeepers outweighed the drawbacks of approaching participants individually in a more public setting.

4.7.2. Managing the research encounter

I conducted qualitative interviews and observations in research participants' homes, where possible. This was to ensure that research participants felt comfortable in their environment and reduced the need to travel, which can be problematic (Barnes and Taylor, 2009). When calling at research participants' households I was attentive to the fact that research participants may not be able to get to their door quickly or could be suspicious of who was knocking at their door (Wenger, 2001). I alleviated this issue in two ways: first, I ensured that research participants knew when to expect my call beforehand through the gatekeeper; and, second, I presented my

university identification to all research participants so that they knew that I was making a legitimate request. In addition, a trusted individual that was known to research participants joined me, and this helped with access and identification.

During the research encounter, care was taken to take into account the cognitive and physical capabilities of research participants. While not constructing research participants as 'vulnerable' (Russell, 1999), it was important to plan for comfort breaks while remaining attentive to impairments that may limit their input (Wenger, 2001). For example, cognitive impairments may prevent research participants from answering certain questions if they are too far in the past. To address this considered how questions were asked and ensured that they were free from jargon. However, I expected to encounter situations related to the different ways in which younger and older people speak, and the frames of reference that may be used (Grenier, 2007). Rather than anticipate every situation that I could encounter, these situations afforded me more time for discussion and reflection around issues of disagreement, as well as agreement, between research participants and me (Grenier, 2007).

A final issue was to ensure that there was a clear end to the research encounter. For some research participants, this may be the only social interaction that they have had for some time and so they may experience the research encounter as tiring or upsetting (Wenger, 2001). For others, the research encounter may be interpreted as much more regimented (Russell, 1999). However research encounters are interpreted, I remained sensitive to the fact that my time was limited and that my role was influenced by a need to generate usable data. I implemented a clear 'debrief' process whereby research participants were asked again whether they consented to their responses being used and whether they had any final comments (Damodaran et al., 2012). I anticipated that this would signal an end to the research encounter, which was signified by a visual prompt such as stopping my audio recorder or closing my notepad. However, for research participants that wanted to talk more, I provided them with additional time to talk freely. As Wenger (2001: 275) argues: "interviewers have to be prepared to be generous with their time if their respondents have been generous with theirs".

4.7.3. Adopting a situated approach to research ethics

Ethical issues relating to the protection of research participants and the researcher are of primary importance when conducting social research with those who may be deemed vulnerable individuals (Israel and Hay, 2006). There are a number of approaches to ethics (e.g. consequentialism and virtue ethics) but I adopted a 'situated' approach (Ryen, 2007; Ryen, 2011). A situated approach focuses on the differences and tensions between ethical conduct and 'regulatory compliance', and emphasises the individuality of research participants and the competence of the researcher in making ethical decisions (Israel and Hay, 2006; Webster et al., 2014). This approach was seen as appropriate because there was no way of knowing beforehand how competent research participants would be in terms of their ability to comprehend information provided to them.

I consulted a number of resources in order to ensure that my research practice was ethical (British Society of Gerontology, 2012; British Sociological Association, 2002; Economic and Social Research Council, 2012; University of Sheffield, 2012). While I do not intend to suggest that older people or stroke survivors require different ethical procedures, reinforcing ageist or 'disablist' stereotypes (Butler, 1990), there was a need to remain sensitive to issues that may have affected research participants': competency to consent and participate; ability to refuse participation due to dependent relationships; and, understanding of information (Denham, 1984; Gilhooly, 2002; Tinker, 2003). In this sense, engaging with older people and stroke survivors required a more nuanced approach to ethics that may not be the case for other social groups.

4.8. Ethical approval and issues of consent

Ethical approval was sought and obtained from the Department of Sociological Studies at the University of Sheffield. The original application was approved on the 25th October 2012 and a revision to the original application (including the naming of the SCRIPT research project) was approved on the 11th September 2013. Clarification on the requirements of the SCRIPT project were obtained and factored into the second application to the Department of Sociological Studies. As research

participants were not recruited through the NHS in either case, an NHS ethics application was not required.

Consent was obtained in a similar way across both cases. First, individuals were presented with an information leaflet (see Appendix B). For older people, I read through the information leaflet with them at the beginning and end of each interview. For stroke survivors, an information leaflet was left with them during the installation of the telerehabilitation system and was confirmed with them when I attended each interview. Second, individuals were asked to sign an Agreement to Participate (see Appendix B). The form was designed to be easy to read and was read to research participants who were asked to verbally agree to consent, too. A copy of signed forms was maintained and the information leaflet left with research participants that provided a contact number should they have any further questions.

4.9. Conclusion

The aim of my research was to understand the ways in which technologies designed and developed to support health and social care were used in practice. This involved taking the perspective of individuals and exploring questions such as how they used their technologies (or not) and what they meant to them. I constructed an analytical framework that focused on the relationship between individuals' identities and roles and the materiality of health and care technologies. The analytical framework extended current research by conceptualising acceptance, rejection and use as an ongoing process experienced through social interaction. The methodology that I chose, therefore, was qualitative in nature and was designed to enable research participants to talk about their individual experiences.

A case study research design was proposed that focused on the construction of two cases that highlighted instances of technology acceptance, rejection and use. The cases were selected to explore the complexity of the analytical framework developed in the previous chapter, which followed from my research aim and question. This complexity was inherent in the focus of each technology on interaction, their technological maturity and the types of user that each was aimed at. The first case focused on an established technology, a telecare system, which was used by older

people. In contrast, the second case focused on a prototype technology designed to support stroke survivors to self-rehabilitate while at home. It was assumed that the differences between both technologies, and the different user types, would draw attention to complementary aspects of my analytical framework as they highlighted contrasting relationships between individuals and the technologies.

The next two chapters discuss each of the case studies in detail, which includes an overview of the case in terms of background information and sample characteristics, and the findings from the empirical investigation that was conducted and organised into key themes. Both of these chapters include a section focusing on the practicalities of the research design and the issues that were encountered during the data generation and analysis processes. A discussion chapter is then presented, which brings together the findings and themes from each of cases in light of my analytical framework. In this discussion chapter, I develop a theoretical framework, which is then used to justify my original contribution to knowledge.

5.   Case one: ageing and the appropriation, interpretation and ongoing maintenance of a telecare system

5.1.   Introduction

In this chapter, I present the first case of two: a telecare system. While telecare systems are designed for use by a wide range of individuals, I chose to focus on older people as they account for the majority of users in England (Ross and Lloyd, 2012). Older people are also a social group that has received little attention within theoretical discussions on technology acceptance, rejection and use (Östlund, 2004). This first case highlights the experiences and perceptions of nineteen research participants: how they negotiated the ageing process, and the role that telecare systems came to play, or not, within the context of their everyday lives. This case presents the perspectives of telecare systems users that have been neglected within current research (see Chapter 2) with a focus on the interpretations and processes of meaning making associated with the technology.

The key argument in this chapter is that users construct and negotiate the meaning of telecare systems through the process of appropriation and through ongoing 'maintenance' activities, which are influenced by users' life course experiences. This builds upon the analytical framework constructed in the third chapter, which drew attention to life course agency and the significance of social interaction to technology domestication. I found the research participants that took part in my research shared a number of experiences and these experiences were influenced by cognitive and physical change, as well as more nuanced issues such as resilience and life

histories. Accepting help and support appeared to be a significant milestone for research participants, and, over time, provided them with an overarching structure to their experiences. A telecare system was therefore embedded within this existing health and social care structure, and provided a complementary rather than replacement service to those interviewed.

My findings show that telecare systems are introduced into users' everyday lives as different life course 'transitions' are taking place. I constructed a typology of these transitions based upon research participants' interview responses. These transitions included a change from a role of 'active' to 'supported' ager and from a role of supported to 'managed' ager[1]. Post-appropriation, users 'maintained' telecare systems as best they could by negotiating how and when button alarms were worn as well as testing the technology to ensure that it still worked. It appeared that testing a telecare system not only served a practical purpose (i.e. ensuring that the technology was functional) but the act of testing was also a means of promoting familiarity with the technology in anticipation of future activation and use. Users of the technology were able to acquaint themselves with those located in call monitoring centres through testing, which helped to increase trust in a telecare system despite a relative lack of use of the service otherwise.

This chapter is organised into two sections. The first section presents an overview of the case in terms of background information, sample characteristics and methods. I focus on a statutory provider of telecare systems, which is one of the largest in England. During the research period between January 2013 and July 2013, the telecare system was free to individuals living within the Bradford District and comprised of a remote call monitoring centre and a mobile response team. A total of nineteen users of the telecare system were recruited and interviewed about their experiences of using the technology and were asked about their attitudes towards ageing and old age. The second section presents findings from a theoretical reading

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[1] The terms 'active', 'supported' and 'managed' ageing provided a means of thinking about older people's life course transitions. This terminology reflects, in part, research on active, harmonious and successful ageing (see, for example, Liang and Luo, 2012; Rowe and Kahn, 2015; WHO, 2002). However, I based my descriptions upon the data that was generated from my own research participants and how this was integrated into their perspectives on telecare systems.

of the interview transcripts (see Section 4.6.1), which support the argument that telecare systems are interpreted through interaction.

5.2. Construction of the case and sample

5.2.1. Case overview

5.2.1.1. National provision of telecare systems

There are two main ways that telecare systems are provided: by local authorities ('statutory provision'); or, by charities or private organisations ('commercial provision'). Statutory provision entails providing equipment to individuals (referred to as 'service users') on a non-contractual basis (usually) for a small fee; commercial provision, on the other hand, involves consumers entering into contracts with sellers following their purchase (Mandelstam, 1997). Approximately half of all telecare systems are paid through commercial provision (Ross and Lloyd, 2012). However, this was based on a conservative estimate and statutory provision is still thought to account for the majority of users (Lloyd, 2012).

The majority of local authorities provide telecare systems to individuals. This is due, primarily, to financial investments made through the Preventative Technology Grant (Department of Health, 2005), which allocated £80 million over two years to revolutionise the delivery of health and social care services. The goal of the grant was to support the independence and wellbeing of individuals, and was accompanied by an implementation guide that focused on the benefits of telecare systems and how local authorities could utilise them (Care Services Improvement Partnership, 2005).

While significant investments have been made in telecare systems there are variations in service provision. The Good Governance Institute (2012) conducted an audit of local authorities and found that the number of users of telecare systems varied considerably. The variation in service provision means that an understanding of the characteristics of the local authority where my research was conducted is required in order to support the generalisability and transferability of findings.

The method of provision may have an influence on how a telecare system is subsequently accepted and used. For example, if a commercial telecare system is purchased and billed on a 'per-use' basis then it may not be used as much (e.g. due to funding concerns) as one that is free or part of a monthly subscription. Although no conclusions can be drawn from my own analysis that compares statutory vs. commercial provision, as my research focuses exclusively on statutory provision (see Section 5.2.1.2), there are indications that service provision may have an influence on the technology's acceptance and use. This is evidenced by the fact that telecare systems are appropriated and interpreted in different ways. It is possible, therefore, to infer that additional metaphors of telecare systems may exist that relate more closely to different models of service provision. However, this is beyond the scope of my research question.

5.2.1.2.   Safe and Sound: a local telecare system

Safe and Sound is a statutory provider of telecare systems that aims "to help people to maintain their independence, giving peace of mind to users and those who care for them" (Bradford Metropolitan District Council, 2012). The service is available to individuals living within the Bradford District for free and to other areas for a fee of £3.00 per week. In 2012, 10,838 individuals used the service, which made Safe and Sound one of the largest providers of telecare systems in England (Bradford Metropolitan District Council, 2012; Good Governance Institute, 2012). From their annual report for 2012, 4,400 users of Safe and Sound lived in their own homes and a further 6,438 users lived in sheltered housing or tenancy accommodation (Bradford Metropolitan District Council, 2012). Research participants were recruited and interviewed when the service was free although a fee of £3.00 per week was introduced to all users post-July 2014.

The main type of telecare system provided by Safe and Sound is a button alarm and box. A 'button and box' telecare system is installed alongside a telephone line, which enables a user to activate a button alarm (if they are able) that connects them to a call monitoring centre. The call monitoring centre then triage the user's telephone call based upon the issue that led to the technology's activation. In most cases, triage

involves contacting family or friends that are nominated as 'first responders' but can include emergency services. Individuals are asked to nominate a number of first responders when the technology is installed.

Safe and Sound also provide more advanced telecare systems such as bed sensors and fall detectors that can be activated automatically on behalf of users. For example, a fall detector can be worn on the wrist that detects sudden movements, which are associated with falling. In these instances, a connection will be made to the call monitoring centre regardless of whether a button has been activated by the user. This is particularly helpful for individuals living with epilepsy, as there is often little or no warning when a fit will occur. Having a telecare system that is able to activate automatically is therefore preferential as the individual may not be in a conscious state to activate a button alarm manually.

Safe and Sound telecare systems are available to any person of any age where there is an assessed need. Individuals are able to refer themselves to the service or can be referred by a health or social care professional. While Bradford Council do not use national criteria to assess need, they conduct assessments in two ways: 1) through self-assessment questionnaires or over the telephone for those requesting a button and box telecare system; or, 2) through home visits when equipment such as automatic medicine dispensers or bogus caller alarms are requested by those with more complex or specialised needs. This means that although the service is available to any person of any age, there must be sufficient need to warrant its installation within individuals' homes.

The health and social care service provided by Safe and Sound includes a call monitoring centre and a response unit. Unlike most other providers of telecare systems in England, Safe and Sound provide an alternative to contacting family, friends and emergency services through the employment of a mobile response team (Bradford Metropolitan District Council, 2012; Incommunities, 2013). Working in collaboration with a local social housing provider, the response team operate from two base stations within the Bradford District and aim to provide assistance to users of Safe and Sound within thirty minutes. This includes attending to telephone calls

related to falls where emergency intervention are not required[2]. From their latest annual review, the response team assisted approximately 4,000 users over a one-year period (Incommunities, 2013).

Type of request	Number of calls	Percentage of total calls
Advice or reassurance	111,108	61%
Door entry	40,030	22%
Fire alarm activations	12,444	7%
Smoke detector activations	11,599	6%
'No speech' calls	4,067	2%
Non-injury falls	2,314	1%
Ambulance to attend	681	<1%
Fire service to attend	545	<1%
Named contact to attend	305	<1%
Doctor to attend	215	<1%
Police to attend	101	<1%
Total	183,409	100%

Table 5.1: Breakdown of requests handled by Safe and Sound over a one-year period (2012), which includes number of calls and percentage of total calls.

The number of calls received by Safe and Sound has increased year-on-year. In 2011/2012, they received 183,409 calls, which increased from 160,551 calls the previous year (Bradford Metropolitan District Council, 2012). Requests for advice and reassurance account for the majority of calls (~61%) and requests for emergency services account for less than one percent (see Table 5.1, above). The figure for emergency service requests includes responses by ambulance, doctors and the police. Fire alarm and smoke detector activations account for ~13% of calls, which reflects the close working relationship that Safe and Sound have with the local fire and rescue service, who coordinate the installation of smoke detectors with users of the telecare system (West Yorkshire Fire & Rescue Service, 2012). The figures on types of calls suggest that, rather than being used solely for emergencies such as

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[2] As can be seen from Table 5.1, the response team are quite active and attended to 2,314 calls in 2012.

falls, telecare systems are used within the Bradford District for informational purposes such as enquiring about other health and social care services.

5.2.2. Recruitment and sample characteristics

The recruitment of users was purposive and not intended to represent the wider population of telecare systems users (see Section 4.7.1). However, it was anticipated prior to recruitment that more females would be identified than males as this reflected the constitution of the Bradford District as a whole, where females over the age of 60 accounted for approximately 63% of all older people within the region (Bradford Observatory, 2012), and the disproportionate ratio of females to males in terms of national statistics on telecare systems users (Ross and Lloyd, 2012).

Between January 2013 and July 2013, a total of nineteen users of Safe and Sound were interviewed. The sample comprised 17 females and 2 males. These users were approached via local voluntary organisations that were gatekeepers (see Section 4.7.1). The characteristics of the sample are shown in the table below:

Pseudonym	Age	Sex	Living arrangement	Gatekeeper
Norma	85	Female	Non-specialist home	#1
Ted	85	Male	Non-specialist home	#2
Hilda	80	Female	Non-specialist home	#2
Nina	91	Female	Sheltered housing	#3
Evelyn	82	Female	Sheltered housing	#4
Leonard	72	Male	Non-specialist home	#4
Cathy	68	Female	Non-specialist home	#2
Orlaith	88	Female	Non-specialist home	#5
Niamh	85	Female	Non-specialist home	#6
Frances	89	Female	Non-specialist home	#2
Louisa	95	Female	Non-specialist home	#2
Rosa	82	Female	Sheltered housing	#7
Dana	94	Female	Non-specialist home	#8
Latifa	71	Female	Non-specialist home	#8

Peggy	93	Female	Sheltered housing	#9
Yvette	84	Female	Cohabiting	#9
Doreen	82	Female	Sheltered housing	#9
Kathleen	84	Female	Non-specialist home	#9
Deirdre	100	Female	Non-specialist home	#9

Table 5.2: Attributes of the nineteen users of telecare systems recruited including pseudonym, age, sex, living arrangement and gatekeeper.

As can be seen from the table above, research participants were recruited from nine different gatekeepers in total. These gatekeepers were dispersed across the Bradford District. Gatekeepers were identified through an online directory of older people's service providers and were contacted first by email and then by telephone if a response was not received. Where possible, a meeting was then arranged with a nominated contact person where I discussed the aim of my research along with a request for them to afford me some level of access to older people. While the number of gatekeepers was more than anticipated to recruit enough users, this had the benefit of assuring a range of research participants with different personal characteristics and circumstances were recruited. For example, some of the gatekeepers worked primarily with individuals living within sheltered housing (n=2) whereas others focused more on individuals living independently within their own homes (n=7).

Most research participants lived alone in non-specialist housing (n=13) or in sheltered housing (n=5). The exception was Yvette[3] who lived with her son following a diagnosis of chronic obstructive pulmonary disease. This meant that she required more help and support than she was able to manage on her own. From those living alone, thirteen research participants continued to live in their own homes while five were living in a sheltered housing complex[4]. The four research participants living in sheltered housing all used a telecare system for door entry but did also own a button alarm. In at least one instance, a research participant owned a button alarm in addition to security alarm pull cords that were installed in their flat. Evelyn was the

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[3] This is a pseudonym, which is true of all references to research participants within my research.
[4] This included 'warden-controlled' flats and flats owned by housing associations.

only research participant living in sheltered housing who did not use their button alarm despite paying for its installation when she first moved in. This was reflected in her account, which focused more on how she did not feel that a telecare system was appropriate to her situation and was associated with the frail elderly:

> **Evelyn**: They all, the older ones that are frail do definitely have [the alarms] on them, but, er, a don't think I need 'em, so.

In terms of the sample, the mean age of research participants was 85 (σ^2=69) and ranged from 68 to 100. The modal age range was 80–89, which accounted for ten research participants. This meant that the majority of research participants were classed as the 'oldest old' (Age UK, 2013). However, as will be made clearer as the chapter develops, the aim is to discuss the people behind the age and focus on their experiences that transcend this numerical classification. All but one research participant was White English and Latifa was from a South Asian background. This cultural difference influenced how Latifa interpreted her telecare system based upon the support that she received from family despite living on her own. However, further research is recommended to fully explore the cultural dynamics of telecare systems use in the South Asian population[5].

5.2.3. Data generation and analysis

Interviews were conducted with each research participant over a period of 21 weeks (see Appendix G). Interviews lasted between thirty minutes and an hour, which was dependent upon the individual[6]. The location of interviews varied, as this was dependent upon the role of the gatekeeper. In fourteen cases, interviews were conducted in research participants' homes. However, all interviews secured through Gatekeeper #9 were conducted in a social day care centre meeting room (n=5). This

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[5] I did approach a number of voluntary organisations working with the South Asian population during the recruitment process. However, the response from them was that they had not heard about telecare systems in any great depth. Gatekeepers also felt that the South Asian population were not the target market for telecare systems as the provision of health and social care support was often provided within and between families. This cultural issue would make for an interesting study into how telecare systems could be provided to the South Asian population.

[6] One interview was cut short, as the research participant was too tired to complete. In this instance, I allowed the research participant time to compose themselves before suggesting that we end the interview. The research participant appreciated this, and I was thanked for my awareness and handling of the sensitive issue.

was because this particular gatekeeper did not provide a befriending service that the other gatekeepers did, which meant that it was not possible to gain access to research participants' homes. Each interview was recorded digitally following research participants' consent to be interviewed, which involved them signing an agreement to participate form that covered issues of anonymity and confidentiality.

Following each interview, recordings were transcribed. Transcripts were imported into a software application[7], which supported the coding of text and structuring of codes. Transcripts were coded line-by-line with a focus on issues related to ageing and social interactions supporting the appropriation and use of a telecare system identified within my analytical framework (see Chapter 3). Following codification, quotes were then added to a working document where they were organised into themes. The next section presents the findings from the theoretical reading, which are organised around research participants' experiences of ageing and their interactions with the Safe and Sound telecare system.

5.3. Analysing the case: key themes

5.3.1. Experiences of the ageing process

Negotiating the process of ageing involved adjusting to everyday life as those interviewed drew upon help and support in different ways. The decision to adopt and use a telecare system was embedded within the existing help and support provided to those interviewed, which was dependent upon their capabilities and needs. As a result, the decision about whether to adopt a telecare system was embedded within the context of the individual ageing process. While there was no 'typical' experience of old age, I was able to identify a number of common experiences that described how the ageing process was negotiated from the perspective of those interviewed.

5.3.1.1. Common situations experienced by older people

A common situation that those interviewed found themselves in was not being able to do something that they used to be able to do. While not all research participants

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[7] A combination of f4analyse and f5 (http://www.audiotranskription.de/english) were used as these were the most user-friendly software applications and were available for Mac OS X.

commented upon this particular aspect of ageing, eight research participants talked about this specific situation. This is a sample of responses:

> **Norma**: There's jobs that I can't do. I can't wash me windows cos I can't reach 'em.
>
> **Orlaith**: I get exasperated because I can't do things. I've always been a doer, y'know.
>
> **Niamh**: I'm not good wi' me memory. I'm not. I forget. Stops me from doing lots of things.
>
> **Louisa**: You find out you can't do things that you used to be able to do. And you get very frustrated.

From their accounts, it was clear that these research participants shared a sense of 'frustration' about their situation. One response to this frustration was not wanting to give in, which was exemplified by Norma who still washed her windows even though she had been "*caught standing on t'sink*". However, frustration could be met with submission and recognition that the best way forward was to do what you could and to make adjustments to counter impairments and everyday challenges. As Orlaith told me: "*people don't realise how … you have to adjust to life*". What this comment showed is that, ultimately, adjustment factored into the everyday lives of research participants whose situations involved not being able to do things that they were once able to do.

Another situation that those interviewed experienced was the necessity of drawing upon formal and informal care, as research participants found they were unable to perform activities of daily living adequately. Seven research participants spoke about their experiences of receiving help and support although accounts varied in terms of the extent to which it was needed:

> **Cathy**: And I do have help. I mean, I've a cleaner, as a say, and shoppers.
>
> **Orlaith**: [My husband] was ill … affected my health. So I've been having, er, [home care] for about four years. Now they come three times a day: they come in a morning to help me, I can't get down to my feet so I have to have help to get that and help with my bath and, er, and then they make my breakfast. And then, in a little while, somebody will be coming, er, to, er, collect my laundry for me and that to take it down to the launderette. And they wash, dry and iron it for me. Er, and then, er, I make my own lunch and then they come back at teatime and make me a hot meal, and then they come at bedtime to see me safely to bed.
>
> **Niamh**: Yeah, I 'ave home care come. Morning and night.
>
> **Frances**: Well, I have a husband and wife that, er, does me shopping for me.
>
> **Peggy**: I've to wait for somebody taking me out cos I dare not go out on me own. If I go out, me daughter takes me, yes. I don't have any carers or any … I do al the cleaning and everything. More or less look after meself. Only thing I can't do is go out and walk and do me shopping.

> *Yvette*: I have a carer come in, y'know, to help me get washed and dressed and that.
>
> *Doreen*: I pay a cleaner. The cleaner comes and does that ... and me granddaughter does the shopping for me.

The quotes highlight some of the help and support that those interviewed received. This included support for tasks such as cleaning and activities such as shopping that were not possible due to research participants' lack of mobility. Others, such as Niamh, Orlaith and Yvette, required more intensive help and support such as for dressing and washing that they received from 'home care' services. Niamh, Orlaith and Yvette all had different living arrangements and so access to help and support was not exclusive to those living in sheltered housing but also included those living alone in their own homes or cohabiting.

Not all research participants, despite the fact they were not able to do things, sought help and support. However, it was drawn upon in most cases in relation to basic activities of daily living such as cooking and dressing. There was a sense that the provision of help and support afforded functional benefits that could not have been achieved in other ways apart from moving into residential care. As Cathy told me: "*I do know my limitations. I do, but. And I don't want to be living in sheltered accommodation unless it becomes absolutely necessary*". An interpretation of this comment is the need to accept help and support based upon pragmatism about what is and is not possible: a sense of necessity and really needing it. However, there was also a sense of uncertainty about the future that informed Cathy's decision to accept help and support. The notion of necessity and uncertainty helps explain why not all research participants were currently drawing upon help and support although it may be a possibility in the future as ageing brings about change. However, there was a sense from those interviewed that, over time, accessing help and support services was a pragmatic option.

A further situation that those interviewed experienced related to the debilitating effects of cognitive and physical impairments. While the majority of research participants were able to negotiate everyday life with minimal intervention from others there were four research participants who were supported much more closely. Leonard, Niamh, Latifa and Yvette had all experienced, or were experiencing,

cognitive and physical changes that meant that they were accompanied throughout the morning and afternoon. For Leonard and Niamh, while they lived on their own, formal care services were in place to ensure that they were helped and supported daily. This was most pronounced for Niamh who was in the early stages of dementia although Leonard, too, had issues with his memory due to an operation that he had to remove a growth on part of his brain. Additionally, family members, rather than formal care services, supported Latifa and Yvette on a daily basis. This experience was negotiated in distinct ways, as Latifa reflected upon this in terms of cultural expectations and the caring role of the family whereas Yvette felt that the help and support she was provided with could undermine her agency:

> **Yvette**: He's a, I mean, [my son] rings me up a couple of times a day and says … I'm fine! I wish he wouldn't ring, keep on ringing me. I says: 'if there's anything wrong I'll ring you, y'know'.

The situation that Leonard, Niamh, Latifa and Yvette experienced involved accessing help and support for basic functional activities. For them, their everyday lives were more structured around the provision of help and support, and this was exemplified by the fact that they talked about the specific times when help and support was available through the day and night. While not experienced by all research participants, there was a sense that structured help and support was seen as an almost inevitable stage of the ageing process.

Although not all research participants accessed help and support to any great extent, the possibility of accessing help and support in the future was evident in a number of accounts:

> **Ted**: As a say a'm not too bad at the moment but you never know. As a say, 85, you're a candidate, aren't ya?
>
> **Nina**: Physically a'm fine it's just a'm so tired. A'm just wearing out; old age never comes alone, always brings unwanted guests.
>
> **Orlaith**: I feel very fortunate from that point of view that I can still know that, er, that I can do these kinds of things and that I still have my, er, my fingers on the pulse as it were.
>
> **Rosa**: I never thought that a'd come … when you say 'come to this', that a'd have to rely.
>
> **Doreen**: I'm not quite sure because I'm losing it. I know I'm losing me memory; I'm going doolally but I'm not quite there yet, if you know what I mean.

As these reflections show, the ageing process was experienced in the present but also with a view towards future situations that may be less favourable. Ted, for

example, talked about feeling "*not too bad at the moment*", Nina talked about "*wearing out*" and Doreen talked about not being "*quite there yet*". All three of their accounts incorporated a sense of time and uncertainty about the future that was expressed through how they talked about their present situation. While change was gradual for the five research participants quoted above it did not make the thought of accessing help and support any easier. As Rosa noted, she never anticipated not being able to clean, cook and wash but this had now become part of her everyday life.

5.3.1.2. Perceptions of the ageing process and old age from the perspective of older people

Beyond the common situations discussed in the previous subsection, research participants articulated the ways in which they perceived the ageing process and what it meant to them personally. While perceptions were not reflected universally across all accounts there were four interpretations that were made explicit or that underpinned research participants' accounts. First, 'keeping active' was seen as a means of 'challenging' the ageing process and was contrasted with being inactive. This desire to keep active and engaged in everyday life could take many forms such as walking to the end of the street and back, using an exercise bike to keep fit, or reading. These activities were dependent upon the individual and their capabilities as well as their interests. Where mobility was problematic, activities that could be performed indoors were popular[8] whereas other research participants preferred seeking social interaction outside of the household such as attending gatherings organised by voluntary organisations. The following accounts reflect the significance placed on activity:

> **Norma**: *You see other people that don't do nowt for the'selves. There's one or two of them that don't do owt for the'selves; you've got to get on with things. You just can't sit down and mope about it like some people do; I get up and do stuff, I make meself useful. I don't, I don't go and sit down all day like some do. They sit down all day and never go out. You've got to get out.*

> **Hilda**: *You've got to think of ways of helping people.*

> **Evelyn**: *[Yeah,] but the' sit there, don't the', and the' say the' feel poorly, and, y'know the' give away to it, don't they. The' don't push the'self on and go … go further; y'know, it's still sitting down and feeling sorry for yourself; no, it's … you've got to enjoy life while you can get about. But the', y'see the' like to sit and moan don't they an', y'know, sit there and feel right sorry for the'selves.*

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[8] For example, jigsaw puzzles, reading and watching television.

> *Deirdre: I have a motto and my motto is: 'always try and do a bit more than you think you can do because it's surprising how often you find you can do it'.*

As can be seen in the quotes, a sense of keeping active and engaged was contrasted with inactivity, which was seen as detrimental to ageing 'successfully'. This included getting out of the house, helping others as a way of increasing social participation and being determined to try activities that you felt that you could not do. While it was not clear how research participants formed these opinions, they appeared to serve as a backdrop through which to make sense of the ageing process. That is, highlighting the need to keep active and highlighting the detrimental effects of not doing so.

However, there were also social factors such as family that could influence the extent to which individuals were able to keep active and exert a sense of agency over their everyday lives. For example, those who were looked after by family and friends such as Yvette had to limit the activities that they took part in as a way of assuring others' peace of mind:

> *Yvette: I used to put the washing in and take it out and put it in the drier and things like that. [My son] said: 'you're not allowed to do things like that anymore mam'. I said: 'why?' He said: 'in case you fall'. 'I want to go to work with a peace of mind', he said. He said: 'promise?' I said: 'no, I won't touch it'. I don't do those things now.*

Second, there was recognition that changes needed to be made to adjust to the effects of ageing. This was implicit within the majority of research participants' accounts but was reflected by the fact that they limited the activities that they took part in. The example discussed above in terms of Yvette's story highlights how adjustment can involve negotiation with family and friends, and assuring their peace of mind despite feeling that you are able to do more than your family give you credit for. Orlaith shared the most explicit example of negotiating the process of adjustment. For Orlaith, adjustment was not about ceasing activities completely following a change in cognitive and physical capacity but accepting gradual transitions that involved drawing upon resources to support the process. In the following quote, Orlaith talked about how she used a tray on wheels and a walking stick as support, which have helped her:

> *Orlaith: And then I have me meals on here. And, er, er, and so I take it in there and then I carry me tray and then I sit and wash up, and, er, then when I'm getting me lunch ready I put me tray ready and then I go to the fridge and take me stick and pull the bottom drawer out*

because, y'know, people don't realise how you have to adjust to life. And if you didn't adjust, well, you just give in.

Third, those interviewed interpreted seeking help and support as a positive step rather than negative step. There was a sense that asking for help and support was an important means of negotiating everyday life, and something that older people should not be afraid of doing. A number of research participants spoke to me about this and shared their opinions on coming to ask for help and support. As identified in the previous subsection, as situations change and individuals transition into old age then it can become increasingly difficult to manage and perform activities such as cleaning, cooking and dressing. The following is a selection of quotes regarding accessing help and support, which highlight a positive approach to help and support:

> **Norma**: *Don't be afraid of asking. I've never really needed, y'know … to have anything to want doing or owt like that.*
>
> **Hilda**: *Some people won't have help. They think it's not good to get help … that they're all right, but they're not all right.*
>
> **Orlaith**: *It's amazing what you have to get used to. Things that you never thought you would. But, if you need help, and I think it's better to have the help than be, I don't know what you'd do, really, if I didn't have them, because I can't get in and out of the bath by myself.*

Fourth, there is a difference between 'age' and feeling old[9]. A number of research participants expressed that they did not feel old despite recognising that they were 'old' in terms of their chronological age. In a number of cases, research participants resisted the negative perceptions of older people as frail and dependent by highlighting how they kept active and drew upon help and support to promote independence. This was important for research participants, as they desired mostly to remain active for as long as possible in spite of change. Of course, this resistance was not always possible as research participants aged in different ways and at different rates as shown in the previous subsection. Here is a summary of responses that encapsulate research participants' thoughts on the notion of 'feeling old' and its potential consequences:

> **Norma**: *I don't see myself as being old, no. I mean, I don't feel old. Put it that way. I'm 86 next Saturday and I don't feel 86.*

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[9] This resonates with work by Nilsson et al. (2001) who identified four characteristics that signified a transition into old age: 1) being able to date the beginning of feeling old; 2) fear of helplessness and of being unable to manage one's life situation; 3) not recognising one's former self; and, 4) feeling different from others.

Ted: I don't feel old. But things are constantly cropping up now to remind me that I am; you never feel old. You always feel, you always feel. I mean, people say: 'what's it like to … be old? Well, it's nowt different from any other age; people have two ages, haven't they? They've a biological age and they've a real age. And the two aren't the same at all. Not at all.

Hilda: Once you start thinking of yourself as an older person you go old.

Rosa: I don't think that I'm old. A don't think old, a don't think that … I'm old in meself, y'know.

Deirdre: No, I'm not an old person. My body's old but not the inside.

Research participants' perceptions of ageing and old age, while diverse, shared some common themes. These themes reflected how they drew on personal resources to negotiate ageing by ensuring that they kept active while drawing on help and support. The physical aspect of ageing involved adjustment with the aid of resources such as trays on wheels and walking sticks, and, eventually, aid from formal or informal carers. Research participants also demonstrated a determination and perseverance to continue living at home, and espoused a positive outlook on the future. For some, such as Ted and Louisa, this involved drawing on emotional resources such as humour to age with contentment: "*you've got to keep a sense of humour, that's the main thing*". For others, such as Deirdre, a positive outlook was promoted by pushing the limits of an ageing body and mind: "*always try and do a bit more than you think you can do because it's surprising how often you find you can do it*". What this meant for research participants' appropriation and subsequent interaction with a telecare system was that the technology was interpreted in light of cognitive and physical change but also a desire to resist negative stereotypes of ageing.

5.3.1.3. Conclusion

As this discussion on the ageing process shows, individuals age in different ways and construct perspectives on the ageing process. The ways that those interviewed adjusted to the ageing process were complex and held different meanings for individuals in a personal sense and in the context of the situations that they found themselves in. There appeared to be a point where those interviewed were required to draw on help and support in order to enable them to maintain quality of life. This could be experienced over a number of years (e.g. due to increased frailty) or could take place more suddenly (e.g. a fall or stroke). However, research participants often described a sense of drawing on help and support in a positive way in order to negotiate everyday life. While accessing help is something that not all older people

do, as the responses show, help and support was seen as an integral part of the experience of ageing. Given this heterogeneity of experiences, the ways in which telecare systems are introduced and used will take on different meanings given the ongoing negotiations as people age.

With the common situations identified above I am able to construct a typology of research participants' experiences. First, there is those who are able to engage and participate in everyday life with little or no help and support: the 'active agers'. These individuals are able to participate in everyday life through activities that stimulate the body and mind such as crosswords, reading and volunteering. While these individuals may experience issues that affect their health they are able to manage these through medications management and by limiting the activities that they participate in that may put them at risk. However, for these individuals, there is a sense that over time their circumstances may change and they will be required to draw on more help and support either through formal or informal health and social care services.

Second, there are individuals who require help and support but are able to maintain independence by retaining social relationships with family and friends that enable them to participate in everyday life within and outside of the household: the 'supported agers'. These individuals interpret help and support as a functional and pragmatic resource that, while structuring some parts of their everyday life, does not prevent them from participating in activities. However, there is a sense that changes in cognitive capabilities such as memory loss may be problematic and will have an impact upon the activities that they are able to perform.

Third, there are individuals who require help and support to negotiate cognitive and physical challenges: the 'managed agers'. For these individuals, everyday life is structured around formal or informal health and social care activities that leave little room for them to participate in activities that are meaningful to them. Cognitive and physical changes prevent the individual from engaging in everyday life without help and support, which can lead to frustration, negative self-perception and fatigue. In contrast with active and supported agers, the emphasis shifts from enabling

individuals to maintain a sense of 'feeling alive' to helping those individuals live although the former is still valued.

The attitudes and experiences of research participants demonstrate the heterogeneity of older people but also draw attention to ageing as a process involving one or many transitions. Older people are required to negotiate cognitive and physical change by drawing on help and support, maintaining a sense of positivity, and keeping active where possible. However, as cognitive and physical changes become more problematic, the everyday lives of older people can become more structured because formal and informal carers are involved. This can benefit older people as it enables them to continue living in their own households for as long as possible but may also require them to limit the activities that they perform due to their perceived risks. For example, climbing ladders or scrubbing floor tiles.

While change can lead to frustration, research participants also contrasted their experiences with others who they saw as less fortunate[10]. There was recognition that one's situation *could* be worse and this self-evaluation drew attention to the positives experienced by those interviewed rather than the negatives. This sense of optimism helped individuals frame troublesome aspects of everyday life, such as declining capabilities, and is important for understanding the context in which telecare systems are situated. As older people transition from active agers to supported and managed agers then help and support, which includes the utilisation of telecare systems, takes on different meanings and significance. It is this aspect of the process of the appropriation and interpretation of telecare systems that the next section addresses.

5.3.2. Appropriating and interpreting a telecare system

The heterogeneity of the ageing process and the experiences of research participants with regards to negotiating old age were also reflected in decisions to appropriate a telecare system. In this section, four interpretations are presented that

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[10] For example, Orlaith told me: "*I'm reasonably agile and, and, and, coherent but I find it must be very distressing for people who … their memory's going and then they have different carers and they get used to one and then they get another, it must be very distressing must that*".

focus on how those interviewed thought about telecare systems and the role that the technology came to play in their everyday lives. These interpretations were, in some instances, constructed through social interaction whereas others were informed by research participants' feelings towards ageing and the benefits of a telecare system to their situation. What this section shows is that telecare systems are thought about in different ways and this goes beyond a common presumption that they are appropriated solely for their functionality such as the ability to reach help quickly.

I analysed the data to construct interpretations of telecare systems in the form of metaphors as this captured the essence of research participants' accounts. These metaphors are: telecare systems as 'prescriptions', 'safety nets', 'load balancers' and 'currency'. While research participants did not use any of these metaphors in their accounts explicitly, they are used as a means of grouping common themes across accounts to support generalisation. A number of quotations are presented alongside each metaphor to indicate the types of answers shared by research participants and can be used to gauge how prevalent each interpretation was. The next subsection discusses the first interpretation that was identified, telecare systems as prescriptions, which was the most common interpretation and reflects a lay, 'medicalised' perception of telecare systems.

5.3.2.1. Telecare systems as 'prescriptions'

A total of eleven research participants associated their telecare system with a health- or social care problem such as a propensity towards falling. While these problems varied there was a sense that a telecare system was appropriated in order to address the problem and to provide a source of help and support. In these instances, the appropriation of a telecare system followed either a stay in hospital or was 'prescribed' by a health or social care professional. I found that users often had little to no knowledge about telecare systems prior to their prescription and so there was little room to negotiate the meaning of the technology beyond the immediate medicalised context. Here is a snapshot of the perspectives of users with regards to appropriation:

> **Hilda**: A got it with ma husband, oh, six years ago. We got one each. Yeah, from before me husband was poorly. He was a poorly man. So they gave me one as well. Cos I wa' getting poorly looking after him.

> **Leonard**: Wha', a reason wa I 'ad a big operation.

> **Frances**: Well, I was falling a lot. Y'know, I might only walk a couple of yards and I got no warning, I just went down. Face down. And that was one of the reasons, because if I couldn't get myself up I could always use that and someone would come.

> **Rosa**: A've had it about ... two year. I was ill; I was in hospital for about eight months. And when a came out they gave me this pendant and ... I 'ave tried it out. If I press this [button] I've got immediate help.

> **Latifa**: The care person, he came to my house. And he say: 'you are living by yourself ... if you need help. So, you call them and press this number. And press this. They'll come, they'll answer you back'.

> **Yvette**: I was on my own and they wanted to make sure because ... I've got COPD. And, also got asthma and that ... and in case I fall I had to press, y'know.

The quotes above describe a variety of situations that led to the appropriation of a telecare system. These situations focus predominantly on health care. For example, Hilda adopted a telecare system after she became ill from looking after her husband and Frances was a frequent faller and so a telecare system was as an appropriate technology to support her. In addition to health-related problems, both Latifa and Yvette's quotes focus more on their social care, and others' interpretations of their situations. In both cases, another individual identified that they were living alone or were on their own and that a telecare system would be beneficial to them. Appropriating a telecare system, at least for these individuals, was associated with a health or social care need.

Family members were involved in the appropriation of a telecare system for two research participants, which went beyond the input of health and social care professionals. For Nina and Doreen, a daughter or daughter-in-law introduced them to a telecare system and took the lead in its appropriation. In both instances, the women knew little about telecare systems beforehand and the family member assessed both of their situations, and identified a need for the technology. As the following quotes from Nina and Doreen show, a family member was integral in the appropriation of a telecare system and associated with "*getting older*":

> **Nina**: Well me daughter. Me daughter worked at the [nursing home] and she come across it before with other people, so. And when a started to be on me own ... my, and a was getting older, a was going for respite every so often then. And, er, I, er, they said that a needed something.

> *Doreen*: Well, it were me daughter-in-law that sort of took me on, y'know, under hand and she were the one that wrote to these people. And then they gave me that. It were cos of me breathing.

In both of the quotes above, Nina and Doreen describe life course transitions where family members took an active approach in their care. Nina came to associate the technology with being on her own and getting older, and talked about how her telecare system was something "*they*" said she needed. While it was unclear as to how many individuals were encompassed in her use of the term 'they', it demonstrated that Nina was not in complete control of the appropriation of her telecare system. This is supported by Doreen's comments, as she described the added pressure of feeling like her daughter-in-law had 'taken her on'. While Doreen associated her telecare system with her breathing it was also quite clear that her daughter-in-law was the main reason for its appropriation. In terms of the technology's meaning, therefore, it was constructed within the context of the relationship between user and family member.

There were also five instances where a telecare system came pre-installed within an individual's flat as part of a sheltered housing arrangement. Nina, Evelyn, Rosa, Peggy and Doreen all lived in sheltered housing and had access to a telecare system. However, installation in sheltered housing did not guarantee a favourable interpretation, as Evelyn did not use the technology actively. This was because Evelyn was more of an 'active ager' and did not feel that the telecare system was appropriate to her situation. While it was helpful for managing door entry into her flat she did not feel that she was the ideal candidate for the technology. She associated it with "*older ones that are frail*", which was not how she identified herself. What this suggests is that, while an individual may 'own' a telecare system and have it within their home, it may be rejected due to an identity commitment.

> *Nina:* It wasn't until a came here I got this.
>
> *Evelyn*: When ye get the house ye get the things for, y'know, for safety really.
>
> *Peggy*: Erm … I don't know that there was a reason, really, because I live in the community houses all with old people. So they put them all in the bungalows. And then these went with 'em.

As technological prescriptions, research participants often had little or no control over the appropriation of their telecare system. The decision to appropriate the

technology was made as a result of entering into a sheltered housing arrangement where the telecare system was used for door entry, due to a relevant health or social care problem, or a family members' interpretation of care needs. Of those living in their own households or cohabiting (n=6), four users could be classified as 'managed agers' and thus a telecare system was appropriated in order to address a health-related issue and to provide additional help and support, when needed. There was a sense that, for these users, a telecare system was part of a wider care package and could benefit their formal and informal carers as much as the individual themselves.

5.3.2.2. Telecare systems as 'safety nets'

In contrast to technological 'prescriptions', five research participants had more control over whether a telecare system was appropriated. For these research participants, a telecare system was interpreted more as a 'safety net' than as a means of addressing a particular problem. Norma and Ted, who were 'active agers', felt that their telecare system could provide help and support should they experience an emergency while at home. This was not the same as appropriating a telecare system for a specific care-related problem, which was focused more on a present situation, but was more a future-oriented decision should help be required. The following quotes present telecare systems as safety nets that focus on the symbolic properties of the technologies such as its ability to promote safety and security. These quotes highlight a number of precursors to the appropriation of the technology, which include the perceived risk of falling, age, living alone and feelings of insecurity at night:

> **Norma:** *Yeah because if I did fall and I di'n't have this alarm and I couldn't move I couldn't get in touch with [my neighbour]. I've not had to use it.*

> **Ted**: *Well, I'm 85. And when you get to be an octogenarian you're a candidate. You're also … strokes, heart attacks, you name it. When you get to be in your 80s, anything can happen. And a've no family, a've no siblings, so I'm on ma own. So a'm determined, like many other people, to keep that, to keep it that way, and keep independent as long as a can. And this is all part of it, a'll do what a can in order to be prepared; It gives you confidence that you don't feel quite as alone; It's just a little bit that gives you a little bit more confidence, a mean if, erm, if as a say anything a could fall.*

> **Louisa**: *Well, I got one in the first place because I live alone. And it gave me a sense of security if anything went wrong.*

> **Dana**: *I feel safer with that at night, y'know, when I'm in bed … cos you don't know what's around here.*

Ted's account, in particular, encompassed the notion of telecare systems as a safety net. Ted, who was active and mobile, perceived his telecare system as an integral part of growing older. Owning a telecare system enabled him to be "*prepared*" for growing older and gave him "*confidence*" to continue living at home on his own since the death of his wife. This focus on a telecare system's ability to promote a sense of confidence was also reflected by Louisa and Dana who felt more safe and secure knowing that they had a telecare system close to hand. For these users, the symbolic properties of a telecare system were interpreted alongside its functional properties and affordances to access help and support quickly. The technology worked alongside individuals' existing receivership of help and support and added an extra level of security should an emergency arise while at home. Given there was less pressure to appropriate a telecare system; this was a more positive interpretation of the technology that was used to support an ageing individual over time.

5.3.2.3. Telecare systems as 'load balancers'

Two further interpretations of telecare systems were identified, which went beyond the notion that they were either prescribed or chosen for future-oriented reasons. The first of these more nuanced interpretations is telecare systems as 'load balancers'. A load balancer is a device used in computing to distribute the load of network traffic across a number of servers. This ensures that the performance of a network is maintained as resources are used more optimally. Those who wanted to supplement existing provision of help and support (through formal and informal carers) interpreted telecare systems as load balancers. One reason for interpreting telecare systems this way was an acknowledgement that either neighbours may not be available when help was needed or that neighbours themselves were getting older, too:

> **Norma**: If I did fall before [my neighbour] before I got this [my neighbour] said: 'knock on me wall if you need me', you see. But, I've never, I've never had to knock for 'im.

> **Hilda**: You've got the security of knowing there's somebody there. Instant. And that you're not relying on neighbours or family or anything. It's good.

> **Orlaith**: But I weighed it up and I thought: 'well, I need help, and I need somebody to get in'. [My neighbour] has a key. But, and if I rang [my neighbour] she would come, but, [my neighbour's] getting older, too. And I don't feel that I ought to put that responsibility on her shoulders. So I feel happier that I know that if I press this buzzer that somebody will come and

they know, y'know, that when they contact me I would give them the key safe number so that they could get in.

Louisa: You get a lot of information about your next door, cos [my neighbour] was having one fixed at the same time, would I be eligible if anything … I said: 'well, I've always kept keys for her and she's always kept keys for me'. Cos apart from that, apart from that, that's all we will do. Cos I mean, we're both in our nineties. So, er, she said: 'oh, that's OK, don't worry about it any more'. And that, that was it.

The quotes describe a variety of situations that those interviewed experienced where they saw the potential for using a telecare system. These situations included handling adverse events such as falling, feelings of reliance on others, recognition of ageing neighbours and reciprocal relationships. In each case, those interviewed drew attention to the fact that existing strategies for dealing with these situations was limited and that a telecare system could provide them with help and support. This support reduced their reliance on those close to them who they felt were willing to aid them but may not be available or able to provide a sufficient level of help and support when needed.

In addition to feeling that neighbours either could not be relied upon, or were also getting older and would be unable to help if an individual did fall, there was recognition that family members may not be able to provide sufficient help and support. This is reflected in the following:

Orlaith: I want to know that if I need care, I don't have to bring my son fifty miles, er, y'know. And he's got his life to live and I don't want to, y'know, I don't want to be a burden to him. I mean, I've only one son in the family and, er, y'know, I've no daughter or anything, and I've always been independent and that's how I want to stay. But, but, er, er, so from my point of view, y'know, weighing it all up, the best thing for me is having this knowledge that I can press this and somebody will come to help me.

Niamh: [My son] is not well in himself, so he wouldn't be able to get me up. He's had, er, heart operations. And, er, so I don't want to, er, put pressure there; I mean, me daughter can't, cos she's poorly. And, er, and I don't want to. I mean, I know now that I'm a burden to 'em. I am; [I know she's not well.] And I know if they'd to ring, er, she'd want to come. And she can't do it. And she'd do it, and I'm a self. I know; I know that they'd come when they aren't able to do it.

For individuals whose telecare system was like a load balancer, there was a sense of thinking about others, which influenced their decision-making. This goes beyond an individualistic reading of the process to consider how others in a user's social network can, implicitly, shape the decision to appropriate a telecare system. In these cases, telecare systems provided a means of enrolling the call monitoring centre operators into help and support networks. By constructing a telecare system in this

way, research participants were not only safeguarding themselves from future emergencies but also aiding others who may be unable to provide help and support. A telecare system was an appropriate 'solution' in these instances as it enabled caring responsibilities to be shared while privileging the agency of users.

5.3.2.4. Telecare systems as 'currency'

The final interpretation of a telecare system that emerged was that of 'currency'. By this I mean telecare systems were used as a medium of exchange so that users avoided a scenario such as being put into residential care. This interpretation was borne out of a specific configuration of social network that was echoed by two research participants. Cathy and Deirdre were supported agers but members of their families had a significant role in providing them with help and support. In both cases, family members were keen to admit their parents into residential care as a means of assuring their safety following a number of admissions into hospital. However, rather than being admitted into residential care, both users were able to dialogue and negotiate with their children to suggest that a telecare system may provide them with reassurance that their parents were safe and secure. As both research participants argued:

> ***Cathy***: *[I got this telecare system] as a gesture to me son and daughter I thought I'd rather have a [telecare system] than go and stay anywhere, y'know. And, er, at least that satisfied them. [Laughs.]*
>
> ***Deirdre***: *Yes, it's changed [my life] completely because without that I think I'd be under a great deal of pressure to go into a home; [My son] said he'd like me to go into a home but he's very supportive, he says that as long as I want to stop at home. He's very pleased about that, as long as he knows I'm safe.*

Cathy's account, in particular, was interesting because she interpreted her telecare system as a "*gesture*" that was appropriated mainly to satisfy her son and daughter rather than for her own self-perceived level of safety and security. That is, for Cathy, a telecare system was interpreted predominantly as a symbolic object that could be used to influence a present situation such as her son and daughter's desire to put her into residential care. This was something that Cathy did not want to happen, as she told me: "*I don't want to move. I don't. Cos I don't think I would get anywhere that I liked as well*". Beyond the previous interpretations of telecare systems shared above, as currency the technology was used as a tool for negotiating with family

members to achieve a particular end: staying at home in a known environment and avoiding residential care due to its negative connotations. Deirdre's account also reflected this sentiment as a telecare system enabled her son to feel that she was safe, which meant that she could continue living at home. Her account is more black-and-white than Cathy's as she described how her telecare system 'changed her life completely'. A telecare system, in these two instances, was used more for its symbolism as an enabler of independent living although, as discussed in an upcoming section, also used in a functional way to access help and support in emergencies.

Like currency, telecare systems can be used as a medium of exchange and, ultimately, as a means of exercising control and power during life course transitions. This was demonstrated by two research participants who were supported agers with sufficient agency to influence a situation in order to keep living at home. That is, by accepting and using a telecare system users were able to maintain independence without compromising their identities as active, older people (see Section 3.1). For their family members, a telecare system was a means of addressing their concerns that their parents would not be able to contact them in an emergency. However, knowing that a telecare system was in place, they felt that a family member was safe in their own household because they were able to activate a button alarm in the event of an emergency.

5.3.2.5. Conclusion

In this section, I presented four interpretations of telecare systems that I constructed from interview data. These interpretations were: telecare systems as prescriptions, safety nets, load balancers, and as currency. As prescriptions, other individuals such as health and social care professionals constructed the meaning of a telecare system. This provided potential users with little room to negotiate their own relationship with the technology as its use was constructed in such a way that it became associated with a health-related problem. While this meaning may 'fit' with certain types of users who are in a period of transition from 'active' to 'supported' or 'managed' ageing, for those who are active agers the association is more problematic. In these cases, as was demonstrated by Evelyn, a telecare system may be rejected as

its use does not fit with the image that users have of themselves as individuals not defined by health-related problems.

Those who were able to take an active role in constructing the technology's meaning interpreted telecare systems in more positive ways. As safety nets, 'active agers' – and those who were 'supported' agers but not 'managed' agers – appropriated the technology to provide them with a sense of safety and security should anything happen to them in the future. For these users, there was no immediate health-related problem that made a telecare system necessary. However they were all, to some extent, experiencing changes in cognitive and physical function that they felt could affect their need for the technology in the future. A telecare system was therefore interpreted as a means of assuring safety and security *should* anything happen.

Telecare systems were also used as a means of addressing perceived weaknesses in users' social networks. As load balancers, the meaning of a telecare system came through knowing that help and support was available even if family, friends or neighbours were unable in the event of an emergency. Like safety nets, telecare systems were interpreted positively as they could be used to assure future certainty should an emergency arise. Finally, as currency, telecare systems were used as a 'bargaining tool' to resist residential care placement. Rather than focusing on past events, as in prescribed telecare systems, or on anticipated future events, as in safety nets and load balancers, telecare systems were used as currency to negotiate present-day concerns that affected users on a daily basis. For these users, who were in a period of transition from supported to managed care, a telecare system bought time to enable users to remain living at home which was where they wished to be.

The following table is organised in terms of the typology discussed in the previous section and the interpretations of telecare systems discussed in this section. The typology is not meant to provide a black-and-white representation of the interview data, as individuals may shift from one position to another based upon a number of factors, but illustrates the interrelationships between living arrangements, roles and interpretations of telecare systems of those interviewed. The table includes the living

arrangement of research participants as a reminder because this was a factor in how a telecare system was appropriated (e.g. when pre-installed in sheltered housing):

Pseudonym	Living arrangement	Ageing 'role'	Primary interpretation	Secondary interpretation
Evelyn	Sheltered housing	Active ager	Prescription	None
Nina	Sheltered housing	Supported ager	Prescription	None
Rosa	Sheltered housing	Supported ager	Prescription	None
Peggy	Sheltered housing	Supported ager	Prescription	None
Doreen	Sheltered housing	Supported ager	Prescription	None
Hilda	Non-specialist home	Supported ager	Prescription	Load balancer
Frances	Non-specialist home	Supported ager	Prescription	None
Leonard	Non-specialist home	Managed ager	Prescription	None
Niamh	Non-specialist home	Managed ager	Prescription	Load balancer
Latifa	Non-specialist home	Managed ager	Prescription	None
Yvette	Cohabiting	Managed ager	Prescription	None
Norma	Non-specialist home	Active ager	Safety net	Load balancer
Ted	Non-specialist home	Active ager	Safety net	None
Louisa	Non-specialist home	Supported ager	Safety net	Load balancer
Dana	Non-specialist home	Supported ager	Safety net	None
Kathleen	Non-specialist home	Supported ager	Safety net	None
Orlaith	Non-specialist home	Supported ager	Load balancer	Safety net
Cathy	Non-specialist home	Supported ager	Currency	None
Deirdre	Non-specialist home	Supported ager	Currency	None

Table 5.3: Mapping between living arrangement, ageing 'role' and interpretation of a telecare system. Data are sorted by primary interpretation and then living arrangement.

What the accounts of research participants showed is that, alongside the heterogeneity of users' experiences of ageing, there was a commonality in how telecare systems were interpreted. In most cases, telecare systems are prescribed and appropriated in order to address a health-related problem or following a period of time in hospital. This makes an inference from a past event to identify a new need for a telecare system. However, telecare systems are also appropriated as a means of addressing a present concern (i.e. the threat of residential care) and future-oriented

concerns associated with life course transitions such as increased frailty. The next section goes on to discuss how these meanings are negotiated and transformed post-appropriation as a telecare system is incorporated into users' everyday lives.

5.3.3. Maintaining a telecare system: wearing, activating and testing

Following the appropriation of a telecare system the technology had to be incorporated into users' everyday lives and made to 'work'. This involved three 'maintenance' activities: wearing, activating and testing. While not all research participants had activated their button alarm in an emergency, with only six users having done so, the other activities were common amongst users. What was interesting from each user's account was that a telecare system was mostly invisible within their everyday lives but it was the work of these three activities that ensured that it remained visible. This section discusses how the act of wearing, activating and testing a button alarm helped maintain its presence within users' everyday lives in light of the ageing process and personal interpretations of the technology.

5.3.3.1. "I gotta remember to put it on your neck": wearing a button alarm

The act of wearing a button alarm was seen as an important means of ensuring its utility and was commented upon by all users. To be useful in a given situation, it needed to be available to be activated. However, some users were liable to forget to wear a button alarm or kept them 'close to hand' rather than worn around the neck or on the wrist as designed. This decision, beyond forgetfulness, was influenced by a number of factors such as the design of the button alarm and the potential to activate it by accident. In addition, for some research participants, there was a sense that wearing a button alarm was associated with old age, which was an identity to be avoided. As Doreen quipped: *It's like an old women's thing!*" A common feature of research participants' accounts was therefore the hiding of a button alarm when outside of the home as it was seen as symbolic of decline despite users' own positive interpretations of their telecare system as a means of negotiating ageing.

> **Norma**: You're supposed to put it on … but I tek it off at night. I can't sleep in it or I might choke myself! [Laughs.] So, I put it in a little drawer.
>
> **Ted**: To tell you the truth, at the moment, a don't feel it necessary to have it 'round me neck or me wrist. A'm frightened of, er, you know, er, setting it off.
>
> **Hilda**: I'm quite happy with it on. But a must admit a don't put it on every day, a forget.
>
> **Leonard**: Well, a've got to wear it … got to wear it all the time.
>
> **Peggy**: Sometimes when I go out I don't always put it on but mostly I do, yes.
>
> **Deirdre**: Oh yes, I wear it.

The quotes above illustrate several negotiations that those interviewed discussed with regards to wearing a button alarm. Norma, for example, took off her button alarm at night for safety reasons. Ted, on the other hand, did not wear his button alarm often because he feared activating it by accident, which was something that he was afraid of doing. Not all of those interviewed chose not to wear a button alarm, though, as Hilda, Leonard, Peggy and Deirdre endeavoured to wear theirs as much as possible. However, particularly for Leonard, he framed this activity in terms of obligation (i.e. "*a've got to wear it*") and this reflected his relative lack of agency as a 'managed' ager. What was clear, even in this limited number of accounts, was that wearing a button alarm was not a straightforward activity and was negotiated by the user individually or in concert with other social relations.

The design of a telecare system was seen as more problematic for some users although others were much less concerned. The following are a range of responses within discussions about the design of button alarms and, in particular, the decision not to wear it due to its look and feel:

> **Nina**: Sometimes when I go out, and, a like to be dressed up, I, er, I leave it; it looks bad when you've got string 'round your neck! I mean, they'll think she's got a string necklace.
>
> **Cathy**: I don't, I don't like those around your neck. I think they make you look old. I wear a wrist one because I can tuck it away and nobody sees it but I know it's there.
>
> **Latifa**: I don't wear it, I tell the truth. Because it's … I don't wear any jewellery. If people like to wear jewellery, I'll wear jewellery. So, I just, I don't wear jewellery any more.
>
> **Peggy**: I did [wear my button alarm] at the beginning, up until about, ooh, a few months ago, I'd wore it all this time. I thought: 'oh, I don't like the way it's showing here'. This thing sometimes shows if you have it, y'know, around your neck; I didn't like the, what is it, string showing; Some have them out on their tops, y'know, hanging down. Ooh, no way!
>
> **Doreen**: A lot depends on what, erm, mind you, what do they call it, er, the word for if you don't like, it being, if it don't match your clothes or whatever. Not that it dun't match, but if, if it won't go down underneath my attire.

These perspectives suggest that interpretations of a telecare system can be shaped by the design of the technology. For some users, while they were happy to wear a button alarm around their home, they opted not to wear it outside or chose to hide it from view. The reasons for this included the fact that a button alarm was associated with jewellery by some users and it did not look right when worn underneath clothes. This was the experience of Nina, Latifa and Doreen. In addition, a button alarm was associated with 'looking old' and this was an identity to be avoided. In these situations, a button alarm was not worn outside of the home.

Negative interpretations of telecare systems influenced how a button alarm was worn. This was most evident for those whose telecare systems were appropriated as prescriptions, as button alarms were worn if remembered or if reminded by others. This included family and friends who came to visit as well as formal carers who interacted with users on a daily basis. Individuals were often aware of the functionalities of a telecare system and assumed that a button alarm needed to be worn for the technology to be most effective. While wearing a button alarm was negotiated by those who appropriated it as a safety net or load balancer, where telecare systems were appropriated as currency there was an obligation to wear a button alarm in the presence of others: "*I would've been in trouble if, er, [my daughter] had come and I wasn't wearing it! [Laughs.] I would be in trouble*". However, over time, a button alarm was worn more often as it was easier to remember to wear it all of the time than in situations that were unpredictable. In this instance, the act of wearing a button alarm became habitual and even saved some individuals when they fell at home.

5.3.3.2. "It's a bit frightening the first time [you press a button alarm], a think. You don't really know what reaction you're going to get from people, do you, when you press a button": activating a button alarm

While button alarms were rarely activated in an emergency, only six research participants had done so, the meaning of a telecare system could be transformed through activation. As the following comments show, users praised the speed in which help and support could be provided and compared it to other emergency

services. Ted's comment, in particular, demonstrated how a telecare system could be beneficial to older people as it avoids "*overkill*" experienced with other emergency services:

> **Ted**: *Many people don't like dialling 999. A voice comes through: 'which service do you want? Do you want fire, police, or'? And it puts the wind up 'em to start with. Well they'll contact them, [using a telecare system], because they know that if they've fallen they're not going to ring for the ambulance, they're going to send their, um, team out to lift 'em up! [Laughs.] Which is just what the' want. The' don't want to see, old folk don't want overkill. Dialling 999 would be overkill to them. The' don't want to end up in hospital. If the' see an ambulance that's where they're going!*

> **Hilda**: *The response is good. And you don't have to go through the rigmarole you have to go through when you do it on the telephone. Cos it can take forever. Cos then, by then they've put you through to somebody or you get through to somebody who takes all the information you're telling them and they go and ring another number to get the doctors or the nurses to see if they've got to make a call to the house, or if they ought to just advise you over the phone. That, that one that, y'know, they say you can ring the out-of-hours doctor but that's the rigmarole that you get … with that system. With this it's a lot quicker.*

> **Leonard**: *It's better using this than telephoning the team, cos this is quicker and … quick, quickest thing.*

Ted reflected on how he perceived the response from his telecare system although had never activated his button alarm in an emergency. He talked about the perceptions of older people in general to emergency services and the drawbacks to hospital admittance. On the other hand, Hilda and Leonard had used their telecare system and reflected on the quick response that they received. Hilda, in particular, confirmed Ted's perceptions that the telecare system reduced the "*rigmarole*" associated with other emergency services. A telecare system, from these responses, was interpreted as an alternative to emergency services and this was regardless of confirmation that this was the case.

A telecare system was used in five instances for an emergency and in one instance for a 'non-emergency'. For emergencies, users had their button alarm close to hand and were able to activate it when needed. The response that they received from the service was quick and helped them in a situation where they would otherwise have been unable to contact help and support. This was reflected in the following quotes that praised the service:

> **Nina**: *I haven't had to use me emergency, no. I've used it twice, when the' were late coming to dress me in a morning. But, uh, that's all. A haven't used it in an emergency. And a don't want to!*

> **Cathy**: *When I had my last, not my last fall but last time I needed to, er, to press it I found it quite difficult in that I fell off the side of me bed, slipped up, cos this leg dun't bend at all, and it's, it's painful all the time. Erm, and I pressed it, and they answered it, but it's in the hallway there. And I couldn't tell what she was saying! She couldn't tell what I was saying, I don't think! But she did realise, bless her, that I needed someone, y'know. And, er, she, er, sent an ambulance, she rang my daughter, and she rang an ambulance.*

> **Orlaith**: *So [I was laid] on my bathroom door I had my dressing gown and so I pulled the dressing gown and I managed to get the door open and then I shuffled right 'round to the other side of the bed to where I could reach my phone and then I pressed my buzzer and I spoke to them on the phone. And they said: 'oh, they'll be with you', and they were about twenty minutes coming. And it, in those circumstances it seems a long time, and I can understand why people maybe panic because you're laid there and you can't, you feel so helpless cos you can't, you can't do anything because you can't get up. And I tried, but I couldn't. And so, and I said they just came and they put one arm each under me and just lifted me up like that and walked around and into bed. And, er, and so I think, er, it's a wonderful service.*

> **Niamh**: *A did use it once, outside. And it worked. A fell outside. And a pressed it and the' got me son-in-law to come and get me up. And he did. But, er, that's the only time I've used it and got the help. [That were] essential to me that day.*

> **Doreen**: *Erm, but, er, I've only used it once. Once. Because I was, ooh, I don't know, I felt sick and diarrhoea, and I just couldn't get up. So, I just pressed the button.*

The notion of a telecare system as "*wonderful*" and "*essential*" suggests that users create meaning surrounding the technology post-activation. However, at least for one user, positivity towards a telecare system was offset against initial reluctance to use the technology because of the perceived response that they anticipated they would receive:

> **Hilda**: *It's a bit frightening the first time, a think. You don't really know what reaction you're going to get from people, do you, when you press a button. You don't know if you're going to get shouted at. Very good are the staff. Very pleasant.*

It appeared from the responses from users that when a telecare system is activated then the service that is provided behind the technology is experienced positively. This, in turn, influences the meanings that users ascribe to the technology in terms of the response that is provided as well as the speed in which help and support can be accessed. Ted and Hilda's comparisons of the technology to the emergency services are interesting in this regard as they suggest an underlying rationality towards using a telecare system as opposed to dialling 999: older people do not want to be put into hospital where they may be put at more risk. Risk, in this case, can come from contracting further infections when in hospital but also the social consequences of pressure from family and friends who may wish to put older people into residential care to remove the perceived risks of falling in the first place. This was a real concern

for some research participants, such as Cathy and Deirdre, as they transition from supported to managed ageing. However, following Hilda's comments, there may be reluctance to activate a button alarm due to not knowing what will happen after it is activated. This is associated with the last maintenance activity that was identified, which was associated with testing a telecare system. Beyond activating a button alarm when in need, the work of testing enabled users to familiarise themselves with the technology and to understand more fully what happens when it is activated.

5.3.3.3. "I only had to use it for when they rang up to test it, to see that it was alright, y'know?" Testing a telecare system

Testing a button alarm was quite a common practice among research participants and was commented upon by five of them. Testing a button alarm was promoted actively by the provider of the telecare system and served three functions. First, it served a practical purpose in that any problems with the connection to the call monitoring centre could be identified and resolved. This was the most common reason cited by research participants when talking about testing:

> **Norma**: You've got to check it every month; I reckon on ninth of t'month, on the ninth of every month I do it and they answer me and I se': 'it's just, just a check-up … to make sure it's still working'.

> **Ted**: 'Remember to test your pendant once a month to make sure it's working. Why not make it the same day each month? Perhaps your birthday, etc.' Well, I do it on the first.

> **Hilda**: You're supposed to do it once a month but they'll ring every two to three months if you haven't rung. To check that it's working correctly.

> **Yvette**: I only had to use it for when they rang up to test it, to see that it was all right.

Second, the act of testing enabled research participants to become familiar with their telecare system. This was in response to users' initial reluctance to press a button alarm due to not knowing where their call was routed to and how a call would be responded to. As Hilda described with regards to her first time using her telecare system: "*I mean it's a bit frightening the first time, a think. You don't really know what reaction you're going to get from people, do you, when you press a button*". However, through sustained use, trust was negotiated between users and call monitoring centre operators who are trained to handle calls. For some users, and Hilda in particular, operators knowing their name helped build a trusting relationship:

> *Hilda: If I press that button now you would hear it. And then they'll come on, there's a voice.*
> *Interviewer: Yeah?*
> *Hilda: Voice comes on, asking … you know. But they know your name.*
> *Interviewer: [Ah.]*
> *Hilda: [They know your name.] What that buzzer goes, they know your name.*
> *Interviewer: Right?*
> *Hilda: Invariably, you say like: "it's Mrs. Young" or "it's Hilda", whichever applies. But they know your name. And when they're ringing up to check, they know your name then because they say: "Hilda" or "Mrs. Young" … "we're just ringing to check that the line's clear".*
> *Interviewer: And is that, er, do you think that's important that they know your name?*
> *Hilda: I think it, I think it makes it a bit more friendlier, dun't it? I mean, this bloomin' thing goes off like a siren and somebody says to you, and they use your name, you've got instant: "I'm alright!" It's not somebody playing and acting the fool. On, you know, they hold control of it. [I think it's good they do.]*

Third, testing enabled the call monitoring centre to build up a profile of users through the phone calls that were made. From a health and social care service perspective, the act of testing helped the call monitoring centre operators to remain attentive to the needs of users and to keep other services informed should users need further interventions to help and support them. From the perspective of developing the telecare systems service, testing afforded the opportunity for users to provide feedback on their experiences that were incorporated into the future delivery of the service (Bradford Metropolitan District Council, 2012). Testing enabled the local authority to learn more about their users but also the needs of the population with regards to health and social care needs.

While a seemingly routine activity, testing a telecare system was an essential means of maintaining the visibility of a telecare system. Not only were users encouraged to take an active role in maintenance but also through the act of testing their uncertainty towards activating a telecare system could be alleviated. This was significant as the call monitoring centre could be seen as both 'close' and 'distant'. That is, it was close in the sense that it was reachable by activating a button alarm but it was distant in the sense that its physical location was unknown. However, through the act of testing, the distance between users and the call monitoring centre operators was reduced and relationships were maintained every time a telecare system was tested.

5.4.   Conclusion

The case presented in this chapter was of a telecare system provided by a local authority in England known as Safe and Sound. Nineteen users of the technology were interviewed and asked about their views on ageing, old age and their appropriation, acceptance and use of a telecare system. Research participants shared a number of perspectives on ageing and the need to keep active and engaged in everyday life for as long as possible. There were individuals who were not able to participate and it was those individuals' whose everyday lives were much more structured around the provision of help and support. The appropriation of a telecare system was seen as part of the ageing process and featured in research participants' accounts in different ways.

For the majority of research participants, a telecare system was 'prescribed' following a stay in hospital or on the instruction of a health and social care professional. However, telecare systems were also appropriated in order to address present and future-oriented concerns relating to what would happen if they needed to access help and support in the event of an emergency. Once telecare systems were appropriated, they needed to be maintained by users through activities such as wearing a button alarm, activating it when in need and testing the telecare system to ensure that it was functioning. These activities made telecare systems visible within users' everyday lives despite their relative lack of use otherwise: the circuit of telecare systems was maintained in anticipation of future activation.

The contribution of this case study is threefold. First, the experiences of research participants and their perspectives on ageing go beyond the stereotype of frail, older person. Many of those interviewed took an active role in their everyday lives and negotiated the ageing process interactively. Second, while many research participants were prescribed a telecare system, others appropriated the care technology to contribute *to* their independence. Individuals interpreted the care technology positively as it contributed to their identities as active older people. Third, interactions with telecare systems were ongoing. Even where a telecare system was

'rejected', it was placed somewhere close in case of emergency. This questions the notion of what the 'acceptance' and 'rejection' of telecare systems means.

My research has shown that acceptance, rejection and use are ongoing processes. Telecare systems may contribute positively to a user's identity but may be hidden if individuals feel they make them look 'old'. Users of telecare systems negotiate activities such as when to wear a button alarm, when to activate a button alarm and when to test a button alarm. A button alarm may be worn, for example, when a family member is coming to visit or an alarm may be taken off when in the presence of others. Individuals negotiate these actions based upon their definitions of situations and the meaning of their telecare system. This has implications for how telecare systems are designed and how individuals are supported to appropriate and use them relative to identities and life course situations.

6. Case two: negotiating everyday life post-stroke and interacting with a telerehabilitation system

6.1. Introduction

In this chapter, I present the findings of my second case: a telerehabilitation system. I investigated the SCRIPT telerehabilitation system, which was developed for stroke survivors in the 'chronic' stage of the stroke pathway. This meant that users were in a stage of their stroke recovery whereby functional gains was still achievable but at a slower pace. Kirkevold (2002) describes this as a 'semi-stable phase' where the focus of adjustment relates to resuming or reforming valued activities and trying to minimise the effects of stroke on everyday life and perceptions of the self. The design and development of the telerehabilitation system was supported by extensive research into the everyday lives of stroke survivors, which included their life and rehabilitation goals as well as familiarity with technologies such as mobile phones.

Following the creation of the prototype telerehabilitation system, the technology was installed in users' homes and was left with them to use over a six-week period. During this time, the research team that designed and produced the technology monitored users closely through telephone interviews and visits to users' homes on a regular basis. During home visits, adjustments were made to the technology based upon users' comments and feedback. My research, in contrast to the work of the SCRIPT project team members, focused on how users *interacted* with the technology in terms of practical issues as well as the meanings that were associated with the technology. Such issues and interpretations were made visible post-installation by talking with users themselves and listening to their perspectives through interviews.

The argument I make in this chapter is that the ways in which the telerehabilitation system was designed constructed a particular 'type' of user with a specific identity and that those that were recruited by the SCRIPT project enacted this identity through their interaction with the technology. What this meant for the SCRIPT project was that users negotiated the challenges that they faced when interacting with the technology because they saw themselves as *active* stroke survivors. Users drew upon family and friends who helped them to 'don' and 'doff' the orthotic device[1], which was a major component of the SCRIPT project. However, these same users recognised that not all stroke survivors would have family and friends to help and that this would have limited others' interaction with the technology. Due to the challenges that those interviewed faced with the technology they interpreted it as something that they would interact with over a short period of time but it was not something that they would use over a longer period of time. This chapter shows that the ways in which users are constructed can influence how a technology is interpreted but that this interpretation is shaped by how users perceive themselves and their identities.

The chapter is divided into two sections. The first section presents an overview of the case in terms of background information, sample characteristics and research methods. The section introduces the SCRIPT project and the technology that was designed and developed to support the rehabilitation of stroke survivors within their own homes. Due to the small sample size (n=4) that interacted with the technology within the project within the English fieldwork setting[2], summaries of research participants are used. The idea behind the summaries is to present the reader with a relatable picture of research participants that can be used to contextualise experiences and perspectives. The second section presents the thematic analysis of observations and qualitative interviews with the four research participants. Taken together, these themes build upon each other to support my argument that users of technologies such as telerehabilitation systems are constructed and this requires a certain type of user to interact with the technology to ensure its successful working.

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[1] The terms 'don' and 'doff' are used within the SCRIPT documentation and relate to taking the orthotic device on and off.

[2] The SCRIPT project also investigated the use of their telerehabilitation system with stroke survivors living in Italy and The Netherlands although I focused exclusively on the experiences of English users.

To understand how users were imagined by the SCRIPT project, I utilise extant documentation from the project (see Section 6.2.3). This documentation is used as a resource, or 'source of evidence' (Prior, 2008), through which to identify how the SCRIPT project represented users. The analysis presented of this documentation focuses primarily on its *content* and is then used to compare and contrast with my own empirical data in the subsequent themes. The themes that were generated, therefore, combine primary (see Sections 6.3.2 and 6.3.3) *and* secondary (see Section 6.3.1) data analysis. However, even when secondary data is used, the aim is not to describe findings but to use them to understand how the SCRIPT project utilised that knowledge to design and develop their telerehabilitation system.

6.2.   Construction of the case and sample

6.2.1.   Case overview

6.2.1.1.   Current provision of stroke services

Despite its impact and prevalence on individuals and on society, there has been relatively little attention paid to stroke within health and social care policy. A report by the National Audit Office (2005) identified several areas requiring change, covering prevention, response and rehabilitation. The main finding of the report was that stroke services varied considerably across local authorities and that many individuals had limited access to services. Post-hospital support services were scarce and difficult to access. The report resulted in the development of the National Stroke Strategy, which followed from a consultation led by the National Director for Health Disease and Stroke (cf. Department of Health, 2006; Department of Health, 2007a; Department of Health, 2007b).

National clinical guidelines targeting health care professionals, managers and service users also continue to be published to improve the quality of care delivered to everyone who has a stroke (Intercollegiate Stroke Working Party, 2012). It is envisaged that improvements in all areas of stroke care and recovery will continue to be made, which is documented in the most recent follow-up report on stroke services by the National Audit Office (2010).

Rehabilitation – which aims to facilitate the restoration of, or subsequent adaptation to, cognitive and physical functioning – is an area of stroke service provision that has improved since the development of specialised stroke units. The rehabilitation of stroke survivors is now provided typically in two care settings: within an acute care facility (e.g. a hospital stroke unit) and in the community. In hospital, a number of activities are conducted with stroke survivors that include occupational therapy, physiotherapy, and speech and language therapy (Department of Health, 2007b). These are delivered by a multidisciplinary stroke team who assess individuals to ensure that rehabilitation meets their specific needs, which may include the provision of assistive technologies such as chair raisers or hoists (NICE, 2013).

Together, the multidisciplinary team, stroke survivor and their carers construct a stroke rehabilitation plan that comprises goals for rehabilitation and outcomes, which are then enacted through intensive therapy (NICE, 2013). This plan and the individual's progress are then reviewed six months after being discharged from hospital and then annually thereafter. Prior to discharge, the multidisciplinary team and a stroke care coordinator ensure that stroke survivors and their informal carers are happy to be returned to their homes. Long-term support, including rehabilitation, is then provided to aid maximum recovery. This final phase accounts for the majority of the costs associated with stroke and can be the most difficult for stroke survivors[3] and their carers to adapt to (National Audit Office, 2005).

Technologies such as telerehabilitation systems are designed to address the shortcomings in the existing provision of post-discharge stroke services. Given that this is the most costly aspect of the stroke pathway, it is envisaged that technologies will be able to supplement existing support and empower individuals to self-

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[3] Bendz (2003) contrasted the perspectives of health and social care professionals with the perspectives of stroke survivors regarding the first year of rehabilitation after stroke. They found that these perspectives differed significantly. Health and social care professionals often focused on restoring function through training whereas stroke survivors emphasised their loss of control, fatigue and a fear of relapse. This demonstrates the need for stroke services to take into account the perspectives of stroke survivors as their goals may be different to those of health and social care professionals. There are implications for the design and development of technologies to support stroke rehabilitation as a focus on repetitive training may neglect the other factors and goals that are influential to the everyday lives of stroke survivors.

rehabilitate. The design and development of telerehabilitation systems is therefore an important, and growing, interest in public policy.

6.2.1.2. The SCRIPT project

The SCRIPT (Supervised Care and Rehabilitation Involving Personal Tele-robotics) project aimed to evaluate whether stroke rehabilitation could be facilitated within stroke survivors' own homes. This involved the novel application of an established technology (i.e. robot-mediated rehabilitation systems) that had only been evaluated within a clinical context rather than in users' homes (SCRIPT, 2011). In addition, the technology had additional novelty as it aimed to rehabilitate the hand and fingers that had not been achieved before (SCRIPT, 2011). The SCRIPT project was funded by the European Commission and involved collaborations between a number of partners across academe and industry[4]. Each partner contributed to the SCRIPT project in different ways, which was spread over several work packages that focused on the design and development of the SCRIPT telerehabilitation system and its subsequent evaluation (SCRIPT, 2013a; SCRIPT, 2013b).

The contribution of the University of Sheffield built upon previous work on technology-enabled rehabilitation systems, which adopted a 'user-centred design methodology' (Mawson et al., 2014; Mountain et al., 2010; Nasr et al., 2010). This was intended to influence the design of the telerehabilitation system as the perspective of users was emphasised, which was evident within the methodology[5] that was employed in order to generate knowledge about stroke survivors (Nasr et al., 2012). In brief, this methodology utilised methods such as 'cultural probes', focus groups and qualitative interviews in order to understand more about the everyday lives of stroke survivors, their interactions with health and social care providers, and their experiences of technologies.

The focus of the SCRIPT project was to support rehabilitation of the upper limb through intensive, repetitive training facilitated by games-based content. The design and development of the telerehabilitation system itself was influenced by theories of

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[4] This included the University of Sheffield, which facilitated my access to the SCRIPT project.
[5] See Appendix C.

rehabilitation – that prioritise activity and feedback – as well as theories of motivation in order to promote use. For example, by drawing on current research on design strategies for motivation that emphasises the role of gaming and personalisation (Colombo et al., 2007).

Motivation was a particularly significant aspect of the telerehabilitation system due to its significance in achieving successful rehabilitation outcomes. As Maclean et al. (2000: 1051) note: "high motivation patients [are] more likely to view rehabilitation as the most important means of recovery and to accord themselves an active role in rehabilitation". Promoting motivation within the SCRIPT project was accounted for in terms of the games-based content that was designed to promote interaction and the active role of users. While games were designed around hand and wrist movements they were incorporated into games rather than being focused around exercises.

A major contribution of the SCRIPT project, alongside the games-based content and an interface for healthcare professionals, was the design and development of an orthotic device that fit over the hands and wrists of users like a glove. The design of the orthotic device was influenced by the development of computer models that simulated the hand and wrist movements of stroke survivors (Ates et al., 2013). These models were used to determine the locations of sensors and supports in order to capture the movements of users accurately. The orthotic device was then built utilising components such as finger caps, forearm shells and hand plates (Ates et al., 2013). Following its construction, the orthotic device was tested with non-impaired users rather than stroke survivors and feedback was incorporated into its 'final' design (Ates et al., 2013).

The orthotic device connected to a desktop computer and touchscreen monitor that displayed the games (see Figure 6.1). The games targeted movements relevant for rehabilitation of the paretic hand and were designed to stimulate interaction and motivation. For example, a game called *Crocco* was developed that depicted a crocodile swimming upstream and the user had to control its movements from side-to-side as well as jumping over rocks and swimming under logs. Users were thus encouraged to bend their wrists upwards or downwards, and from side to side, in

order to control the movements of the crocodile. A score counter was also implemented that was increased for successful actions, which aimed to motivate users as a target to improve upon the next time that they played.
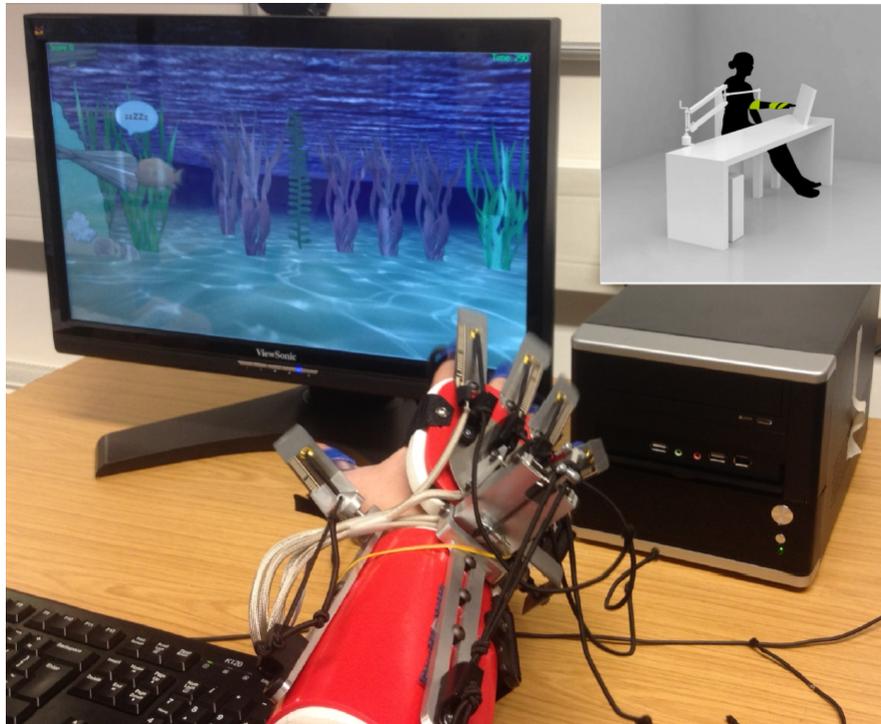
Figure 6.1: The SCRIPT telerehabilitation system including orthotic device, desktop computer and touchscreen monitor for displaying content.

The telerehabilitation system also connected users to a health and social care professional, which was used to monitor progress and provide electronic feedback[6]. Users were also able to interact with a health and social care professional asynchronously through a messaging platform. The messaging platform worked a bit like email in that both groups of users could exchange messages that appeared in an inbox and were notified on-screen of new messages. Health and social care professionals were also able to assess users' interactions with the telerehabilitation system through charts depicting the time spent on games as well as displaying score counters. This enabled the personalisation of content to the specific user and enabled the health and social care professional to manage the progress of stroke survivors remotely.

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[6] Users were also given paper-based records that they used to record progress and identify any problems that they encountered with the telerehabilitation system.

In terms of processes that contributed to the design of the telerehabilitation system, quantitative and qualitative data were generated[7]. For example, the design and development of an orthotic device was influenced by computer models of stroke survivors' upper limbs that helped inform where to place components to enable the greatest range of movement of the device. In addition, qualitative knowledge regarding users and the personal context of use was collected to inform the developers (Nasr et al., 2012). Focus groups and interviews with users were used to establish the personal effects of stroke and users' familiarity with technologies such as mobile phones and personal computers. This qualitative knowledge gave developers a sense of what it was like to be a stroke survivor and some of the challenges that they faced. However, the qualitative knowledge required 'translation' into requirements that could then be used by the developers.

In terms of use, evaluations of the telerehabilitation system focused more on usability rather than the technology's incorporation into users' everyday lives. The system usability scale was employed in order to generate a 'measure' of users' perceptions of the telerehabilitation system (see, for example, Nijenhuis et al., 2013). However, while the system usability scale provides a means of assessing perceptions of 'usability' (Bangor et al., 2009) it does not provide further information as to why users rated a technology in a particular way. For example, the difference between a system usability score of 100 and 67 cannot be explained using only numbers (Nijenhuis et al., 2013). I draw upon the documentation and work of the SCRIPT project in order to focus on users' experiences and interpretations of engaging with the telerehabilitation system. This does not replicate the work of the SCRIPT project but instead provides an alternate focus on the identities of users and the ways in which they used the technology. The purpose of my research is therefore different to the goals of SCRIPT.

In summary, the SCRIPT project evaluated how and whether telerehabilitation systems can be used to support the rehabilitation of stroke survivors within their homes. The focus was primarily on the design and development of the prototype technology, which was then left with users to evaluate over a period of six weeks. I

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[7] See Appendix C.

was able to observe the installation of the technology and question users about how they felt about the technology and what challenges they faced when integrating it into their everyday lives (see Section 6.2.3). This research went beyond the evaluations of the SCRIPT project as my focus was on how users were constructed by the producers of the technology and the ways in which users interpreted the technology and went about using it.

6.2.2. Recruitment and sample characteristics

Four stroke survivors were recruited from the SCRIPT project (see Section 4.7.1). The stroke survivors who were interviewed and observed were all female and living in their own homes (one was cohabiting and three were living on their own). All research participants attended weekly stroke clubs or therapy sessions delivered by a private health care provider as part of their rehabilitation. Research participants paid for attendance at these stroke clubs and therapy sessions. All research participants considered themselves fortunate to be able to afford to attend these activities, which gave them an opportunity to interact with other stroke survivors as well as receive personalised rehabilitation. This was something that they knew not everyone could afford but that contributed positively to their own life course goals.

Pseudonym	Age group	Side affected	Living arrangement
Iris	30 to 40	Right	Cohabiting
Jayne	70+	Right	Own home
Keira	60 to 70	Left	Own home
Laura	40 to 50	Left	Cohabiting

Table 6.1: Attributes of the four users of the telerehabilitation system recruited including pseudonym, age group, side affected by stroke and living arrangement.

While all of the research participants were reliant on others to some degree, they maintained a high level of independence. Although there was little variation in self-rated feelings of independence, accounts differed in terms of the influence of stroke on their everyday lives. For example, unlike the other research participants, Iris was working at the time and has since found it difficult to return to work as her impairments mean that she is unable to drive. Jayne, on the other hand, was able to drive and was also an advocate for stroke survivors. This was an occupation that she

enjoyed and embraced as she felt she was helping others. There was therefore some variation in the life course goals that each research participant talked about.

Due to the small number of stroke survivors that were recruited (n=4), I felt that the most appropriate way to present their accounts was in summary form. This was due to the fact that presenting data in tabular form, as was possible with research participants for the first case study, would not be meaningful. Each summary has been generated from interview transcripts and observational notes. These summaries are a representation of research participants' accounts and, as such, do not attempt to present a comprehensive account of research participants' everyday lives but are included to provide background information. The summaries focus on aspects of the everyday lives of research participants that they were willing to share, including their (rehabilitation) goals, and the social relationships with others.

> **Iris:** lives at home with her mother and father who provide her with help and support. She has strong links with her local community and this has helped her feel 'accepted' post-stroke despite the challenges that she continues to face. In particular, Iris is a member of the local church and so has been able to interact with people that knew her both pre- and post-stroke. She had a stroke while at work and hopes to return there as soon as possible. This is her goal for rehabilitation although she has been able to adjust to working at home, too. Iris was discharged from hospital relatively early post-stroke and now pays for private stroke-related care that she receives every week. This is something that she is able to pay for herself, which she is grateful for, as she knows that not everyone can afford this level of help and support. Iris incorporates stroke rehabilitation into her everyday life rather than dedicating blocks of time to exercise. She feels she is goal-driven and is looking to return to some form of 'normality'. The only thing that she would like to do but can't do is drive. This would help her in getting to and from work. She continues to make progress and has learned to adapt to her new life. Iris is keen to do all that she can to support her return to normality, which includes searching the Internet for new assistive technologies. However, she finds that her

expectations and those of her physiotherapists differ, as they tend not to support her requests to appropriate the assistive technologies she finds.

Jayne: has a busy lifestyle and gets out of the house on most days. She is still able to drive and looks to test herself through exercise and challenges such as walking to the kitchen unaided. She feels that sitting in a chair would be detrimental to her health so aims to be active as much as possible. Jayne receives quite a lot of formal care and support although tries to do as much as she can on her own. Her husband died a few years ago and her son is able to visit her once a week. She also keeps in touch with her son through her tablet computer, which was a gift from him. Jayne she is not a novice when it comes to computers and so enjoys using her tablet computer often. Jayne attends a stroke club every week and shares her experiences with others, which is all part of her recovery. This attitude is something that she adopted from working with younger colleagues who she enjoyed competing with in weekly challenges. Jayne is very determined to regain her mobility and use of her arm and this is why she takes it upon herself to exercise every day. Her state of mind is very positive and this is something that she thinks every stroke survivor needs to maintain. For Jayne, post-stroke recovery is a state of mind.

Keira: is keen to do everything that she can to support her recovery. This includes walking to the shops and attending private physiotherapy every week. She has even gone online to search for assistive technologies to aid her rehabilitation. Her friend, who has helped since her husband died a few years ago, provides a lot of support: he is a great help. While she receives some formal care, Keira is keen to do things on her own. Despite the advances that she has made she is still hard on herself and wishes she could do more. She is very proud of her daughter who visits her regularly. Keira's mobility was impaired following her stroke and is set to have her foot operated on. Currently, she has accepted an orthotic shoe that she feels looks unsightly. She hopes that the operation will improve her mobility. Sadly, she had to stop working after her stroke although was fortunate to have been close to retirement when her stroke happened. In the future she hopes to have a new

driveway built as this was something that her husband wanted before he died. She enjoys living where she does and would not want to move.

Laura: lives at home with her husband and dog. She attends a physiotherapy session every week and tries to exercise on her treadmill as much as possible at home. This is because she desires to regain as much of her lost functionality as possible and considers exercise an important factor in this process. Her mobility issues have meant that travelling on public transport has been particularly difficult and so she does not tend to travel far on her own. She doesn't mind, though, and spends a lot of her time in the garden that she is really proud of. Following her stroke, Laura spent a lot of time in her front room and so modified the room to accommodate this. This included moving a bed, commode and telephone downstairs. While this was a challenge at first, it was essential to her recovery. She is now able to help her husband a lot more with his work and takes telephone bookings for him when he is not at home. While her stroke has affected her everyday life she still remains positive. This was exemplified by the fact that she went on holiday just a few weeks after being discharged from hospital.

The research participants shared a number of common characteristics that, in turn, influenced how they interpreted and interacted with the telerehabilitation system. First, research participants were in the 'semi-stable phase' of their post-stroke illness trajectory (Kirkevold, 2002). This phase means survivors have come to terms with the effect of stroke on their everyday lives and are working on practical strategies to resume and reform valued activities. This included activities such as attending stroke clubs, paying for continued rehabilitation and returning to work. Second, research participants had strong links with family and friends who were able to provide help and support. In two cases, this was made possible through cohabitation with parents or a partner whereas for the other two cases help and support was provided from external sources. However, research participants were all in a position to draw on help and support when required. Third, research participants articulated a strong desire to continue with their rehabilitation. This reflects current research on personal factors that promote post-stroke recovery,

which highlight the significance of 'inner strength', optimism and a desire to reduce reliance on others (Jones et al., 2008). Fourth, and in addition to personal factors, research participants described specific 'markers' of independence that were used to assess progress. Some of these markers were developed in collaboration with health and social care professionals but also include the performance of tasks such as cleaning, cooking and dressing. While these characteristics were common across research participants, that is not to say they are representative.

6.2.3. Data generation and analysis

Data for this second case were generated from a number of sources. Documentation produced by the SCRIPT project was utilised in order to gather details about the technology and how those working on the project conceptualised users and the potential for the technology to be incorporated into users' everyday lives (see Appendix D). This documentation from the producers of the technology was contrasted with the 'real-world' experiences of users who interacted with the technology over a period of six weeks. During this time, I was able to observe how the technology was installed in users' homes and then talk with them to see how easy the technology was to interact with and how users, with regards to their identities as stroke survivors, interpreted the technology.

Observational notes written during installations were clarified during interviews, which also focused on research participants' experiences of stroke and how this was associated with their identities (see Section 4.4). Using observational notes in this way enabled me to clarify my interpretations of research participants' interactions with the technology and provided me with an opportunity to ask specific questions about what I had observed during installations. While observational notes were used when developing the themes, the main data source was the interview transcripts that captured the experiences of research participants. As with the first case, themes were constructed in relation to how research participants spoke about themselves and their experiences with the technology that focused around the practicalities of incorporating its use within their everyday lives.

6.3. Analysing the case: key themes

6.3.1. "The findings help designers and technology developers have a detailed knowledge of the diversity of [users]": imagining 'ideal' users of the telerehabilitation system

This theme focuses on how users of the telerehabilitation system were constructed. Using the 'sources of use knowledge' framework (Peine and Herrmann, 2012) and documentation produced by the SCRIPT project (see Appendix D), I explore references to 'users' to understand how images of stroke survivors were identified and incorporated into the telerehabilitation system. While it is accepted that documentation only provides one perspective, it represents how the SCRIPT project chose to present itself to others both within and outside of an academic community of researchers. The following quote served as a starting point for my analysis and encapsulated the general approach of the SCRIPT project in terms of its design methodology, which emphasised a affinity with principles of 'user-centred' design:

> *"The aim of this methodology is to ensure that designers, developers and clinicians have an in-depth knowledge of the diversity of the potential users of robotic devices, namely people who have had a stroke, carers and professionals working in stroke rehabilitation. Additionally, the methodology adopted aims to engage the target users during the process of system development by enabling them to provide their views on design and functionality … We have been particularly interested in what people with stroke express about the experience of living with the condition, and also how people with stroke and carers use technology in their daily lives, and to capture their views on stroke rehabilitation." (Nasr et al., 2012: 5)*

The main sources of use knowledge identified within the documentation were 'indirect' and 'direct' representations. Indirect representation, which focuses on the expertise of designers and developers, could be identified within discussions surrounding the orthotic device. The orthotic device was highly complex and consisted of a number of sensors that captured and analysed the hand and wrist movements of users. The placement of sensors was informed by computational models that simulated the capabilities of stroke survivors, which were based upon a range of values capturing 'range of movement' (Ates et al., 2013).

Figure 6.2 depicts a computer simulation of the hand and wrist that was developed in MATLAB and then configured to approximate the range of movement of a stroke survivor (Ates et al., 2013: 2):

Segment	Joint	Degree of Freedom	Max [deg]	Min [deg]
Forearm	Wrist	Flexion/Extension	40	40
Thumb	CMC	Palmar Abduction	50	0
	CMC	Radial Abduction	20	0
	MCP	Flexion/Extension	60	5
	IP	Flexion/Extension	80	0
Index,	MCP	Flexion/Extension	60	5
Middle,	PIP	Flexion/Extension	80	0
Ring, Pinky	DIP	Flexion/Extension	80	0
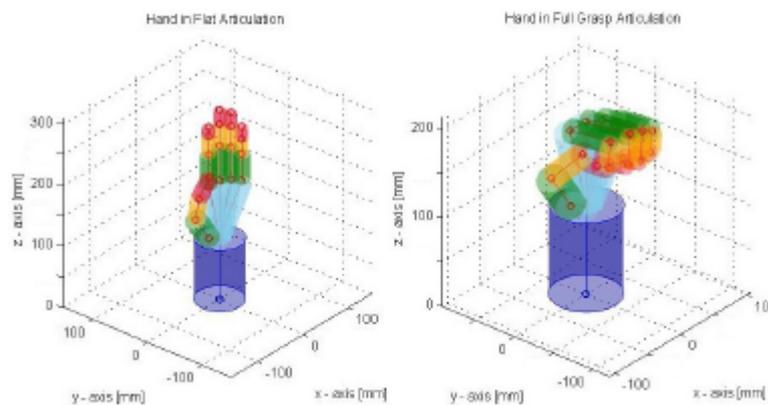
Figure 6.2: Simulation of the hand and wrist that was used to inform the design and development of the orthotic device (Ates et al., 2012).

Testing of the orthotic device, aided by the simulations, was performed with 'healthy' subjects and took approximately five minutes for them to 'don' and 'doff' the device (Ates et al., 2012). However, it did not appear from the documentation identified that stroke survivors' ability to don and doff the device was evaluated until the technology was placed in their homes (see Appendix E). As Ates et al. (2012: 5) note: "*The clinical partners of the SCRIPT project have already started the real experiments with actual stroke patients at their places. So far, it was observed that some stroke patients are in need to use the SPO with external help*". In this case, the expertise of designers and developers appeared to be removed from 'clinical partners'.

To complement indirect representations of users, qualitative methods were utilised in order to understand the context of use as well as stroke survivors' comfort and interactions with technologies. Methods included focus groups, qualitative interviews and home visits utilising cultural probes (Nasr et al., 2012). In addition, usability of the

user interface of the telerehabilitation systems was evaluated before deployment into users' homes (Steffen et al., 2013). This also included the use of 'cognitive walkthroughs' and 'cooperative evaluations' that were used to evaluate prototypes and report back to the designers and developers. As with the evaluations of the orthotic device, 'real world' testing was performed after near-final versions of the user interface were completed and was treated as a separate stage of the design process: "*the system has now entered intensive evaluation that will continue in the following year with patients in real-use situations at home*" (Steffen et al., 2013: 2).

Direct representations of stroke survivors aimed to highlight the challenges of living with stroke as well as stroke survivors' attitudes towards technologies for rehabilitation. This included the perspectives of health and social care professionals who were also seen as users of the technology in terms of providing remote support for rehabilitation. Findings from the qualitative methods were 'translated' into user requirements, which were discussed with designers and developers: "*requirements were added by the clinical partners, based either on the outcome of focus groups, cultural probes or interviews reflecting on true user requirements*" (Nasr et al., 2012: 75). User requirements were classified in relation to issues such as usability, motivation and feedback on progress. Negotiation then took place between those who worked directly with stroke survivors and designers and developers who were tasked with incorporating images of the user into the telerehabilitation system: "*it was necessary to find a balance between the user requirements reflecting on the diversity and complexity of the problem, and the achievable and feasible breakthroughs possible technologically*" (Nasr et al., 2012: 75).

SCRIPT research participants were generally positive about the role of technology for stroke rehabilitation although few were able to imagine what a robotic technology to support stroke rehabilitation would look like. There were also some reservations from stroke survivors and experts as it was argued that "*home-based technologies should be introduced when the user still [has] some degree of movement in their affected arm*" (Nasr et al. 2012: 21). This suggests that the technology may only be usable by a subset of 'capable' stroke survivors, and that not everyone will be a capable user. This is despite the potential for the technology to provide motivation

and help users achieve goals (Nasr et al., 2015). The following quote describes stroke survivors' perceptions of what a technology to support stroke should support:

> *"[All research participants recruited] stressed the importance of having meaningful goals and receiving motivating feedback during the process of stroke rehabilitation using home-based robotic technology." (Nasr et al., 2012: 37)*

It was evident from the documentation produced by the SCRIPT project that the provision of feedback, goal setting and motivation were essential characteristics of a telerehabilitation system. SCRIPT focus groups and interviews centred on these themes, and were interspersed with stroke survivors' reflections on the use of technologies in general. The final design of the telerehabilitation system incorporated the provision of feedback that was intended to motivate users and enable them to achieve life goals. However, while there was some reflection of how the design of the technology may affect its usability, research participants did not interact with a telerehabilitation system in-person and so their comments reflected their perceptions rather than their actual experiences. Design decisions were left to the developers who interpreted research participants' responses and anticipated user needs.

The role of users in the design of the telerehabilitation system focused on the identification of usability issues such as the size and weight of the technology. Stroke survivors were described as able, willing technology users in search of a technology that would enable them to meet life goals through feedback designed to motivate them to self-rehabilitate. The design of the technology centred on this conception of 'the user' and users were 'constructed' (see Chapter 3) as individuals capable of engaging with a technology designed to motivate and promote activity. This is an important finding for the remainder of this chapter, which goes on to assess whether this user conception was valid and discuss the unanticipated challenges faced when the technology was used in practice.

6.3.2. Adjusting to everyday life after stroke

My research participants' experiences of everyday life post-stroke reflected the unanticipated nature of stroke and the challenges that they faced as a result of

cognitive and physical changes. While the research participants dealt with the effects of stroke in different ways there was a sense of commonality between their accounts, which are discussed in this section. In particular, as with the accounts of older people discussed in the previous chapter, research participants spoke about the need to keep as active as possible while working together with others to limit the detrimental effects of stroke. The ways in which research participants adjusted to everyday life post-stroke was particularly significant for their interactions with the telerehabilitation system, which may not have been the case for other users.

6.3.2.1. Adjusting to changes in cognitive and physical capabilities

While a stroke can affect people in different ways it is likely that it will leave survivors with weakness on one side of their body, which is known as hemiparesis. In most cases, hemiparesis can affect a person's mobility and leave them with reduced muscular strength and range of movement that can make everyday activities such as cooking, cleaning and dressing difficult. Stroke can also affect a person's ability to speak, to find the right words and to understand what others are saying, which is known as aphasia. This can limit an individual's ability to communicate and, when combined with issues of mobility, affect their quality of life negatively. For the research participants who took part in the SCRIPT project, issues with mobility and speech were less pronounced but were still visible within their accounts[8]. All research participants commented upon how the cognitive and physical changes arising from stroke had affected them:

> **Iris**: It is challenging to be suddenly different to everybody. And to find that you just can't do things; In a way, that [getting back to work] brings its own pressures because I, um, sort of like to look as normal as you can and then when some, some, situation you're suddenly … you can't do something, it's quite hard to cope with; [Dependence on others] is one of the most difficult things I've found to cope with.

> **Jayne**: They haven't got much drive in them not to want to walk and I think that's their greatest hazard of all not being able to use your legs. But, er, I think I'm proving that as you do it I'm getting better. I will walk very soon I think.

> **Keira**: Y'know, and what I've learned to do wi' me left hand is incredible, really. People say you're amazing at how you've, how resilient you've been and how you've got on. I don't think so, I am negative, it's what I can't do, not what I can do. How bloody good it is … put double sheets on and get on and tuck 'em in. I like me hospital corners … an' everything's just got to be so. But I can't put pillowcases on. She says: 'you're so negative!' Y'know, but that's me … I want me life back.

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[8] For example, while Iris was left unable to drive following her stroke, Jayne was still able to.

The quotes above cover a range of responses to everyday life post-stroke. Those interviewed highlighted the significant cognitive and physical effects of stroke in terms of "*drive*", "*not being able to use your legs*" and the need to be "*resilient*". Laura, for example, found that she had to counteract feelings of falling over through conscious mind action. However, the cognitive and physical aspects of stroke were also associated with social implications of stroke. For example, those interviewed spoke about feeling "*suddenly different to everybody*", wanting to return to work and feeling that increased dependence on others was difficult to handle. These quotes illustrate how stroke can have social implications but that these implications depend upon the individual and their present circumstances. For Iris, her desire to return to work featured mostly in her account whereas for others, such as Jayne and Keira who were no longer working, their accounts focused more on activities such as walking and making beds that were seen as meaningful activities to them at this particular moment in their everyday lives.

Research participants reflected mostly on how they wanted to return to some form of 'normality' that was 'disrupted' by their stroke. Iris, for example, desired to return to work as soon as possible but this was problematic for her as the effects of stroke meant that she was unable to do things that she once could such as driving her car. In turn, this influenced how she felt about herself as she described the added 'pressure' she felt when in social situations that she had little control over. However, as Jayne and Keira described, surviving stroke also involved the adjustment to cognitive and physical changes by learning and pushing yourself to perform activities as much as possible, and recognising that there may now be some aspects of everyday life that will need to be sacrificed.

6.3.2.2. Recognising the need to keep active and motivated

While all research participants were affected by their stroke in terms of reduced cognitive and physical capability, they emphasised a need to keep active as much as possible. Keeping active featured in all of the accounts and was associated with a return to some form of 'normality'. That is, research participants desired to return to

a previous state of affairs in spite of cognitive and physical change. There was, however, also a need to maintain a level of motivation in order to keep active. It was recognised by those interviewed that not everyone is able to maintain this level of motivation, as they referred to how the alternative, being inactive, was also possible but not a choice that they accepted. Their experiences were as follows:

> *Iris*: In hospital they kept saying: 'what are your objectives?' and I kept saying: 'to get back to normal'; You go through a stage where everything's a bit of a nightmare and you're very frustrated and then, then I went through a stage where I was … sort of got time on my hands and I couldn't really stand that.
>
> *Jayne*: The physiotherapist will tell you that the average person comes home from hospital from the' stroke and they sit in the chair and they watch the television, and they don't do anything else. I think that's fatal because you'll be stuck to the chair, y'know. I get up out of the chair all the time for all sorts of reasons. I try and, well, in the morning the helper's supposed to give me a shower and dress me and give me my breakfast and all that. I do as much as I can to dress myself, and the same at night. I try and make it as normal as it can be, y'know.
>
> *Keira*: I know people that's had stroke that's still getting physio and they're not doing anything between the visits. And I think: 'well, what a waste'. Y'know, they just sit in their chair all day.
>
> *Laura*: I try and do exercise every day cos I think if ye get out of the 'abit, ye just don't do 'em, do ye? I think you've got to because otherwise you could sit and watch telly, couldn't ya?

The quotes above draw attention to how keeping motivated was first emphasised when in hospital and then in conversations with physiotherapists. There was a sense that motivation changed over time and that this was in response to different stages of stroke rehabilitation and recovery. While physiotherapists were there to promote motivation when those interviewed were attending physiotherapy sessions there was a need to maintain a level of motivation when at home. It was recognised that this could be difficult and required participation in everyday activities such as dressing and exercising. The activities that those interviewed took part in differed, and were not always performed every day, but were recognised as significant to promote further recovery.

Motivation for keeping active ranged from dealing with boredom through to a desire to return to normality. Iris, for example, described how she experienced stroke recovery in a number of stages that involved maintaining certain levels of activity during the early weeks and months through to eliminating inactivity in the later months. She described a desire to return back to work as quickly as possible and to maintain the levels of activity that she did pre-stroke. Both Jayne and Keira, while

retired, also strived to keep active by performing everyday activities such as cooking, cleaning and dressing to the best of their ability. Laura, in contrast, chose to exercise to keep herself active, as this was a means of feeling that progress was being made.

Research participants' recognition that they needed to keep active and motivated was a significant factor in their interactions with the telerehabilitation system. While this is discussed in the next section it is important to note that all of the stroke survivors said that they *chose* to keep active and this could take a number of forms. There was recognition, however, that some may not be motivated enough to keep active and this could lead to activities that were perceived negatively such as sitting and watching a television all day. This, to all research participants, was something to be avoided as best possible. The research participants who were recruited by the SCRIPT project all spoke about keeping active and had a desire to either return to some form of normality or to reduce feelings of boredom.

6.3.2.3. Accessing formal and informal help and support

Accessing help and support, whether formal or informal, was seen as important to research participants. In all cases, the support that was provided after they had left hospital was often minimal beyond a six-month period. To this end, research participants drew on financial resources in order to access private therapy to provide support. The reason for doing so was related to a desire to continue improving in spite of cognitive and physical change. Iris, in particular, identified that she was fortunate to be able to do this and that many would not be able to access the level of help and support that she could afford. Jayne, who emphasised the significant role that carers could play in providing motivation, also reflected the benefits of support.

> *Iris: For a while, um, they came out from the community team but, obviously, they couldn't provide as much physio as they can give you in hospital. And they did that for quite a long time but it reached the stage when they couldn't really come any more, um, but I knew that I could continue to make progress and so I went for private therapy; I do feel very sorry for people that are, um … I mean I, I had very good treatment but some people are … leave hospital ever so quick. And I know at that time I would've been. I don't know what I would've been! But it would've been a very scary experience; a lot of people would be left pretty much on their own and I feel very sorry for anyone in that situation.*

> *Jayne: They are just carers. They bring me meals and y'know general things and that. But when you get the corporation set of people they're … they give you physio as well as care. They*

do your exercises with you and other things. Stand with you while you do them, y'know. And, er, that's in a way good for people that aren't motivated because. Like I am anyway, I still want to do it all. Like I'm practically walking and, er, every day I think I'm going to go to the telly and, y'know, try it on your own.

The experiences of Iris and Jayne highlight the benefits of formal help and support to stroke recovery. However, as Iris noted, such benefits could only be realised through private physiotherapy that she paid for and attended on a weekly basis. This was associated with her own desire to make progress although she recognised that she was able to access formal help and support because she was stable financially. Jayne, on the other hand, talked about changes in help and support that influenced her levels of motivation. While she was used to the provision of help and support in bringing meals she also received in-home physiotherapy. This was part of Jayne's care package and, although she was a motivated individual, helped prioritise exercise and rehabilitation activities.

Similar to the experiences of older people discussed in the fifth chapter, help and support was interpreted positively rather than negatively. That is, private physiotherapy was seen as beneficial in terms of the motivation that it could provide as well as beneficial in terms of the guidance that physiotherapists provided on how to handle changes in cognitive and physical capabilities. In this sense, accessing help and support provided a 'social' side of stroke rehabilitation that enabled those interviewed to learn more about themselves but also gave them an outlet to share their experiences with others[9]. However, there was a sense that there could be a downside to accessing help and support, too, which is reflected in this comment from Jayne:

> **Jayne**: *Y'see, there's a very happy medium there because it's either you've nobody to help you or you've someone to help you and they're really hindering you, y'know. Because you're doing what they would do with it rather than what you would do with it.*

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[9] The sharing of experiences and encouragement, for example, are seen as essential to post-stroke recovery and are known as 'vicarious experience' and 'verbal persuasion' within the literature on stroke (Jones, 2006). Vicarious experiences focuses on "the comparison and modelling of others, it can be beneficial to observe someone perceived to be similar (model) successfully performing the task" (Jones, 2006: 842) and verbal persuasion "serves to increase an individuals belief about their personal level of skill through the use of persuasion and verification from a significant other (professional or key family member)" (Jones, 2006: 842).

Further to Jayne's comment above, accessing help and support must be attentive to the needs of the individual rather than a 'one size fits all' solution. She described a "*happy medium*" between help and hindrance, and a need to focus on what the stroke survivor wants rather than the formal or informal carer. While other research participants did not reflect upon the challenges of getting appropriate levels of help and support it was illustrated by how they balanced activities that they tried to do themselves with those that they accessed help for. For example, how Keira liked her "*hospital corners*" on her bed, which enabled her to retain a personal touch against the backdrop of the routinised help and support she was provided with. This shows how an everyday activity such as making a bed can be interpreted meaningfully by stroke survivors and that this meaning can add value to their everyday lives if they are able to master it.

6.3.2.4. Maintaining a positive state of mind

The final 'aspect' of adjustment identified by research participants was maintaining a positive state of mind. Research participants were affected by stroke in different ways and employed strategies to overcome challenges by keeping active, and accessing help and support. However, underlying each of their accounts was a personal philosophy to maintain a sense of positivity and to act upon this positivity as much as possible. This was not easy for research participants, as Keira's reflection below testifies, but remaining positive either through personal mastery of tasks such as cooking and cleaning or sharing experiences with others was seen as an important part of post-stroke recovery. Research participants phrased this aspect of adjustment differently based upon their personal circumstances, which are encapsulated in the quotes below:

> ***Iris****: Well, I've just always believed in taking any opportunity you get and might possibly help you and help the wider community. If you've had something like that happen to you you're conscious of lots of other people who maybe haven't been so fortunate in terms of their recovery.*

> ***Jayne****: A person's state of mind to life is more important than anything else. Like if you give up and that then the treatment generally doesn't do you any good but if you have high hopes for it then it will do.*

> ***Keira****: People say you're amazing at how you've, how resilient you've been and how you've got on. I don't think so, I am negative, it's what I can't do, not what I can do.*

For Iris, maintaining a positive state of mind was associated with taking up opportunities and helping others in the wider community. This was something that she did through connections with a local church where she was able to talk with others about her experiences and to help others that had been through similar situations. For Jayne and Keira, maintaining a positive state of mind was more about an internal drive to keep active and engaged although this could also be shared with others. Keira, in particular, drew upon formal carers as a source of motivation as they kept reminding her about the significant progress that she had made. While this was difficult to accept, as Keira did still deny that she was making progress, having that contact with others was a source of personal inspiration.

Maintaining a positive state of mind is supported by research on the aspects of everyday life that support self-efficacy (Jones, 2006). This aspect of research participants' adjustment was constructed personally but was influenced by social relationships that were negotiated with formal and informal carers. For example, while Keira maintained that she was a negative person her formal carers, who gave her praise at every opportunity, often challenged this negativity. This highlights how social relationships can support an individual by providing positive feedback, which enables them to challenge themselves further. For my research participants, such interaction appeared to be an important means of supporting their positivity.

6.3.2.5. Conclusion

As can be seen by the accounts presented above, research participants claimed to be engaging actively in their everyday lives to overcome the effects of stroke. While they experienced some form of cognitive and physical change they were self-motivated to keep active and determined in order to return to some form of normality. In addition, research participants were supported to do this by both health and social care professionals as well as family and friends who provided help and support. Research participants embodied a philosophy of not giving up and, as Jayne told me, focused on maintaining a positive state of mind. This was achieved through activity but also focusing on the future and drawing on help and support to negotiate challenges as they arose.

6.3.3. Interacting with the telerehabilitation system

The telerehabilitation system was installed in research participants' homes for up to six weeks. During this time, users were asked to interact with the technology for an agreed amount of time but the expectation of a minimum amount of interaction was set. During the six weeks, members of the SCRIPT project team were contactable through email, the technology's messaging system, and through weekly visits to the users' homes. Engaging with the telerehabilitation system in practice, rather than in theory, challenged users in several ways that were not anticipated at the outset of the SCRIPT project. However, reflecting the active identity of research participants in terms of rehabilitation, users negotiated challenges in order to interact with the technology to a level that they deemed was appropriate.

6.3.3.1. Being selected to take part in the SCRIPT project

The ways in which research participants were recruited by the SCRIPT project provided a baseline through which to understand users' interactions. It appeared from research participants' accounts that they were recruited because of their abilities that were assessed by their private physiotherapist. To this end, those recruited were deemed suitable by virtue of the fact that their profile met what physiotherapists thought the SCRIPT project was looking for. This was reflected in research participants' accounts as they spoke of "*fitting within a certain framework*" and saw themselves as "*likely suspects*" to get involved with the SCRIPT project. The following quotes illustrate how research participants were recruited by the SCRIPT project and the ways in which they made sense of the recruitment process from their perspective:

> ***Iris***: *I think … (did I first hear about it on the phone, I'm not too sure?) Yeah. She rung me up, and I spoke to him, actually. And he just said he'd been approached by this project and it had to, um, fit within a certain framework of how well, how far you'd got on. And I obviously met the … I was obviously at that stage. I think it was just how much movement you'd got and hadn't got and etc. And that … and how long since you'd had your stroke, and … that sort of thing.*
>
> ***Jayne***: *You see [my physiotherapist] … I was going to them for physiotherapy and he told me to ring up about this, you see, well he could see that I was the kind of person that needed it. In his own professional way he knew. And, er, they all think: 'oh, I must get one of them!' And I'm like: 'well, they can't!' [Laughs.] Because they're not … not because you don't want to but because they're just not suitable.*

> *Keira*: I'd been going to [a physiotherapist]. I'd had six months NHS physio and then they sort of get you on your feet and that's it, you're left to your own devices. I was going to see [the physiotherapist] and I think [the university] must have approached them: 'have you got any likely suspects?' And my name were put forward. But I didn't know if I'd be picked. But, I asked my doctor if there were anything like this going on and he said: 'oh no'. And yet on television it says: 'ask your GP, they should know all this thing'. And I've tried all this thing and I've tried to look online to see if there's anything I can get involved with but there were nothing I could see, so, that's how I got involved.

> *Laura*: It was through the physio that I go to. Although I don't see [the main physiotherapist], I see his understudy. Um, he asked me if I'd like to take part.

In some respects, research participants saw themselves as privileged to take part in the research because their physiotherapist had selected them personally. This was most visible in Jayne's account as she dismissed the claims of peers as simply "*not suitable*" when they told her they wanted to get involved in the research, too. The use of physiotherapists to aid recruitment was helpful in one sense, as it saved the SCRIPT project time in identifying users, however this process of selection can reinforce the self-selection of users that fit the conceptions of 'ideal' users as constructed by the designers and developers of the technology. Those that were recruited, therefore, may not have been representative of stroke survivors but just the ones that were capable of engaging with the technology to a meaningful extent. However, even this selection did not eliminate the challenges faced by research participants, which will now be discussed.

6.3.3.2. 'Donning' and 'doffing' the orthotic device

The biggest challenge that research participants faced was donning and doffing the orthotic device that was given to them. While this device was designed to fit comfortably it was difficult for research participants as they had little movement in the affected arm and hand to fit the device correctly. Even when they were able to don and doff the device independently it took a considerable amount of time and this made research participants tired even before they had time to interact with the games-based content. This could lead to research participants feeling tired and worn out before they even had time to interact with the games due to the physicality of donning the orthotic device. In most cases, research participants had to ask a friend or family member to aid them and this limited the times of day that they were able to interact with the technology. This challenge is captured in the following quotes:

Iris: Mum tends to help me put the thing on because I'm not very good at it.

Jayne: It took rather a long time. All these straps and things, y'know. I found that I didn't know whether to put me thumb inside the strap or outside the strap. Y'know, the thing. What do you call it? The cap thing that you put on your fingers. It was troublesome. It took me about ten or fifteen minutes. Ten minutes I think to put it on.

Keira: The glove itself, by the time I fitted it on meself you're worn out because I'm having to thread things through … and fasten it all and then put your finger ends in because I'm having to straighten these fingers out to put it in. I think it could be lot more user friendly, that.

Laura: I've enjoyed being involved in it, something to do. But there was parts of it that are quite difficult. It's like putting the arm thing on … I can't do that without my 'oosband.

The quotes from research participants demonstrate the challenges faced by users every time they interacted with the technology. While computational models were used to simulate the workings of affected upper limbs they did not take into account the real-world difficulties that could be experienced by users. To this end, the image of users constructed by the designers and developers was not comprehensive enough to account for the varying capabilities of stroke survivors. While research participants were able to draw on family members and friends to help them don and doff the orthotic device when needed it was recognised that not everyone would have such access to people who could assist and this would severely limit how often users are able to interact with the technology.

6.3.3.3. Interacting with the telerehabilitation system

Once research participants had donned the orthotic device they were able to interact with the games-based content. While each of the games available to users targeted movements and were selected to meet their rehabilitation needs there was a sense that some games were much more suited to meeting those rehabilitation needs than others. In most cases, research participants found one game incredibly difficult to interact with and, although sometimes problematic, some were much more accessible.

The experiences that research participants shared were all quite similar as they worked to negotiate how their movements were 'read' by the technology that, in turn, controlled the characters on-screen. This took a certain amount of work as research participants worked out how their movements were translated and then adjusted them accordingly. As Jayne shared, you have to "*make up your own*

program" when playing on some games and this could lead to inconsistent results. This could lead to frustration as research participants were not sure whether they were moving their hands in the correct way, which they had little control over anyway, or whether the technology was configured properly:

> *Iris: That's the, um, that is the biggest problem I would say ... the fact that you can do something once and you get the right result and you can you do it again and you don't really know whether you're doing it differently or whether it's, um; On the crocodile one I've had such a problem that you tend to think: 'what am I doing differently with my hand that I wasn't doing before?'*
>
> *Jayne: It just became exasperating. I knew that I had to put it up ... you had to make it up really like ... make up your own program really and that was beyond me, couldn't do that; But the thing is, it didn't seem to be the same every time. Er, once you would do it and it would go left the right there (and then you got another movement that was supposed to take it up there) but the next time you did that movement it didn't do it. It didn't put it any higher up, y'know. Which I thought it should do, y'know.*
>
> *Keira: It doesn't always do what you want it to do touching the screen. It doesn't seem to react to, y'know, what you're wanting it to do. Firstly, I thought it were me, y'know. But, I mean, I am computer literate. I've worked with computers a lot at work and that. Erm, but you're supposed to leave your finger on it but it's still black screening and you're thinking: 'come on, come on'. There's all that. But, yeah, basically the idea's good; You're watching that clam and you know you've got to, I think you've got to squeeze your hand for that one, but it just seemed to be going willy-nilly. It didn't coordinate with your hand as far as I was concerned. And sometimes you thought you'd got a fish but it didn't ... so had you or hadn't you? You don't know.*
>
> *Laura: I like the Crocco one and I like that Shell one. They are good. But I don't like that ... I think it's ... I don't know if it's because I can't master it, y'know, I can't move it along like I need to.*

The quotes above describe a variety of experiences with the games-based content. There was a sense that the technology did not map to the actions that those interviewed felt they were making. The inconsistency that they experienced was seen as problematic and, as Jayne mentioned, it became "*exasperating*". Keira attempted to rationalise that it must be an issue with the technology rather than her as she was good with computers but found the problems with the technology to be irritating. However, because they were part of the SCRIPT project, those interviewed strived to work with the technology despite challenges faced. They did this by consciously altering their movements and, as Jayne said, 'making up their own program' to ensure that movements were captured more accurately.

Interactions with the games-based content, along with donning and doffing the orthotic device, influenced the extent to which users interacted with the technology. In particular, games that enabled users to master them were preferred although

there was still a level of frustration experienced due to users' movements not matching up to their perceptions of what should happen on-screen. However, due to their persistence, research participants looked beyond these challenges and were selective about the games-based content that they interacted with. Users did this by focusing more on some games than others and ensuring that they spent sufficient time on games that they could do, which meant that the time spent on the telerehabilitation system was maximal but was focused around one or two specific movements. This meant that, despite the 'prescription' of certain games to their situations, users negotiated their own relationship with the technology.

6.3.3.4. Incorporating the telerehabilitation system

Issues related to time were another key aspect of research participants' accounts. Engaging with the telerehabilitation system not only took time in terms of donning and doffing the orthotic device but also involved exercising for an extended period of time per day. In most cases, research participants aimed to follow the guidelines set by the SCRIPT project (30 minutes per day) although this depended upon the individual as to how they negotiated this guideline. In some cases, time was 'made up' if a day was missed or more time was spent playing with the games on days when users had more time to interact. However, in all cases, research participants had to negotiate the time commitments needed to interact with the technology and this could be after a long day at work or between visits from formal and informal carers:

> *Iris*: *I'm, basically, I'm on work in the day or if I'm not at work it's ... I'm on a couple of days working on something else. So, I just tend to do it in the evening; Now I'm busier it's actually, y'know, you have to work to fit it in whereas if you had more time you'd probably actually experiment with it more and ... do you know what I mean?; It has been a pressure on time, I mean, in the sense that the only time I have is in the evening and you're sort of tired in the evening and you still have that to do.*

> *Jayne*: *I've felt like practising a lot more than I did. But, er, I just think with being on me own there's people coming and going all the time and you get that thing on your hand you didn't want anyone to interrupt you, y'know. You didn't want to take it off.*

> *Keira*: *[My friend] doesn't come until four o'clock so I've tried to put it on myself. That Velcro fastens on to everything dun't it so it is a bit of a pain but you get 'round it, you do it; It were just as and when. The mornings I don't go out ... I like to go out every day just for some fresh air. If it's only into t'village and back. So if I'm going out later in t'day for any reason I'll go on it on a morning. If not, I'll go out and get me jobs done when I'm doing and then come back in about two o'clock I might go on it more, for however long. Then about eight, nine o'clock at night. And that's when I'm all right to spend time. It's no good thinking: 'oh, I've got fifteen minutes I'll just get on'. I think you've got to be ... wanting to spend that quality time on it, if*

you like, not just, er, think: 'oh, I've got that thing to do. I want to sit on and, y'know, I'm dedicated to you for the next half an hour or whatever. And that's how I do it, anyway.

Laura: *Yeah, I mean I have to wait to night 'til [my husband's] 'ome and there'd be times where we've 'ad us dinner and washed up so it can be like nine o'clock at night, when really I'm starting to feel tired and, y'know, so, um, I've tried to go on it 'alf an hour, cos she says 'alf an hour a day is minimum, y'know. But I haven't been on it no longer than that cos it's too much.*

The long time that was required to interact with the technology in a meaningful way was significant. Due to the need to draw on family and friends to don and doff the orthotic device, the time that research participants could use the technology was also limited. Iris and Laura, whose interactions with the technology were mostly at night, felt this most significantly. By this time both women were tired and this was reflected in the extent to which they interacted with the technology. The issues of time and the incorporation of the technology into everyday life were only revealed post-installation but highlight how this influenced users' interpretations of, and interactions with, the technology. This interpretation could be positive as well as negative, as shown here:

Jayne: *I thought it was great and I enjoyed it. It became, y'know, part of what I did every day rather than an exercise that I had to do. I was looking forward to the, sort of a … you've so little to test your, test yourself on. It's nice to get something to do, y'know … as a physical thing that you're gonna do. I mean, they said to me: 'use your hand'. And I thought that was marvellous, y'know.*

Jayne's account was, in contrast to other research participants', much more positive in terms of how she found time to interact with the technology. This was, in part, due to the time she had available to her as well as her general enthusiasm for the project. She enjoyed having something to test herself with, as there was very little opportunity to do this in her everyday life. What Jayne's comments show is the potential that telerehabilitation systems can have in terms of promoting activity and motivation but also the challenges users face when integrating it into their everyday lives. These challenges included donning and doffing the orthotic device as well as finding time to interact with the games. Rather than seamless integration into users' everyday lives, time had to be set aside to use the technology and this could be problematic for those who found this difficult. Further to this, research participants reflected on the need to spend 'quality time' with the technology and thus they were willing to negotiate difficulties to assure future benefits.

Incorporating a telerehabilitation system into everyday life was problematic for research participants. However, the process draws attention to the significance of domestic life for our understanding of technology (Silverstone, 1993). Despite the potential of the telerehabilitation system, its use was embedded within the dynamics of the home. For some research participants, the 'free' time that they had available to use the telerehabilitation system was limited. It was permeated by other activities such as cooking and dealing with formal care services. For other research participants, they were able to make time for the telerehabilitation system through conscious time management. Understanding how telerehabilitation systems are used involves taking this temporal dimension into account, which includes how users find time and how the technology affects an individual's time.

6.3.3.5. Interpreting the telerehabilitation system

Throughout the six weeks that research participants interacted with the telerehabilitation system they formed opinions about its potential. Beyond the practical challenges that they faced in terms of donning and doffing the orthotic device and interacting with the games-based content they came to interpret the technology in different ways. For example, Iris found the technology difficult to incorporate into her everyday life and this meant that she interacted with it when she was able. To this end, she viewed the technology as a temporary inconvenience and would view it with "*a different mindset*" if it was more of a long-term project. On the other hand, Jayne saw the positive potential of the technology for different situations and thus interpreted the technology more favourably than Iris:

> *Iris: I do think that probably ... to be sort of presented with that equipment and then, I'm not saying they would, but if somebody was just out of hospital and feeling pretty confused and then being presented with that equipment and sort of left to get on with it they wouldn't stand a chance. But, yeah, it's probably one thing that would make them ... give them some hope; I suppose you'd view it with a different mindset if you're only doing it for a few weeks to doing it for a longer time.*
>
> *Jayne: I think that the length of time having the machine can be longer because you're on your own. It could be shorter if you have people helping you to know what's the right thing to do with it.*
>
> *Keira: It's just ... a means to an end, y'know. You will try anything, absolutely anything.*

In addition to how research participants interpreted the technology itself they provided an insight into whom they felt would not be a suitable user. This insight was

influenced by research participants' own experiences and also reflected how they perceived themselves and their capabilities. It was from these reflections that comparisons could be made with the image of users constructed by the SCRIPT project. In particular, research participants distanced themselves from a negative image of a stroke survivor who was older and living on their own with little or no support. It was this particular stereotype that those interviewed felt would not be suitable candidates for telerehabilitation systems in the future:

> *Iris: Well, I suppose typically people that have strokes would be a lot older. Um. Not that you need any knowledge at all of computers but just the very fact of sitting at a computer and things isn't fairly novel to me but it would probably be a new thing to a lot of people there. The other thing is that, um, through much mercy, it didn't impair my cognition … it affected other parts of me. But I would think that anybody with such problems from a stroke would struggle with it. Not that you need any technical knowledge or whatever of computers but just the whole. I sort of try and imagine my older friends, at sort of; I just think they might find the whole thing a bit daunting. I don't know.*

> *Keira: I think older people, older than me anyway. I'm fairly patient but I wouldn't imagine somebody, y'know, an older person'd be able to … if they'd got shake hand and stuff like that I think it'd be difficult for them to get the velcro things through the holes and tie 'em and that and then manoeuvring your arm up into that thing. I think it'd … for somebody on their own, an older person, I think it; they'd find it difficult.*

> *Laura: Um, well, I suppose people that aren't computer literate 'ud, 'ud find it difficult wouldn't they?; I just think if you lived on your own all the time it'd be quite difficult, wouldn't it? Y'know, ta get somebody a come in ta fit it, sort of thing.*

What the research participants' interpretations show is that the technology was more than just an object designed to support rehabilitation. Based upon the practical challenges that users faced, as well as the time it took to incorporate into their everyday lives, the technology was seen as a temporary inconvenience but also as a means of supporting stroke survivors to push themselves to take an active part in their own rehabilitation. However, there was a sense that the technology was not suitable for everyone as research participants reinforced the constructions of 'ideal' users by ruling out the technology's potential for older people and those who are not computer literate. The telerehabilitation system, despite being designed for 'stroke survivors', was still difficult to use by stroke survivors.

6.4.   Conclusion

The case presented in this chapter was of a telerehabilitation system that was designed and developed for use by stroke survivors. Four users of the technology

were observed during the installation of the telerehabilitation system and were interviewed approximately four weeks after the installation. During these interviews, research participants were asked about the installation of the technology and the challenges that they faced incorporating its use within their everyday lives.

To situate research participants' responses, documentation from the SCRIPT project was also analysed. In particular, I looked at how users of the telerehabilitation system were conceptualised in terms of the data that was generated about them. The SCRIPT project made use of both quantitative and qualitative knowledge about stroke survivors, which was incorporated into the design of the technology. The type of user that was envisaged by the research project was an active individual keen to interact with technologies. This image of the user became part of the recruitment process and, subsequently, informed who was selected to take part in the research. My findings highlight how this particular conception of 'the user' was only partial but had an influence on user interactions with the technology.

It was identified that research participants interacted with the technology to the extent that was expected of them but it was difficult for them to incorporate its use within their everyday lives. For example, all research participants found donning and doffing the orthotic device difficult and relied upon family and friends to help them with this process. To this end, users had to wait until family and friends were available and by this time were less encouraged to spend time using the technology. In one case, this was because use was limited to late in the evening. There was potential for the technology to be used more extensively but this was dependent upon the time users could dedicate to using it. While this was possible for most of those recruited to test the telerehabilitation system, with the exception of one who worked, it was a luxury most felt they could not afford. This has significant implications for future users of the technology that are not as active or dedicated as those who were recruited to interact with the telerehabilitation system.

7.   Discussion

7.1.   Introduction

In the previous two chapters, I explored how older people and stroke survivors interacted with two health and care technologies. I approached these cases through the construction and exploration of an analytical framework (see Chapter 3). My analytical framework emphasised the role of interaction, individual agency, the capacity of users, and the significance of meaning to health and care technology acceptance, rejection and use. I envisaged that a theoretical approach would shed light on how users incorporated the health and care technologies into their everyday lives. In addition, it would show how interpretations and meanings were constructed, negotiated and acted upon in relation to health and care technologies.

The next section, which draws on findings from both case studies (see Chapters 5 and 6), presents a theoretical framework of health and care technology interaction that emphasises micro-level actions. The framework highlights how interaction with technologies is 'situational' while acknowledging the role of agency, and the design of health and care technologies in shaping (but not determining) action. This section is divided into two subsections that present the components of my interactionist framework and then discuss its significance. I then use this framework to revisit current research on telecare and telerehabilitation systems, and to discuss the implications of my research and interactionist framework for understanding health and care technology acceptance, rejection and use (see Section 7.3). A conclusion is then presented at the end of this chapter emphasising the significance of my theoretical framework and its implications for the design and provision of health and care technologies.

7.2. An interactionist framework for understanding health and care technology acceptance, rejection and use

7.2.1. Components of my interactionist framework

The primary contribution of my research is the development of an interactionist framework for understanding the ways individuals interact with health and care technologies. The framework focuses on ongoing processes and the relationship between users and health and care technologies within contexts (see Figure 7.1).
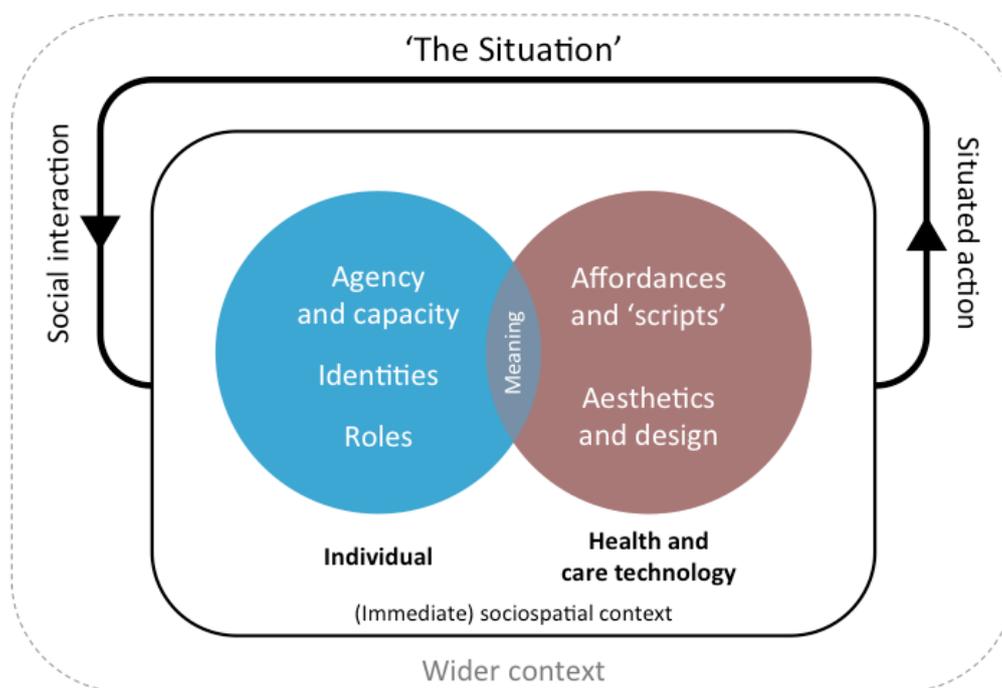
Figure 7.1: An interactionist framework for understanding health and care technology acceptance, rejection and use, which highlights the relationship between individuals and the technologies within contexts such as the home.

The first component of the framework is labelled as 'the situation'. My use of the term 'situation' has roots in symbolic interactionism (Mead, 1938; Thomas, 1923; Thomas and Thomas, 1928) and social studies of human-technology interaction (Suchman, 1987; Suchman, 2007). From a symbolic interactionist perspective, action is not seen as a direct response to external stimuli (as is the case for how animals react to the environment). Individuals construct and negotiate the social world

through symbolic, mind action[1] toward oneself as well as social interactions with other individuals (Blumer, 1966; Charon, 2010). A significant aspect of social interaction is how individuals define and interpret situations, draw upon objects, and align their actions with the actions of other individuals (Blumer, 1966). As Thomas (1923: 41) argues "preliminary to any self-determined act of behavior there is always a stage of examination and deliberation which we may call the definition of the situation". What this means for my interactionist framework is that, to understand action, the aim is to focus on social interaction, how individuals define their situations and how, in turn, these situations inform their actions. This can include an individual's conceptions of the past, present and future, the meanings of a health and care technology, as well as how they perceive others will respond to their actions.

This conceptualisation of situations from a symbolic interactionist perspective has parallels with research by Suchman (2007) on 'situated action'. Suchman (1987: 50) argues, in relation to understanding action, "rather than build a theory of action out of a theory of plans, the aim is to investigate how people produce and find evidence for plans in the course of situated action". Situated action involves exploring how individuals frame their circumstances and act based upon this framing. What this means for my argument is that user interactions with health and care technologies should be understood in terms of how individuals define situations at a moment in time. How individuals define situations will make a health and care technology more or less relevant, and will aid an understanding of how and why it is used in a particular situation. This places the individual at the centre of interactions.

Framing users' interactions with health and care technologies in terms of situations goes beyond current research (see Chapter 2). Situations provide a means of recognising that user experiences go beyond an interpretation of health and care technologies as objects for reaching help quickly (cf. Porter et al., 2013) or for personalised, self-rehabilitation (cf. Laver et al., 2013). Interpretations that prioritise

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[1] Symbolic interactionists assert that individuals engage in 'self talk' and label this 'mind action' (Charon, 2010). Mind action goes against social scientific perspectives that propose individuals are caused, conditioned or 'driven' to act by social forces such as their past histories. In contrast, mind action asserts that individuals are thinking beings that interpret their situations and act based upon their definition of situations (Charon, 2010).

the functionality of a health and care technologies tend to neglect how users may interpret them differently (see Chapters 5 and 6). With reference to interacting with health and care technologies, the notion of 'situations' covers a range of possibilities such as appropriation decisions through to placement, activation, and activities such as wearing and testing. For example, in terms of telecare systems, a focus on users' definitions of situations helps explain scenarios where button alarms are worn in the presence of family members (cf. Mort et al., 2013; Thornton and Mountain, 1992). Individuals' definitions of situations provides a means of understanding action in relation to the individual and the role of social interaction in shaping their use of a telecare system.

The definition of situations is personal. As individuals negotiate the life course they experience changes in capacity (see Section 3.7). These changes can influence the extent to which individuals are able to act with autonomy and the extent to which they come to depend on others for help and support. As evidenced by my research, these changes can affect an individual's ability to interact with a health and care technology such as in the case of physical impairments associated with stroke. As Charon (2010) notes, situations can be constrained as they are grounded by real-world experiences. This is significant particularly for the experiences of older people and stroke survivors whose everyday lives may be influenced by significant life course events. As identified in both cases, individuals experience ageing and stroke in different ways, and this shapes their attitudes towards health and care technologies and their use (see Sections 5.3.1 and 6.3.2). Beyond the domestication framework, which focuses on the 'biography' of technologies (see Section 3.6), my framework also highlights the biographies of individuals and how they form a basis for interaction that is not deterministic but is influential in negotiating the life course.

Extending the personal dimension of situations, the second component of the framework is the individual. Rather than a perspective of the individual that focuses on personal 'attributes' such as age and health status, a more expansive conceptualisation is proposed. This conceptualisation encompasses theoretical concepts of agency and capacity, identities and roles. Individuals are conceptualised as active participants in the social world. Individuals have agency and make decisions

within the constraints of individual capability (Elder, 1994). They negotiate and respond to situations that they define through social interaction. While attributes such as age and health status contribute towards how individuals define situations they do not *determine* action. This means that just because an individual is of a certain age or health status does not mean that they will act in a particular way. As found within my own research, individuals had different perspectives on ageing and chronic illness that they drew upon to act. There were some common themes across these experiences but they were not limited to personal attributes such as age or health status.

Agency and capacity acknowledge that an individual's ability to interact with health and care technologies is shaped by a number of factors. These factors include cognitive and physical capacities, the expectations of others, and also perceptions of personal autonomy. As Hitlin and Elder (2006: 38) argue, agency is "an individual capacity for meaningful and sustained action, both within situations and across the life course". In light of agency and capacity, individuals negotiate everyday life with reference to changing identities and roles that, in turn, influence action. This could be seen in relation to the 'active', 'supported' and 'managed' agers (see Section 5.3.1.3) and through the changes stroke survivors made to adapt to everyday life post-stroke (see Section 6.3.2). In terms of my theoretical framework, individuals are located within social contexts that influence their capacity to interact with health and care technologies. These contexts also influence the situations that they may find themselves in as they negotiate changing identities and roles.

An 'interactionist' view of individuals highlights the inherent complexities within health and care technology interaction. Individuals are conceptualised as actors located within context and webs of relationships that influence and shape action. For example, through the recognition of 'human spirit'[2] and the ways in which an individual's approach to everyday life influences and shapes how they interact with

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[2] The notion of 'human spirit' is similar to the term 'resilience', which is used within health services research to describe "how people achieve normal or better than expected outcomes despite exposure to ongoing risk, or living with an ongoing limitation; or, successful adjustment following an adverse event, such as ill-health or loss" (Sarre et al., 2014: 716). The emphasis that I place on human spirit is its ongoing construction and negotiation as individuals define and interact in situations in spite of cognitive and physical challenges, and working with limited resources.

health and care technologies as well as those around them. Contributing to the theoretical aspects of the domestication framework, individuals are also conceptualised as physical beings. That is, through changes in cognitive and physical capacities that are experienced throughout the life course there is a 'reality' that grounds their actions (see Section 3.3). For some individuals, this reality enables them to interact with health and care technologies in creative ways but, for others, this reality can limit the extent to which they are able to interact with health and care technologies. As individuals negotiate the life course, their interactions with health and care technologies may change (cf. Solomon, 1983) but can be explored and understood with reference to agency and capacity, identities, and roles. This adds a life course dimension to the domestication framework (see Section 3.7).

The third component of the framework is the health and care technology. This includes the design of the technology, the functionalities that it affords (see Section 3.4), and the 'scripts' (Akrich, 1992; Akrich and Latour, 1992) embedded within it (see Section 3.5). The symbolic aspects of health and care technologies are also highlighted with reference to meaning and how meaning is constructed and negotiated in relation to the individual. This meaning may change over time, and is not 'determined' by designers, as individuals interact with health and care technologies and put them to use. This is influenced by the situations individuals may find themselves in. For example, while the meaning of a telecare system was established through appropriation it was through use in an emergency that the technology's meaning was transformed to realise its functional utility. Health and care technologies, like individuals, are subject to change as they are interacted with and meanings are negotiated.

Focusing on the symbolic *and* material aspects of health and care technologies, my framework contributes to symbolic interactionist thought more broadly in relation to user interaction with technologies (see Section 3.4). The framework emphasises that individuals interact with *material* objects, which involves a degree of agency and capacity. Telecare systems require interaction with button alarms and telerehabilitation systems may require individuals to 'don' and 'doff' orthotic devices. In both instances, action has a physical as well as symbolic aspect. As evidenced

through my own research (see Chapters 5 and 6), health and care technologies require physical interaction[3]. This interaction included wearing a button alarm, 'donning' and 'doffing' an orthotic device but engaging with family and friends as a source of support. In doing so, individuals were confronted with the affordances and scripts embedded within the health and care technologies. While not determining action, affordances and scripts influenced the extent to which individuals could interact with health and care technologies.

The fourth and final component of the framework is 'context'. The use of the term 'context' encompasses both a macro- and micro-level of social interaction:

> *"While [the term 'wider context'] refers to broad and slowly evolving historical and societal processes (e.g. the post-way transformations of the nuclear family), the [term 'immediate sociospatial context'] boils down to its everyday sediments, which we tend to translate into the constantly changing immediate social and spatial environment [that] we live in on a daily basis. We equate this environment with the concept of the home and its immediate surroundings." (Courtois et al., 2013: 425)*

The term 'context' is used in my theoretical framework in two ways. First, it highlights the wider context in which health and care technologies are located. This includes the social and political context such as the role of health and care technologies within public policy. As indicated in the introduction (see Chapter 1), health and care technologies have become an integral part of public policy. Second, the immediate sociospatial context draws attention to micro-level considerations such as the constitution of households and availability of help and support networks. Both of these contexts are significant as they suggest that, even when individuals with similar situations use health and care technologies, they may experience them differently due to the context of use. This is because individuals may have different levels of help and support available to them that may affect interactions. In this sense, the term 'context' encapsulates the micro-level differences that serve as a backdrop to action but also includes the wider, macro-level differences that may distinguish user experiences between societies.

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[3] While health and care technologies do not determine action, they "can be understood as artefacts which may be both shaped by and shaping of the practices humans use in interaction with, around and through them" (Hutchby, 2001: 444). This combines a social constructivist reading of technologies that emphasised the shaping power of human agency and the realist emphasis on the constraining power of technological artefacts.

Taken together, the components of the interactionist framework provide a means of understanding user interactions with health and care technologies (see Section 7.3). The relationships between the various components of the framework suggest that understanding user interaction cannot be fully realised by focusing on a single component but the interaction *between* components (cf. Snow, 2001). The significance of the framework is that it focuses *both* on the biographies or 'careers' of technologies (Kopytoff, 1986) as well as the 'careers' of individuals within life courses (Hughes, 1937). Careers are particularly important when focusing on an individual perspective, as they constitute "the moving perspective in which the person sees his life as a whole and interprets the meaning of his various attributes, actions, and the things that happen to him" (Hughes, 1937: 413). What my research adds is that, within these careers, that individual may draw upon health and care technologies to interact meaningfully within everyday life. Health and care technologies are a part of life course careers and transitions, and can enable individuals to maintain independence while at home. However, given that the careers of individuals *and* health and care technologies can change through interaction, there is a need to focus on the situations where the careers meet.

7.2.2. Significance of my interactionist framework

My theoretical framework provides an abstraction from the experiences of older people and stroke survivors, and their interactions with telecare and telerehabilitation systems. It will aid the analysis of user interaction with health and care technologies by highlighting the components that are significant to acceptance, rejection and use. These components relate to the individual, technology, context, and the situations in which technologies are used. Meanings are made through the relationships between these components and are interpreted by individuals in order to stimulate action. This is why an emphasis is placed upon *symbolic* interaction, which involves the definition and interpretation of situations, identities and roles, and the meaning of health and care technologies.

The main contribution of my theoretical framework is its emphasis on how interpretation and interaction are key dimensions of use. Health and care

technologies can mean different things to individuals and this can influence how they are interacted with. This was demonstrated most clearly by users of telecare systems, as I was able to identify four interpretations that were constructed (see Section 5.3.2). A narrow conceptualisation of 'use' could mean wearing a button alarm and activating it in an emergency. This would mean that, for my research participants, most of the time their telecare systems were not 'used'. However, because of the different meanings that were constructed, this did not mean that telecare systems were 'rejected' but they were not in use *at that moment*. This adds empirical support to what Strathern (1992) calls the 'mirror of technology' (see Section 1.5), which emphasises how technologies are 'switched on' by users.

As individuals interact with health and care technologies, their meanings are subject to change. And, in turn, the meaning of a health and care technology may change as individuals age or experience significant life course events. This can contribute to the interpretation of health and care technologies and how relevant individuals perceive them to be in situations. For example, a button alarm may be worn sparingly if appropriated initially as a 'safety net' but, following an emergency, may be worn more often as the individual feels more 'at risk'. I identified that interaction with telecare systems was experienced in a number of ways (see Section 5.3.3) and was key to the success of the telerehabilitation system (see Section 6.3.3). However, in terms of the telerehabilitation system in particular, interaction could be limited by its design. This adds a material dimension to interaction, which focuses on significance of aesthetics and design.

Interaction is a term used to evoke a sense of meaningful *engagement* with health and care technologies. Interaction is not simply about using a health or care technology in the way that designers intend but utilising them in ways that are meaningful. For example, users may wish to interact with a telecare system by wearing a button alarm when in the presence of family members and not wearing it afterwards. This was seen when telecare systems were interpreted as 'currency' (see Section 5.3.2.4). This was an example of how individuals may wear a button alarm in front of family members to demonstrate that they are 'compliant' with their wishes. In this example, interaction was not about activating a button alarm in an emergency

but wearing a button alarm to manage an impression in front of a family member. This suggests that interactions *may* be functional, in that a health and care technology is used as intended, but may also be symbolic in that 'use' centres on meanings defined by individuals and others within their social networks.

A focus on interaction goes beyond a conceptualisation of the user based upon personal characteristics to consider how the user and their situations change over the life course. This includes their identities and roles, as well as the contexts in which they are located. It is through these changes that individuals choose to draw upon health and care technologies in situations. What this means for an understanding of health and care technologies is that a focus on personal characteristics is not enough. What is needed is a focus on the importance of these personal characteristics to the individual and how they inform the following: their perceptions of self; the interpretations and meanings of health and care technologies; and, their interactions with health and care technologies.

7.3.   Using my interactionist framework to extend current research

My research and theoretical framework have implications for designers and developers, local authorities who provide telecare systems, and researchers who are exploring user interaction. In particular, my research highlights how the relationships between technologies and users within contexts are ongoing processes. What works at one point in time may not work in another but what is important is *facilitating interaction* with health and care technologies. This can include modifying their design and aesthetics, providing services that help to engage the user in interaction, and exploring how interaction happens in practice. An increased awareness of how individuals make sense of their interactions with health and care technologies should benefit designers and developers, local authorities as well as researchers. Specific implications are discussed in this section, which are translated into recommendations in the final chapter (see Section 8.4).

7.3.1. Implications of my theoretical framework for telecare systems' research and practice

7.3.1.1. Beyond 'personal characteristics' as determinants of telecare systems' appropriation and use

The first implication of my theoretical framework is that it enhances models that utilise the personal characteristics of users (e.g. age and health status) as predictors of technology acceptance, rejection and use. Personal characteristics are often used to target individuals who are deemed 'suitable' for telecare systems such as 'the elderly' or those living alone. This follows from current research that has identified age, health status and household composition as key determinants of telecare systems appropriation (see Section 2.2.2.2). However, while this may be true, personal characteristics alone fail to account for the heterogeneity of 'older people' and how identities and roles may differ.

As I found in relation to my own research, individuals with similar personal characteristics may adopt different roles as they age (see Section 5.3.1.3). These roles are negotiated through social interaction and can influence how individuals perceive themselves and their situations. I do not neglect the importance of personal characteristics, but my theoretical framework unpacks how personal characteristics are associated with agency and capacity as well as how individuals perceive themselves (see Section 3.7). This positioning helps locate other research, such as the work of Mort et al. (2013: 809) who identified a lack of creative engagement with telecare systems due to the personal characteristics of users:

> *"Although some participants were managing to act in [creative ways], most were not. In the latter cases, systems were installed in the homes of older people who were struggling with everyday life and who showed little or no understanding of, or engagement with, the technologies they were supposed to use. Such installations appeared to be last ditch attempts to manage older people in their own homes and to make only negligible contributions to improving users' daily lives."*

What this quote draws attention to in agreement with my own analysis is how an individual's agency and capacity, as well as situation, can influence their interactions with telecare systems. That is, not everyone may be able to interpret telecare systems as creatively as those interviewed in my research. However, what my

research contributes is how the significance of a telecare system is constructed and negotiated *through* interaction. It is through social relationships between users, which includes their personal characteristics, and technologies within contexts that meanings are made. Personal characteristics do not determine these relationships but are nevertheless a significant aspect of them and can enable or constrain action.

7.3.1.2. Design as a significant, although not determinant, aspect of user interaction with telecare systems

The second implication of my theoretical framework is that it makes a connection between the identities and roles of users, and the design and meanings of telecare systems. Current research identified that the aesthetics and design of button alarms, and their association with 'decline' can influence whether they are worn (see Section 2.2.2.3). This particular aspect of appropriation and use was emphasised by those interviewed in my research in terms of how users negotiated the design of button alarms creatively (see Section 5.3.3.1). For example, turning a button alarm around when close to worktops that could set it off accidentally. Contrary to other research (cf. Bentley et al., 2014), I found that individuals were comfortable wearing button alarms most of the time and did not see them as a 'threat' to their identity. In some cases, they were interpreted positively as they enabled individuals to remain living at home independently.

However, I found that users' decisions to not wear a button alarm were more contextual in that they felt comfortable wearing a button alarm inside their homes but when they went outside of their home they chose to hide it. This was because individuals did not want to be perceived of as an older person by others despite their own rejection of an identity as 'older person'. What my theoretical framework highlights is the significance of the situation (i.e. being outside) and context on acceptance and use. That is, the meanings of telecare systems may change dependent on whether a button alarm is worn at home or when outside.

This aspect of my theoretical framework complements the work of Porter (2005) on 'temporising' and how individual agency can influence and shape when a button alarm is worn. However, my research also shows that individuals may wear a button

alarm when in the presence of *certain* others and so the context in which 'temporising' occurs matters. The aesthetics and design of button alarms are part of this decision but are also related to how individuals interpret their button alarm. This includes the extent to which they feel they feel others will interpret wearing a button alarm as a signifier of old age.

7.3.1.3. The significance of users' definitions and negotiations of 'situations' to telecare systems' appropriation and use

The third implication of my theoretical framework is that it draws attention to the relationship between individuals and telecare systems in terms of 'situations'. Current research has tended to focus on the association between individuals' 'expectations', expectations of the technology, and expectations of individuals' performances with the technology by others such as family members (see Section 2.2.2.2). Mann et al. (2005), for example, focused on how the concept of 'perceived need' provided an indicator of individual intentions to adopt a telecare system. This type of research suggests that individuals reach a point in time when a 'need' for a telecare system is stimulated such as following discharge from hospital after a fall at home. While this was true for some of those interviewed, a broader concept of 'the situation' encapsulates users' experiences more comprehensively.

Research participants did not always identify a point in time where they felt sufficiently 'at risk' to need a telecare system. However, individuals identified numerous situations that stimulated the appropriation of a telecare system. These situations related to anticipating future situations, as in the case of 'safety nets' (see Section 5.3.2.2), or dealing with present situations such as ageing support networks (see Section 5.3.2.3) and family members who want to put users into care (see Section 5.3.2.4). In these cases, the appropriation of a telecare system was not related to a past emergency (and thus 'need') but helped contribute positively towards an individual's identity as an active, older person (cf. Bowes and McColgan, 2013). A telecare system was used as a means of remaining independent at home for reasons other than an immediate health or social care need. This highlights the utility of my theoretical framework in combining individuals' sense of self and identity with their interpretations of a telecare system.

7.3.1.4. Locating telecare systems' acceptance and use within contexts

The fourth implication of my theoretical framework is its emphasis on how the contexts in which telecare systems are located can influence use. Current research has focused on the home as the place where telecare systems are installed (see Section 2.2.2.4). While this particular finding was emphasised less by those that I interviewed, there was some evidence to suggest that the environmental context could influence how telecare systems were interpreted and interacted with. In particular, one individual rejected a telecare system that came pre-installed within their sheltered housing apartment. In this instance, the individual who lived in the apartment felt that they were in good health and therefore would not need to use the technology despite its installation (see Section 5.3.2.1). While individuals that I interviewed did not highlight problems related to installation a telecare system, this could be an issue for others (e.g. those who have less space to install the technology or whose homes do not have sufficient electrical and telephone sockets available).

An additional aspect associated with the context of use is individuals' social relationships with others such as family and friends. Research participants were located within social networks and these influenced the extent to which some individuals could act. Family and friends were also significant actors in appropriation decisions for many. This implies looking beyond the individual to their social networks and how they are drawn upon for help and support; to cite Bowes and McColgan (2013), this implies looking at the 'human use of technology and its moral context'. The role of family and friends, and their expectations of users' performance were identified in a number of cases. There were instances, for example, when a telecare system was appropriated for the benefit of a family member rather than the user (cf. Breen, 1992). There were also instances where users wore a button alarm when in the presence of certain family members (cf. Mort et al., 2013; Thornton and Mountain, 1992).

Issues associated with context draw attention to how the appropriation and use of telecare systems is both situated and influenced by social interactions with others such as family and friends. That is, acceptance and use are not 'one-off' events but

are part of ongoing negotiations between users, technologies and others within contexts such as the home. It is within these relationships that telecare systems are made meaningful as a telecare system may mean one thing to the user and another to a family member. This makes a user's interactions with a telecare system dynamic as they may use it in different ways dependent upon individuals they are with. Understanding how telecare systems are accepted and used involves looking at the meanings individuals attribute to them but also how these meanings change when in the presence of others who may interpret them in different ways.

7.3.1.5. Interaction as an important enabler of telecare systems' use

The final implication of my theoretical framework is the emphasis it places on user *interactions* with telecare systems. Interacting with a telecare system was an important means of helping individuals to build trust in the technology, which enhanced its meaning. There is therefore an incentive to promote familiarity with a telecare system so that button alarms are worn or kept close to hand so that they can be interacted with. This is akin to conclusions drawn by Greenhalgh et al. (2013) that emphasises a need to support creative engagement with telecare systems. Current research (see Section 2.2.2.3) has tended to emphasise the aesthetics and design of button alarms as determining whether they are worn. However, I was able to identify that users may be reluctant to activate a button alarm if they do not know what will happen when they do. To this end, testing a telecare system was seen as an important means of building trust in the technology.

Current research has focused on the provision of the *service* behind a telecare system (see Section 2.2.2.5). However, current research has tended to focus on when button alarms are used in emergencies. Through my research, it was identified that the testing of a button alarm was a significant aspect of users' interactions with Safe and Sound. Testing was not just a functional task but helped users establish confidence and trust in the service. This was because it helped keep the technology 'active' and users engaged in its use. Testing provided a means of engaging with users and this, in turn, influenced the ways in which they interpreted the technology. My framework emphasises this process through the notion of interpretation and action,

and their relation to meaning. What the framework articulates is the ways in which meanings of a health and care technology may change over time and this is shaped by users' interactions with the technology as an *interactive* service.

7.3.1.6. Conclusion

My theoretical framework, in relation to current research on telecare systems, provides a means of exploring the *interactive* relationship between users, technologies and the contexts in which telecare systems are located (see Appendix G). While current research drew attention to the role of meaning in the appropriation and use of telecare systems in terms of 'becoming a user' and interpreting the technology (see Section 2.2.3), there was minimal empirical data to demonstrate their significance. Through my research, it is evident that processes of meaning making *do* play a role in the appropriation and use of telecare systems. Meanings are constructed and negotiated by individuals through the technology's appropriation and subsequent interaction through activation and maintenance. While telecare systems are, in the main, 'prescribed' to individuals in order to address issues such as a fear of falling, my research suggests that other interpretations exist. These alternative interpretations (see Section 5.3.2) are weighted more positively by users, and represent their independence and perceived control over everyday life.

My research identified that supporting individuals to maintain interactions with telecare systems can help promote their acceptance. Individuals sought to integrate the care technology into their everyday lives in ways that were meaningful to them. This included contributing to their identities and roles as 'active', 'managed' or 'supported' agers (see Section 5.3.1.2). Interpretations of telecare systems can influence how they are used, which can be understood with reference to the relationships between the individual and the technology in contexts. If individuals are supported to interpret their telecare system positively and see that it can contribute to their identity as an active older person then it is likely to be accepted. Telecare systems are not just for the frail but also those who are active and wish to remain independent for as long as possible.

7.3.2. Implications of my theoretical framework for telerehabilitation systems' research and development

As opposed to research on telecare systems that has quite an extensive history, current research on telerehabilitation systems has focused little attention on the user and their perspective (see Section 2.3.3). I used the concept of 'user-centredness' to critique current research on telerehabilitation systems. I conceptualised user-centredness in terms of: user focus, context-centredness, user involvement, and system personalisation (see Section 2.3.1.6). The SCRIPT project aimed to address all four areas through its 'user-centred' methodology and interactions with users. However, what my research showed is that, despite the 'user-centred' methodology that the SCRIPT project adopted, when users were confronted with the technology they experienced a number of difficulties. However, users persevered by drawing on external help and support, and their willingness to participate in the project.

The first aspect that my research focused on was how users of the telerehabilitation system were 'imagined' (see Section 6.3.1). It was within this process that images of users were constructed by designers and researchers, and was then used to inform the development of the SCRIPT telerehabilitation system. This included the utilisation of computer models to simulate the movement of hands and wrists, and the adoption of qualitative methods to explore what it is like living with stroke. Data from these requirements capturing [4] methods were then utilised by the designers and developers of the telerehabilitation system, and the technology was produced. However, approaches to requirements capture can downplay users' agency and capacity to interact with technologies and their willingness to interact with technologies (Peine and Neven, 2011). This is because requirements capture can promote the 'closure' (see Section 3.6) of a technology, whereby the design of a

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[4] Requirements capture relates to the process of establishing the services that a technology should provide and the constraints under which it will operate (Sommerville, 1992, as cited by Jirotka and Goguen, 1994). The notion of requirements 'capture' suggests that requirements exist 'out there' and can be discovered by designers and developers through empirical research, and then embedded within technologies in some form (Jirotka and Goguen, 1994). This is deemed problematic because it fails to account for the changing nature of requirements and the issue of identifying requirements through empirical research.

technology stabilises and a predominant meaning and use emerge (Oudshoorn and Pinch, 2003). As Peine and Neven (2011: 131) argue in relation to the process of requirements capture:

> *"[Designers] proceed on the assumption that users have to use the technology in question and thus have to live up to its demands. As such, they downplay a user's potential desire and ability to selectively and innovatively engage with technological environments."*

Through the design and development process, a technology was produced that built upon the assumption that users would *actively* engage with it. That is, without interaction the benefits of the technology would not be realised. The focus on interaction constructed a particular type of user that was capable and willing to interact with the technology in their homes over a six-week period. The second aspect that my research focused on was therefore the extent to which the research participants 'met' this specification (see Section 6.3.2).

Those recruited by the SCRIPT project (who I observed and interviewed) were motivated in their recovery. They adjusted to everyday life post-stroke by focusing on activity, accessing help and support, and maintaining a positive state of mind. It was partly due to these particular characteristics that individuals were selected to take part in the SCRIPT project (see Section 6.3.3.1). What this meant, in terms of understanding users' interactions with technology, was that individuals were selected (either explicitly or implicitly) because they met the criteria of an 'ideal user'[5]. Individuals took on the role of this ideal user (in addition to their identity as stroke survivor) and interpreted the telerehabilitation system as an object designed for interaction. In short, individuals' experiences with the telerehabilitation system were constructed within the context of a research project and their role within it.

Despite the fact that users met the image of an ideal user, aspects of users' interactions with the telerehabilitation system were difficult (see Section 6.3.3). This included users' ability to 'don' and 'doff' the orthotic device (that was designed using

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[5] The term 'ideal user' is used to describe the image of users that are incorporated into the design of technologies. As Silverstone and Haddon (1996: 50) argue, this is "a design process through which the user is incorporated into the hardware (and software) of the machine in such a way as to enable the user's relationship to fit both with the intentions of the designer and the embodied possibilities in the functional apparatus of the machine itself". However, users are not 'ideal' and this is reflected in the different ways in which they interact with technologies.

biomedical knowledge), understanding and negotiating how their movements were captured and displayed onscreen, and finding time to self-rehabilitate. Due to these difficulties, and the need to draw on others to support them with the technology, users' interpretations of the telerehabilitation system were ambivalent (see Section 6.3.3.5). On the one hand, the technology enabled them to test their abilities in a novel way and contributed to a positive identity as an 'active' stroke survivor. However, on the other hand, the technology was an inconvenience that users felt obligated to use as they were committed to the role of research participant. This role, in particular, kept them engaged in the project. This aspect of user interaction could not have been anticipated within the process of requirements capture.

My theoretical framework draws attention to the materiality of telerehabilitation systems. This materiality is encompassed within the concepts of affordances, 'scripts' and aesthetics. However, knowledge of a technology's design is insufficient for understanding user interaction fully. It is through interaction with within contexts that technologies are constructed as meaningful objects and are interacted with. That is, even when users of the telerehabilitation system matched the conceptions of users envisaged by designers and developers, interaction was not straightforward. Individuals had to negotiate issues such as donning and doffing orthotic devices and engaging with games-based content. While users strived to adopt the identity of a 'compliant' user of the technology within the context of the SCRIPT project they were cautious how this may change outside of it.

In terms of contributing to current research on telerehabilitation systems, my framework maintains the significance of design but places design within a wider framework of interaction. My framework highlights that designers' conceptions of 'ideal' users are only ever partial representations. While the design of the SCRIPT telerehabilitation system took account of the capabilities of stroke survivors, it could not anticipate issues related to using the technology in practice. This included their motivation to interact with the telerehabilitation system, the resources needed to support interaction, and their interpretations of the technology's utility Users have agency and their interactions with telerehabilitation systems are negotiated in contexts based upon how they interpret themselves as well as the meaning of the

technology. This goes beyond capturing requirements to focusing on how individuals interact with the technology through situated action (cf. Jirotka and Goguen, 1994).

The implication that my research has for the design of telerehabilitation systems is that it locates design within a broader process of interaction. It suggests that the design process can benefit from looking at how users interact with telerehabilitation systems following appropriation. This includes the identities and roles of users, the ways in which they draw upon help and support, and the meanings they associate with a telerehabilitation system. Within the context of a research project, users may feel obliged to interact with a telerehabilitation system and this may affect how they choose to evaluate it. There is therefore a need to understand the meanings that users ascribe to the technology as well as how their interaction is 'structured' by the protocols of research projects.

Rather than arguing that all users will accept 'user-centred' technologies, I emphasise the need to design technologies that are *interaction*-centred. That is, designs must support the *interactive* relationships between users and technologies. These relationships evolve over time as users attempt to 'work out' how a technology should be used and incorporated into their everyday lives. This has implications for how 'use knowledge' (Peine and Herrmann, 2012) is incorporated into designs but it also leaves open questions of who should test technologies and how this knowledge should be used within the design process. In the case of designing for stroke survivors, there is a need to involve those who engage actively in their recovery but also those who are less able or inclined to engage. For users who are less inclined to engage, designing *for* interaction will be more challenging but will help designers to understand the reasons why telerehabilitation systems are accepted or rejected.

7.4. Contributions of my research to social theories utilised within my theoretical framework

In this section, I describe some of the ways that my research and theoretical framework contribute to structural symbolic interactionism, the life course perspective and the domestication framework.

First, in terms of symbolic interactionism, my research contributes a set of empirical case studies that emphasise the significance of the life course to user interactions with health and care technologies. My theoretical framework highlights how the *material* properties of health and care technologies, as well as their meanings, are a significant component of interaction. This includes the role of design in the 'structuring' of use (e.g. affordances and scripts), which is a neglected area of structural symbolic interactionist research. In addition, by focusing on the perspectives of older people and stroke survivors, my cases drew attention to the significance of agency and capacity to action.

Individuals may have limited capacities and these can influence how they perceive themselves and alter their ability to interact with health and care technologies. This introduces an embodied dimension that is pertinent to understanding the actions of those living with impairment (Charmaz, 1995). That is, there is a *physical* aspect to an individual's ability to act with agency. While agency and capacity do not determine action, they contribute to individuals' ability to act with autonomy. My research and theoretical framework therefore reinforce the need to consider the content of technologies and the embodied nature of interaction, and how that contributes to individual action. This adds specificity to structural symbolic interactionist concepts in terms of theorising health and care technology acceptance, rejection and use.

Second, in terms of the life course perspective, I highlight how individuals use health and care technologies to negotiate social situations. This includes the utilisation of telecare systems to remain living at home (even if they are never activated) and the use of telerehabilitation systems to promote recovery. However, health and care technologies can also make everyday life more problematic for individuals who are unable to interact with them due to a lack of capacity or poor design. Domesticating a health and care technology is a process that imbues the individual with new responsibilities and roles to ensure it is kept maintained. For some, this can be a welcome challenge but, for others, this can create new problems that individuals are unable to cope with without appropriate levels of help and support. By focusing on the *relationship* between individuals, technologies and contexts, my theoretical framework helps to understand how life course agency is lived out from the

perspective of the user. This implies a need to consider, within a life course approach, how individuals use technologies to alter the choices that they have available to them.

Third, in terms of the domestication framework, I draw attention to the *situations* in which health and care technologies are negotiated. While the domestication framework highlights the significance of 'moments' such as appropriation and incorporation, the experiences of health and care technology users suggested that these were not singular moments but formed part of an ongoing process. That is, interactions with health and care technologies were based upon the situations that individuals found themselves in as well as their ability to negotiate them. The domestication framework does consider the incorporation and objectification of technologies but does not tend to provide tools for exploring how these moments are experienced from a user's perspective. Utilising concepts such as agency, capacity, identities and roles helped to extend the definition of the user that is the central actor within the domestication framework. These concepts emphasised the changing nature of 'the user' and the ways in which individual agency and capacity may be altered as they navigate the life course. This adds a temporal dimension to conceptualisations of the user within the domestication framework, which is sensitive to changes that they experience across the life course.

While each of the perspectives and social theories (of technologies) may have shed light on aspects of health and care technology interaction, their combination proved effective. Their combination not only helped to produce a more robust theoretical framework but also enabled a contribution to be made to each perspective individually in some way. My theoretical framework therefore not only contributes to current research on health and care technologies in terms of an enhanced understanding but also contributes a theory of technology interaction.

7.5.   Conclusion

Health and care technologies are 'switched on' in situations defined and interpreted by individuals who are located in social contexts. This introduces an interactionist dimension to their domestication, as they are sustained through ongoing social

interaction (cf. Strathern, 1992). These interactions involve relationships between users, social relations such as family and friends, and technologies. Through these interactions, the meanings of health and care technologies are constructed and negotiated, and these form a basis for action. As meanings are made through interaction, this means that the 'same' technology may be interpreted in different ways because meanings are made within the context of users' everyday lives. This includes how individuals perceive themselves and their situations. Given these situated definitions, the acceptance or rejection of a health and care technology is not a straightforward, one-off event but is negotiated over time through interaction.

Research participants managed their experiences of growing older or with chronic illness subjectively with reference to their identities and roles as older people and stroke survivors. Health and care technologies could 'fit' (or not) within these personal narratives of ageing well and living independently, which was enabled by the capacity of the user and their ability to draw on resources for help and support. The notion of 'fitting' a health and care technology into a personal narrative was evidenced most clearly by individuals who interpreted telecare systems as 'safety nets' and 'load balancers' (see Section 5.3.2). For these individuals, a telecare system was used as an enabler of independent living regardless of whether it was 'used' in the traditional sense of activating a button alarm in an emergency. In contrast, for users of the telerehabilitation system, their ability to 'fit' the healthcare technology successfully was constrained by its design limitations.

Advocates of a linear view of the design process argue that: 1) technologies are functional; 2) the role of design is to develop technologies that address particular sets of 'user needs' that can be identified through research and embedded within the functionalities of the technology; and, 3) users approach technologies as 'readers' and interact with them in predictable ways (Ingram et al., 2007). On this view, design and use are conceptualised as linear processes as the former occurs before the latter (Ingram et al., 2007). In terms of the focus of my research, this would suggest that health and care technologies could be given to individuals with specific health and social care needs and that these needs could be alleviated through technology acceptance and use.

However, through my empirical research, I was able to show that this linear view is incomplete. Individuals engage *interactively* with health and care technologies. My theoretical framework provides a means of exploring the interactions between individuals, health and care technologies, and contexts. It also introduces the notion of 'the situation' to acknowledge that health and care technologies are drawn upon by individuals to meet self-defined goals and desires. This interaction is personal and social, thus constructing telecare and telerehabilitation systems as products and services that can enable or constrain independence.

The significance of agency and capacity demonstrates that health and care technologies do not determine action but that individual *imagination* enables interaction through personal definitions of situations. The work of imagination is emphasised by Silverstone (1994: 126) who describes it in the context of consumer goods as a process whereby "goods are imagined before they are purchased". McCracken (1988: 104) also talks about the 'displaced meaning' of consumer goods as "bridges to … hopes and ideals. We use them to recover this displaced cultural meaning, to cultivate what is otherwise beyond our grasp". Both definitions emphasise how the meaning of consumer goods may change through the transformative process of appropriation.

In the context of health and care technologies, imagination works in a similar way as individuals negotiate acceptance and use against the backdrop of their everyday lives. This may be in relation to identity commitments (e.g. as 'active' agers) but also perceptions of health and care technologies as enablers of independence as they support individuals to remain at home. This may include the involvement of family and friends who enable the use of health and care technologies but also broader influences such as the context of a research project. Both of my cases show that agency and imagination are the means through which health and care technologies are interpreted and their value assessed, which influences future interaction. This is an ongoing process as meanings are constructed and negotiated through users' interactions with health and care technologies. The work of imagination continues to feature in the ongoing interactional processes that define how health and care technologies are made meaningful throughout the life course.

If health and care technologies are to promote independence then they need to be designed *for* interaction and imagination. This complements research by Peine and Neven (2011: 136) who argue that health and care technologies "should allow [users] to engage with [them] in a proactive and playful way, i.e. [they] should encourage them to domesticate it as active users". The agency and capacity of users should be prioritised while emphasising that the design of health and care technologies, as well as the contexts in which they are used, could enable or constrain action.

Individuals should be encouraged to interact with health and care technologies in ways that evolve over time *through* interaction. This has implications for the design of health and care technologies. Based on the findings and analysis of my research, a recommendation is that design should focus on interaction. That is, the design of telecare systems should encourage button alarms to be worn or kept close to hand. The design of telerehabilitation systems, on the other hand, should eliminate the problems encountered by individuals that prevent them from being used more often. This includes the design of orthotic devices as well as games-based content that should provide motivation to support rehabilitation.

My research implies a greater focus on the life course and how health and care technologies can be utilised in ways that are meaningful. It also implies a need to focus on the *ongoing* relationships between individuals and health and care technologies within contexts. This requires the provision of help and support as different life course situations occur and individual agency is changed. Finally, in terms of research, an interactionist perspective provides a foundation through which to explore and understand health and care technology acceptance, rejection and use that does not under- or over-play individual agency or the affordances and 'scripts' of these technologies.

8. Conclusion

8.1. Introduction

The contribution that my research makes is the development of an interactionist framework for understanding health and care technology acceptance, rejection and use. The framework is informed by two case studies of health and care technologies, which were at different stages of development and technological maturity. This enabled me to incorporate aspects of the design process into my analysis as well as focus on users' perceptions of a prototype technology that was in the early stages of development. Through my interactionist framework, I emphasise the significance of *interaction* as an ongoing process that can enable the sustained use of a health and care technology or can, ultimately, lead to a technology's rejection. Interactions with health and care technologies are also seen as *meaningful* and these meanings may change over time in response to users' interactions with them. This has implications for how health and care technologies are designed and researched as it suggests an ongoing relationship between user and technology in response to individuals' definitions and interpretations of situations.

Specifically, my interactionist framework draws attention to the changing nature of the relationship between users and health and care technologies, and the implications these changes have for interaction. By this I mean that as individuals age and negotiate the life course their perceptions of identity and roles may change, and this can alter their capacity to interact with health and care technologies. These changes may also alter the meaning of a health and care technology as the meanings of the objects are bound up within individual life course experiences and situations. The meanings of health and care technologies are therefore not fixed but are subject to change *through interaction* over the life course. My theoretical framework enables

a more thorough understanding of how these interactions work in practice from the perspective of the user. This is achieved with reference to the concepts of agency and capacity, identities and roles that helped to understand the actions of users of telecare and telerehabilitation systems.

I argue that the acceptance, rejection and use of health and care technologies is not a 'one-off' event but is sustained through interactions between individuals and technologies within contexts. There is not one determinant to acceptance, rejection and use as each component (i.e. individuals, technologies and contexts) is enacted through situated action. This can influence the relevance and use of a health and care technology at different times throughout the life course. Health and care technologies, therefore, need to be introduced and embedded within the context of the individual life course with an emphasis on how the technology can support a positive sense of identity and roles. Exploring the relationships between individuals, technologies and contexts can enable an understanding and appreciation of the reasons behind acceptance, rejection and use from the perspective of the user.

8.2.   Research contribution

We are living in an ageing society (Rutherford, 2012). This means that the number of people over the age of 60 is increasing and has been for a number of decades (Peace et al., 2007). This is significant because, as people age, there is a greater possibility that cognitive and physical capacities will decrease. Ageing, alongside the challenges that present themselves following the diagnosis of an age-related disease, can lead people to become more involved with health and social care services to provide help and support. Given the increasing costs of health and social care services, as well as the lack of resources to meet needs, supporting the ageing population is becoming more difficult. Within public policy, there has been an increased emphasis on supporting individuals in the community and their own homes as a means of reducing the 'burden' on health and social care resources[1] (see, for discussion, Age UK, 2014; Foot et al., 2014; Oliver et al., 2014).

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[1] From the perspectives of older people and stroke survivors, an increased emphasis on home-based health and social care aligns with the acceptability of 'ageing in place'. The premise of ageing in place is

My research investigated how individuals use telecare and telerehabilitation systems. I explored how the interpretations of these technologies were constructed and negotiated, and how this influenced acceptance or rejection. To aid my exploration and understanding of this issue, I constructed an analytical framework (see Chapter 3). Through the analysis of empirical data from two case studies, I constructed a theoretical framework that extended the concepts developed within my analytical framework. The implications of my theoretical framework for current research on telecare and telerehabilitation systems were discussed in the previous chapter (see Section 7.3) alongside contributions to theory (see Section 7.4).

For health and care technologies to support and facilitate individuals to retain some form of independence, it is important to recognise that the relationships between them are *interactional* and ongoing. Just because an individual meets a particular set of criteria that makes a health and social care technology applicable to their current situation does not mean this will always be the case. As individuals negotiate the life course their interactions with technologies are subject to change. These interactions are between individuals within different contexts and with different personal resources and social circumstances. Individuals must negotiate social situations with the agency and capacities that they have available to them. This can influence and shape the meanings that individuals construct with regards to health and care technologies, which may change over time. As meanings are subject to change through social interaction, health and care technologies may become more or less relevant to individuals. This has implications for how health and social care services are designed and provided, and the importance that services must place upon enabling interaction.

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that supporting individuals to remain in their own homes in later life or following a significant life event "positively contributes to an increase in well-being, independence, social participation and healthy ageing" (Sixsmith and Sixsmith, 2008: 220). Being supported to continue living at home is something that is desired by the majority of individuals and is tied to a sense of attachment and security associated with the home (Wiles et al., 2012). However, there is growing recognition that supporting an individual to 'age in place' must also consider that homes can be places of isolation and loneliness. To this end, a focus on supporting social attachments may be preferred over supporting individuals to remain *in situ* (Hillcoat-Nallétamby and Ogg, 2013). In addition, for stroke survivors in particular, returning home post-discharge may be problematic due to decreased cognitive and physical capacities (Wottrich et al., 2012). These can make everyday activities such as cleaning and cooking difficult, and may require the help and support of formal and informal care services.

8.3.   Addressing my research question

The research question I posed from the outset of my research was: *how does the process of health and care technology acceptance, rejection and use occur in practice from a user's perspective?* A qualitative research approach, supported by a case study design, was adopted to address this question. This enabled users to talk about their interactions with health and care technologies. In this section, I highlight four areas that are significant to understanding how the process of health and care technology acceptance, rejection and use occurs. These areas elaborate upon what Silverstone and Haddon (1996: 44) call 'the design/domestication interface', which "involves both producers and consumers in a dynamic interweaving of activities which are solely determined neither by the forces of technological change nor by the eccentricities of individual choice".

The first area of significance for understanding user interactions with health and care technologies is design. Design is significant because it is through this process that developers embed representations of 'users' into technologies that, in turn, can support or inhibit interaction. User representations may be based upon images of individuals collected through empirical research or conceptualisations of 'the user' envisaged by designers. As Silverstone and Haddon (1996: 46) argue: "domestication is anticipated in design". Within this process, designers take into account who they envisage 'the user' to be and what users' capabilities are so that a technology is as 'usable' as possible (Woolgar, 1991). However, in practice, these images of the user are only partial representations and are challenged when individuals appropriate technologies and attempt to incorporate them within their everyday lives. This was true of both telecare and telerehabilitation systems that, although designed with particular users in mind, still presented challenges that meant that user interaction was not a simple or straightforward process. This demonstrates how the design of a technology may shape use to some extent but it cannot *determine* how health and care technologies will be used in practice.

Focusing on the design process alone prioritises the perspectives of designers and developers, and neglects the experiences and perspectives of technology users. The

second area that is important to acknowledge is therefore how health and care technologies are introduced to the user and are "found a space, literally, in the home" (Silverstone and Haddon, 1996: 64). This is referred to as appropriation (see Section 3.5). Appropriation is a social and *interactive* process. Individuals and members of their social networks construct and negotiate the meaning of technologies, and how they perceive they will be used in certain situations. From the perspective of designers and developers, telecare and telerehabilitation systems are constructed as objects that will provide the user with certain functionalities such as mediating access to help and support in an emergency or enabling self-rehabilitation. These meanings can inform how users perceive and use the technologies. However, this can lead to rejection if users do not subscribe to certain meanings or associate them with negative identities (e.g. 'badges of disability').

Appropriation establishes the meaning of a health and care technology although this meaning can change through social interaction. Following appropriation, users negotiate the functionalities and meanings of health and care technologies through their *interactions* with them. While meanings can be associated with the functionalities of health and care technologies, functions are also created *through* processes of meaning making. For example, health and care technologies may come to represent feelings of safety and security, or as an important enabler of cognitive and physical recovery following a stroke. These meanings are not intrinsic to the technology but are shaped by the users' experiences within the life course as well as through social interactions with others such as family and friends. For example, users of telecare systems that were 'active' agers interpreted them primarily as 'safety nets' (see Section 5.3.2.2). In contrast, where users demonstrated little agency and control over their everyday lives, telecare and telerehabilitation systems were interpreted predominantly as 'prescriptions'. In these instances, users felt obligated to use them and non-use or rejection was associated with non-compliance. This demonstrates the significance of appropriation to how health and care technologies are interpreted and interacted with.

Rather than a single interpretation of telecare and telerehabilitation systems, my research identified that were multiple interpretations that could shape the way the

technologies were accepted and used. There was a 'structural' aspect of meaning making, however, and this meant that users were not completely 'free' to ascribe any meaning to either of the health and care technologies. This is reflected in the inclusion of 'context' as a component of my theoretical framework. Appropriation was a significant process in the construction of meaning and involved input from health and social care professionals as well as family and friends. Alongside these actors, users constructed and negotiated meanings based upon expectations and prior knowledge. It was only when users came to *interact* with the health and care technologies that they could begin to develop their own meanings that are constructed through use. These new meanings, in turn, influenced how a health and care technology was used and negotiated over time. That is, functionality and meaning were not static but developed as new situations arose in the everyday lives of users and as meanings changed.

The third area that is important to recognise is that *interactions* with health and care technologies do not stop following appropriation. Post-appropriation, I identified that users were required to 'maintain' telecare and telerehabilitation systems to ensure that they kept 'working'. This meant that, to remain functional, users *interacted* with the technologies over time. As Strathern (1992) argues, technologies work when they are 'active'. Without this sense of interaction, users of health and care technologies will not benefit from them. I found that interaction could be supported or inhibited through the design of technologies and the responsiveness of services behind them. For telecare systems, interaction was encouraged through testing practices that enabled users to build up confidence with the technology through relationships with call monitoring centre operators. However, users still found aspects of wearing a button alarm (see Section 5.3.3.1) and activating a button alarm (see Section 5.3.3.2) problematic. This indicates that the design of the care technology needs to be improved, as it has an influence on its acceptance.

Enabling *interaction* is an important aspect of telerehabilitation systems that are designed to promote repetitive action. Design is an important enabler of interaction, as telerehabilitation systems must support the capabilities of stroke survivors who may have cognitive and physical limitations that make interacting with the technology

difficult. If designs do not account for these cognitive and physical limitations, individuals may be required to draw on help and support to ensure that they can interact with a telerehabilitation system when desired. Requiring the help and support of others can have significant implications for usability, as individuals may have to wait on the availability of others to help them. This can mean interacting with a telerehabilitation system at times that are not seen as appropriate by the individual such as late at night when a partner comes home from work. In addition, where content such as games do not meet user expectations, or users find them confusing (see Section 6.3.3.3), there is the potential for rejection. In this instance, the relative 'success' of a telerehabilitation system is based upon the motivation of users and the meaning that they ascribe to the technology. However, these meanings are bound up within the context of use and so outside of a research context the technology may be rejected altogether (see Section 6.3.3.5).

Interactions with health and care technologies are also negotiated at an individual level. This includes the personal and social resources that individuals are able to draw upon to maintain their autonomy. In addition, it includes how individuals perceive themselves and their identities, which features in their decisions to act. Many of the research participants that I recruited were, despite differences in their cognitive and physical capacities, able to interact with health and care technologies to some extent. They employed strategies to remain as active as possible both within the context of negotiating old age (see Section 5.3.1) and everyday life post-stroke (see Section 6.3.2). This enabled research participants to engage with health and care technologies through interactions with them.

I identified a resistance to negative perceptions associated with 'older people' and 'stroke survivors' such as sitting around at home and "*feeling sorry for yourself*" (see Section 5.3.1.2) or watching television all day while sat in a chair (see Section 6.3.2.2). Research participants drew upon these negative perceptions as resources to highlight how their activities set them apart from other individuals who were less active. Challenging these negative perceptions kept individuals motivated to participate in everyday activities such as cleaning, cooking and dressing that they found difficult due to cognitive and physical change. Motivation and 'spirit' influenced

how research participants interpreted telecare and telerehabilitation systems, and their maintenance. This particular aspect of user interaction may be overlooked, but is a crucial aspect of how individuals make sense of their situations including the use of any health and care technologies that they may have access to.

The final area that is significant to understanding user engagement is that individuals and their situations change over time. Engagement is *interactive*. This is referenced by Silverstone and Haddon (1996: 52) when they argue that "users and not just technical users" and by Hynes (2009: 27) who argues that "individuals design their own socio-technical relationship" with technologies. However, there are limits to how 'successfully' individuals are able to demonstrate agency in the case of telecare and telerehabilitation systems. In some instances, individuals may lack the capacity to interact with the technologies, or family and friends may influence the acceptance of a technology beyond an individual's control. Technologies are placed into these existing relationships and support networks, and can further limit users' control but may also empower them and promote independence.

The process of health and care technology acceptance, rejection and use is ongoing. There is a temporal dimension to the process as technologies are *interacted* with. As individuals' agency and capacities change, which can affect their ability to act, their ability to interact with a health and care technologies may change. This can alter how useful a technology is to an individual and may lead to rejection. Given the temporal dimension of technology interaction, there is little value in talking about the 'acceptance', 'rejection' or 'use' of a health and care technology as a one-off event. These events are actually processes that involve relationships between users and technologies in contexts that are subject to change. It is through these relationships that meanings are constructed and negotiated by users and members of their social networks to make sense of situations.

Telecare and telerehabilitation systems are designed, appropriated and sustained through social interaction, which includes a health and social care support service infrastructure. Their acceptance, rejection and use cannot be reduced to identifying factors related to the technology, users or contexts. It is through the interactions and

relationships between these factors that acceptance, rejection and use are negotiated over the life course. The theoretical framework that I developed aims to unpack these relationships between users and technologies, which are negotiated through social and symbolic interaction within contexts.

8.4. Recommendations for health and social care policy, practice, and future research

There are debates surrounding whether qualitative research can address the question of 'what works' that is often asked by policymakers who wish to establish cause-effect relationships (Donmoyer, 2012). The way in which my theoretical framework was presented does not focus exclusively on 'what works' but on questions of 'how' and 'why' health and care technologies are accepted, rejected and used. To this end, recommendations are made that take into account the complex interrelationships between technologies, users and contexts that are often neglected within evaluations of health and care technologies (Greenhalgh and Russell, 2010). My theoretical framework challenges positivistic assumptions underlying explanations of cause and effect that typify many research projects that fail to account for how technologies are used in practice (Greenhalgh and Swinglehurst, 2011).

Recommendations are split between telecare and telerehabilitation systems due to their differences. Policy recommendations are given first, and recommendations for practice and future research are then listed. These are presented as bullet-points for enhanced readability and are accompanied by a short summary beside each recommendation. In the next section, opportunities for further research are presented alongside the limitations of my research. This section provides more specific directions for further research in light of my research.

8.4.1. Recommendations for the provision of, and research on, telecare systems

The recommendations for telecare systems focus on their provision with an emphasis on going beyond their current promotion as care technologies for emergency situations. Beyond emergencies, telecare systems can be interpreted

more positively as technologies to support independence and to promote safety. More research is needed to explore alternate interpretations of telecare systems and how, in turn, these interpretations are associated with acceptance and rejection.

1. **Advertise and promote telecare systems as care technologies to support independence in ways that go beyond a 'technological prescription'.** Make telecare systems more freely accessible so that individuals can develop their own relationship with telecare systems in ways that are meaningful to them and their situations.

2. **Promote telecare systems as 'safety nets' rather than emergency-driven technologies.** While telecare systems *are* used in emergency situations these interactions only account for a small percentage of individuals' interactions with the care technology. Users draw benefits from the meanings they associate with the technology (that go beyond 'use') such as the belief that it keeps them safe and secure in their own homes by virtue of its presence.

3. **Support individuals and members of their social networks to appropriate telecare systems, which includes the provision of up-to-date information and post-installation guidance.** Work must be done to promote awareness of telecare systems as enablers of independent living and to raise the awareness of others of the benefits of the care technology. For most of my research participants, members of their social networks identified telecare systems as appropriate. However, support networks cannot be relied upon in all instances.

4. **Identify and work with the different ways that individuals interpret and interact with telecare systems rather than focusing solely on their installation.** While the installation of a telecare system is an important means of establishing the care technology within a household, ongoing help and support is needed over time. This includes technical maintenance but also identifying the relevance of a telecare system at different stages in an individual's life, which may change over time.

5. **Promote the testing of telecare systems as a means of building up users' confidence in the care technology.** Some users see testing as a way of

getting to know what a button alarm does and this helps to reduce the general reluctance regarding the use of the care technology.

6. **Share information about design and use between telecare systems suppliers and providers in order to improve designs.** In particular, the meanings users associate with the technology and how these inform the situations in which they are used.

7. **Promote theoretical approaches to telecare systems interaction that focus on the relationship between users, the technology and contexts.** Researchers must appreciate that interaction with telecare systems is an ongoing process and this is not determined by the personal characteristics of users or the materiality of the technology.

8.4.2. Recommendations for the research and development of telerehabilitation systems

The recommendations for telerehabilitation systems focus on their design and development, and how social research can contribute to innovations. In particular, methodologies that focus on how designs are used in practice should be favoured over 'one-off' evaluations of telerehabilitation systems. Researchers need to be reflexive about conceptualisations of 'the user' and how representations of the user are associated with acceptance.

1. **Ensure funding for further research into telerehabilitation systems acceptance and use.** Particular attention should be directed towards qualitative research that focuses on how the health technologies are used in practice, and research that combines design and use research methodologies. This goes beyond the development of technology to appreciate how stroke survivors use the technologies to promote independence and support their rehabilitation goals.

2. **Approach and recruit stroke survivors with more challenging cognitive and physical impairments such as those with complex communication and sensory problems as a result of stroke.** While there is a balance between a representative sample and recruiting stroke survivors who are

capable of engaging with a telerehabilitation system there is a need to approach a range of stroke survivors to identify further, more complex, interaction and usability issues. This will require technological advancement as well as additional help and support for individuals to support interaction with telerehabilitation systems.

3. **Complement quantitative research designs with qualitative research that focuses on how telerehabilitation systems are used in practice.** Beyond health services research that aims to establish the clinical efficacy and effectiveness of the health technology, qualitative research is needed to understand how, when and why users interact with telerehabilitation systems.

4. **Continue to incorporate use knowledge into the processes of design and development so that meaningful feedback from users is incorporated into future telerehabilitation systems.** Beyond 'capturing user requirements', knowledge generated through users' interactions with telerehabilitation systems should be utilised to limit the challenges faced by users and to promote system usability. This should be conceptualised as an ongoing process to bridge the gap between technical possibility and user interaction with technology.

5. **Produce telerehabilitation systems that can be installed and used by stroke survivors outside of research projects.** This includes addressing technical challenges such as the detection of movement and the production of meaningful feedback. It also includes addressing 'social' challenges such as developing ways of promoting interaction with telerehabilitation systems that fit more seamlessly into users' everyday lives. In this way, interacting with telerehabilitation systems could be seen as an integral part of the day rather than an additional inconvenience.

8.5. Research limitations and opportunities for further research

It is recognised that my research has some limitations that could be addressed by further research. First, my research is limited in terms of the research participants that were accessed and recruited. Recruitment was particularly challenging, as

accessing older people who were also users of telecare systems, in particular, was difficult. Local voluntary organisations were used as gatekeepers to this specific group of users but this narrowed down the research to individuals accessing these services. It could be argued, therefore, that the older people accessed and recruited were more proactive than others in terms of accessing help and support to ensure that they keep active and engaged with others. Further research could be conducted that utilises a different recruitment strategy.

Accessing stroke survivors through the SCRIPT project meant that users were more inclined to use the telerehabilitation system as they had volunteered to participate in a research project. While not an issue of recruitment per se, access to stroke survivors was influenced by the need to involve users who could interact with the technology. Gaynor et al. (2014) argues that there is an inherent 'bias' within studies involving stroke survivors in terms of the mean age of research participants in comparison to the national average of those who experience stroke, and in terms of the severity of impairments experienced by individuals. For example, dysphasia is a common impairment among stroke survivors and this can affect an individual's comprehension as well as their ability to put words together to make meaning. While the goal of the SCRIPT project was to develop a usable prototype, and thus more impaired users were not sought, a benefit of my research is that it draws attention to the significance of 'the user' to interaction. Further research is needed to evaluate health and care technologies, such as the one developed by the SCRIPT project, with users that are less able to interact with them. This will identify unanticipated challenges and promote further system usability.

Second, feeding back my findings to designers and developers of health and care technologies could have extended my research. Having identified the contribution that my research could make to the design process, it would have been instructive to evaluate my theoretical framework in practice. This would require working more closely with research projects such as SCRIPT and identifying ways of translating my findings into usable knowledge by technology designers and developers. In turn, I could then observe how changes to the technology influence how users interact with a health and care technology. This would contribute new knowledge into how the

ongoing evolution of requirements from processes of interaction can be supported in practice, which is an underexplored area of research (Jirotka and Goguen, 1994). However, this would have directed attention away from my main argument that focuses more on the significance of interaction to understanding technology acceptance, rejection and use.

Third, generating more data from a wider range of sources could have enhanced my analysis and findings. As Haddon (2011) notes in relation to research studies utilising the domestication framework, more context can always be added to construct a richer picture of use. For telecare systems, further research could include interviewing members of users' social networks or analysing records from call monitoring centres to ascertain how frequently a telecare system is used. It is possible that this data could be triangulated with users' own interpretations of use to generate a more 'realistic' picture of their interactions with a telecare system.

In terms of telerehabilitation systems, and prototype health and care technologies in general, data analysis could include working with the quantitative data logged by the technology. In this way, users' accounts could be corroborated with usage data and questions could be asked if any discrepancies were evident. This would add a further dimension to user interpretation as it may identify situations not considered 'important' by users and thus not shared in interviews. While it is appreciated that the process of capturing and implementing user requirements is complex, it is clear that once users appropriate health and care technologies then a process of interaction and negotiation takes place, as the object is fit into everyday life. It is knowledge of this process that can be used to inform the design of health and care technologies, and to move beyond a 'user-centred' methodology to one that focuses on interaction.

While addressing these limitations could have enhanced my research, it is important to recognise that the research was conducted as part of a PhD where resources are finite. In the context of a PhD, connections with gatekeepers were made as soon as possible but this took time in terms of scheduling meetings to discuss my intentions, and working to gatekeepers' schedules. Accessing older people who also used

telecare systems was more challenging than anticipated and finding a research project that was deploying a health or care technology within users' homes at the time of my research even more so. However, by recognising the limitations of my research it is possible to make suggestions for further research that addresses and extends some of the challenges faced, which could be taken up in the future. A guide has been produced to support that process (see Appendix H) that can be adopted by researchers utilising an interactionist approach to technology use.

8.6.   In summary

Health and care technologies such as telecare and telerehabilitation systems are designed to promote independence and recovery following a significant life event such as stroke. The producers of these technologies claim that this will be achieved by enabling older people to remain living at home with a sense of security or by helping stroke survivors to rehabilitate at home. However, to ensure that health and care technologies are successful in promoting independence and recovery they must be incorporated into everyday life. This is not a straightforward process of acceptance as the everyday lives of users are complex, and individuals interpret health and care technologies in ways that are meaningful to them.

My research brought together a number of disciplines to more fully understand how users interact with health and care technologies. My findings raised questions about the nature of health and care technology acceptance, rejection and use from the perspective of older people and stroke survivors. Acceptance, rejection and use were not 'one-off' events but ongoing, involving interactions between users and the technologies within contexts. Through these interactions, the meaning of health and care technologies were constructed and negotiated. This included a social structural dimension as health and social care professionals, as well as family and friends, influenced how the technologies were given meaning. There was also a functional dimension to interaction, which involved the agency and capacity of users, and their ability to interact with the technologies. That is, as individuals negotiate the life course, interaction can become difficult and users may draw on others to help them 'domesticate' these technologies into their everyday lives.

To improve the design, development and provision of health and care technologies, and to stimulate further research, a theoretical framework was developed. This theoretical framework drew upon two case studies of telecare and telerehabilitation systems. The theoretical framework emphasised that individuals interact with health and care technologies through their definition of situations. These situations are ongoing, as individuals negotiate the life course and their agency, capacity, identities and roles change. Through interaction, the meaning of health and care technologies are constructed and negotiated, which further supports their acceptance or rejection. To promote use, health and care technologies must be designed *for* interaction and enable individuals to interpret and interact with them in imaginative ways that are meaningful to their identities, roles and future aspirations.

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Appendix A: Topic guides

This topic guide was used during interviews with older people:

About your button alarm and use of the service

- How did you come to have a telecare system?
- Who told you about telecare systems?
- Where is the telecare system is located in your household?
- What has your experience of telecare systems been like?
- Have you ever used your telecare system?
- Do you wear your pendant alarm?
- Do you know how the telecare system works?
- Has having a telecare system changed your everyday life in any way?
- What does having a telecare system mean to you?
- How could telecare systems be improved in the future?

About you

- Do you, on the whole, enjoy good health?
- Do you have any particular longstanding disabilities or illnesses that significantly affect your everyday life?
- Are you able to do everything that you want to do or do you need help or special equipment?
- Do you consider that you are more or less independent than you were last year?
- Who are the people closest to you and has that changed since last year?

Final thoughts

- Would you recommend telecare systems to others?
- Do you think that telecare systems should be given to all older people?
- Do you think that the button alarm is a 'badge' of old age?
- Do you think that telecare systems provide an alternative to moving into a nursing or residential home?
- Is there anything else that I should know about telecare systems before we finish?

This topic guide was used during interviews with stroke survivors[1]:

Thank you for agreeing to take part in this research. I am interested in hearing about your experiences of the technology that you have been given. In particular, the reasons why you got involved in the SCRIPT project, what negotiations took place when the technology was installed and how and when you use the technology. I'd like you to be as open as possible with your answers and I hope that the interview will be an enjoyable experience. Before we start, I'd like to run through some administration that is required by my university:

Firstly, I would like to record this interview. The recording will be transferred to a computer to be transcribed and used alongside other transcripts to generate an aggregated picture of people's use of the technology. Secondly, the recordings and transcripts will not be shared with anybody, and will be anonymised for future use such as publications. Finally, if at any point in the interview you would like to stop, please let me know. If I could get you to sign this document saying that you agree we can begin the interview. I would like to talk with you specifically about the SCRIPT project and your experiences with the technology.

To begin, could you please describe the technology that you have been given?

Imagination and appropriation

- How did you first hear about the SCRIPT project?
- What were your reasons for getting involved in the SCRIPT project?
- Did you have any expectations of the technology prior to having it installed?
- Have you used any technologies to support your rehabilitation in the past?
- Having used the technology for some time, do you think that there are people for whom the technology would not be suitable?

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[1] Following the interviews with older people, there was a need to have a clearer introduction and ending to the interview. Brinkmann and Kvale (2015) advocate the use of 'briefing' and 'debriefing' statements, which were incorporated into the topic guide for stroke survivors.

Objectification

- Thinking back to when the technology was installed, what room did you decide to have it installed in? Do you think that this has had any influence on how and when it has been used?
- What do you think about the design of the technology? Do you think that the technology has changed the look and feel of the room?
- Do other people use the room where the technology has been installed?
- Do you pack the technology away when others are in there?
- Do you think that the presence of the technology has changed how you feel about the room in which it is placed?

Incorporation

- Are you able to use the technology on your own or do you get help from others?
- Have you encountered any problems with the technology and how did you overcome them?
- Do you schedule your use of the technology and has this changed over time?
- Has your use of the technology meant that you have spent less time on other rehabilitation activities?
- What have been the biggest challenges in incorporating the technology into your daily routines?
- Are there specific times when you don't use the technology?
- Would you say that the technology has become part of your daily routines?
- Do you think that the 'gaming' elements of the technology have made it more appealing to use? Have you ever shared your achievements with others?
- Have you used the technology in any other ways that you weren't shown during the installation?
- How do you feel about others being able to view your progress via the 'healthcare professionals portal'? What do you think that it is for? Have you used it? How useful has it been?

Conversion

- Have you talked to anyone else about this technology or the SCRIPT project?

- Do you see yourself as someone who could benefit from the technology? If not, what kind of person do you think would benefit?

- Would you recommend the technology to others in a similar situation?

- Have your expectations been met by the technology?

- What would you change about the technology?

Experiences of stroke

- Could you tell me what happened immediately before and after your stroke?

- What, if anything, did you know about strokes at that time?

- When did you first realise that you had had a stroke? What happened next?

- Who have been the most important people involved in your rehabilitation?

- What have been the main challenges that you have had to overcome?

- What strategies do you use to overcome or reduce these challenges?

- How, if at all, have your thoughts and feelings about stroke changed?

- What positive changes have occurred in your life since your stroke?

- What negative changes, if any, have occurred in your life since your stroke?

- What do you hope for in the future with regards to rehabilitation?

Finally, is there anything else that you think would be helpful for me to know regarding your experiences with the technology or the SCRIPT project in general?

# Appendix B: Participant information

Telecare systems

Ethical Statement

As a research participant, you will have a right to:

- Consent to participate, withdraw from, or refuse to take part in this research.
- Confidentiality; personal information or identifiable data will not be disclosed to anyone without your prior consent.
- Security; data collected will be stored on a secure laptop computer. Audio recordings will be transcribed as soon as possible after the visit and the original audio recording will be deleted.

All personal information you provide will be anonymised. However, I am happy to acknowledge your contribution in my PhD should you wish to be named.

Links

KT-EQUAL
http://kt-equal.org.uk/
British Society of Gerontology
http://www.britishgerontology.org/

OLDER PEOPLE'S EXPERIENCES OF TELECARE SYSTEMS

The University Of Sheffield.

Who?

My name is **Mark Hawker**. I am a postgraduate researcher from the Department of Sociological Studies at the University of Sheffield. I can be contacted in the following ways:

Telephone: (01274) 792634
Email: m.hawker@sheffield.ac.uk

Should you have any further questions about this research, please do not hesitate to get in touch with me.

What?

My research will involve one visit to your household. (There will be times scheduled for breaks!) During the visit you will be asked to talk about yourself and your experiences with your telecare system. For example, how you came to have it, how you go about using it and what having it means to you. The visit will be informal and should provide us both with an opportunity to explore your experiences with your telecare system.

To help me remember what is talked about I would like to record the discussion using an audio recorder. Nobody else will have access to this audio recording, which will be transcribed and deleted at the end of my research.

Where?

The research will be conducted in your household. This will enable me to observe where you keep your telecare system and how you use it.

When?

The visit will be scheduled at a time that is convenient to you. You will also be able to reschedule the visit by using the contact details provided.

My visit is scheduled for:

_____ the _____
_____ at _____.

Why?

The aim of my research is to explore how a group of older people incorporate telecare systems into their everyday lives. Telecare systems are being promoted as one way of supporting independence. However, little is known about what it is really like living with a telecare system.

While telecare systems may support independence they may also be a source of distress and worry. It is therefore important to find out what additional support may be required to help ensure that telecare systems meet the needs of current and future populations of older people.

Telerehabilitation systems

Why?

The aim of my research is to understand how an assistive technology becomes 'integrated' (or not) within the everyday lives of people who have had a stroke. To be perceived useful, technologies need to find a space and a time to fit into people's everyday lives. By understanding how people who have had a stroke experience an assistive technology, and exploring any challenges they may face, we can look to design better and more useful assistive technologies in the future.

In many instances, the needs of people who have had a stroke are not incorporated into the design of assistive technologies. These technologies, rather than support people's independence, may be a source of distress and worry. It is therefore important to find out first-hand from people who have had a stroke what it is really like using an assistive technology.

Ethical Statement

As a research participant, you will have a right to:

- Consent to participate in, withdraw from, or refuse to take part in this research at any point in time.
- Confidentiality; personal information or identifiable data will not be disclosed to anyone outside of the **SCRIPT** project without your prior consent.
- Security; all data collected will be stored on a secure personal computer. Audio recordings will be transcribed as soon as possible after the visit and the original audio recording will be deleted.

All personal information you provide will be anonymised.

HOW DOES AN ASSISTIVE TECHNOLOGY BECOME 'INTEGRATED' (OR NOT) WITHIN THE EVERYDAY LIVES OF PEOPLE WHO HAVE HAD A STROKE?
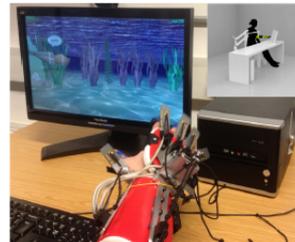
Sponsors:

Who?

My name is **Mark Hawker** and I am a PhD student from the **Department of Sociological Studies** at the **University of Sheffield**. I can be contacted in the following ways:

Mobile: 07736466620

Email: m.hawker@sheffield.ac.uk

Should you have any questions about this leaflet, please do not hesitate to get in contact with me.

What?

As you will be aware, you are taking part in a research project called **SCRIPT**. This project involves installing an assistive technology in your home and evaluating your use of it over a period of time. As a member of this project, I am interested in listening to your experiences of using this assistive technology. This will contribute towards the successful completion of my PhD. I would like to interview you to try to understand:

- The reasons why you got involved in the **SCRIPT** project.
- The expectations that you had of the assistive technology.
- Where you have placed the assistive technology in your home and whether this has changed since it was installed.
- How and when you use the assistive technology and whether this has changed since it was installed.

The interview should last no longer than one hour; times will be scheduled for breaks, where appropriate. The format of the interview will be informal, but directed, as I would like you to be able to speak freely (and truthfully!) about your personal experiences with the assistive technology to date.

To help me remember what is talked about I would like to record the discussion using an audio recorder. Nobody else outside of the **SCRIPT** project will have access to this audio recording, which will be transcribed and deleted at the end of my research.

Where?

The interview will be conducted in your home, which will enable me to observe where you keep the assistive technology.

When?

If you would like to be interviewed, I have attached a form that I'd like you to fill out to indicate the dates and times that you are available. Ideally, this will be four weeks after you had the assistive technology installed. **Nasrin Nasr**, from the project, will pick up this form when she comes to visit you next week. I will then be in touch to confirm the arrangements.

Agreement to Participate

Agreement to Participate

I, ..., agree to take part in this research project.

- I have had the aim of the research project explained to me in clear and understandable words.

- I have been informed that I may refuse to participate in the research at any time by simply saying so.

- I have been assured that my anonymity will be protected as specified in the *Participant Information* leaflet.

- I agree to an audio recording being taken of the interview, which will be transferred to a secure laptop computer, transcribed and the original audio recording deleted.

- I assign the copyright for my contribution, and any materials created through the research process, to Mark Hawker for use in education, research and publication.

SIGNED		DATE	

This **Agreement to Participate** form has been adapted from one provided by the British Society of Gerontology. For more information, please visit: http://www.britishgerontology.org/ageing-studies/bsg-ethical-guidelines.html.

Appendix C: SCRIPT methodology

The SCRIPT project involved collaborations between a number of partners across academe and industry. Their methodology was 'user-centred' and informed by evaluations across Italy, The Netherlands and the United Kingdom (Nasr et al., 2015). I focused on the experiences of users in the United Kingdom.

From the SCRIPT project documentation:

> *"WP1 is focused at determining user requirements to inform the design processes of the SCRIPT systems. This contains two subsequent phases of formative evaluation (FE): FE1 for the passive SCRIPT1 system, FE2 for the active SCRIPT2 system. The aim of the proposed methodology is to give voice to study participants as partners in the design activities. This elicits a range of perspectives on the design problems and required solutions. A range of qualitative methods, such as focus groups, in-depth interviews and formative evaluation activities has been used to capture user perspectives including people with stroke, their carers and stroke rehabilitation professionals. The methods of data collection including focus groups and one-to-one interviews encourage a pragmatic approach to experience what is the users experience of using technology or their experience of living with stroke. The proposed methodology will also allow participants to express their opinions of acceptable and desirable design solutions during the iterative process of technology evaluation. These activities are categories under two phases:*
>
> - *Phase 1: User-centred design including focus groups and home visits*
>   - *Focus group (1) with people with stroke and carers*
>   - *Focus group (2) with health care professionals*
>   - *In-depth interviews (and home visits)*
> - *Phase 2: User centred design; formative evaluation"*

Appendix D: SCRIPT data sources

Documentation used relating to the SCRIPT project:

- News update that includes an overview of the project in terms of its various components and a description of the project's progress. Available from: http://rehabilitationrobotics.net/cms3/sites/default/files/Deliverable_SCRIPT_NEWS%20_9.6.pdf.

- Paper submitted to the 2013 IEEE International Conference on Rehabilitation Robotics by Ates et al. (2013). The paper was entitled: *SCRIPT passive orthosis: design and technical evaluation of the wrist and hand orthosis for rehabilitation training at home*. The focus of the paper was on hardware design and testing through computer simulations.

- Paper submitted to the 2013 International Neurorehabilitation Symposium by Nijenhuis et al. (2013). The paper was entitled: *Feasibility of a personalized arm/hand training system for use at home after stroke: results so far*. The focus of the paper was on the usability of the technology and System Usability Scores were presented.

- Academic poster depicting an overview of the SCRIPT project and associated methodology focused on system usability and clinical effectiveness (see Appendix E).

- Article published in the Biomedical Engineering journal by Steffen et al. (2013). The paper was entitled: *SCRIPT: usability of hand and wrist tele-rehabilitation for stroke patients involving personal tele-robotics*. The focus of the paper was on the design of the user interface.

- SCRIPT project overview, aim and objectives (see Appendix F).

- SCRIPT project deliverable (D1.1) entitled: *Scoping the knowledge and evidence and featuring target users, physical and social context of use*. Available from: http://rehabilitationrobotics.net/cms3/sites/default/files/D1%201_Scoping%20the%20knowledge%20and%20evidence.pdf.

- SCRIPT project deliverable (D7.2) entitled: *Project-wide integration of the passive therapy device*. Available from: http://rehabilitationrobotics.net/cms3/sites/default/files/D7%202_Integration%20of%20the%20passive%20therapy%20system.pdf.

- SCRIPT project periodic report (year one). Available from: http://rehabilitationrobotics.net/cms3/sites/default/files/Publishable%20Summary%20SCRIPT.PDF.

Appendix E: Academic poster from the SCRIPT project

Appendix F: SCRIPT project aim and objectives

SCRIPT

Supervised Care & Rehabilitation Involving Personal Tele-robotics

SCRIPT - Provision of motivating and challenging therapeutic activities using a robotic hand and wrist rehabilitation device at home, will provide a chance for more frequent therapies and interactions. It is thought that such frequent interaction will further influence recovery of stroke rehabilitation.

Objectives of the project

Context:

Due to the high costs of clinical neuro-rehabilitation, post stroke treatments are generally limited from several weeks to a few months after the stroke event, with a restricted amount of training due to therapist availability. Any system aimed at pro-longing neuro-rehabilitation independently, out of the clinics, ie. at patients' homes, with low cost treatments, addresses a major issue in our current health management systems.

The SCRIPT project will;

- use such technologies at patient's home, enabling better management of chronic stroke patients.

- focus on hand and wrist exercise that present the least researched area with the most functional relevance, and potential for contribution to personal independence.

- look at differences between passive and active actuated devices.

- provide an educational, motivational and engaging interaction, which makes a therapy session more enjoyable.

- focus on remote management and support of the patient.

- infer from summative evaluation in this project, the impact on health and recovery and its potential cost implications.

Project Description

The SCRIPT project will produce two prototype robotic devices, a passive-actuated device (*SCRIPT1*) and one actuated actively (*SCRIPT 2*), both can be used in the home at an affordable price. A novel objective in SCRIPT, in line with the identified gap in this area, is to target the hand and wrist therapies that are most beneficial to gaining personal independence and performance of activities for patients' daily living.

SCRIPT will advance adaptive therapeutic rehabilitation, where the patient set-up time is minimised and the patient's engagement is maximised due to providing challenging therapies based on this adaptation. These will focus on both aspects of implicit and explicit relearning, thus aiming to improve practised skills that are transferable and more useful to activities of daily living in a complex environment. Remote interaction will be based on existing clinical workflow and will focus on educational, motivational and remote support aspects, of tele-robotics for rehabilitation.

SCRIPT will benefit from a robot's sensory potentials to measure biomechanical parameters during the interaction between human and robot, enabling monitoring of limb movements as well as benchmarking recovery. This will be aligned with the clinical outcome measures enabling fusion of clinical, biomechanical and temporal data. Based on analysis and fusion of these measures, a decision support system will support patients' and clinicians' interaction while using the SCRIPT system.

The project will enable remote interaction and remote supervision of patients, thus reducing travel costs and effort to and from hospitals

SCENARIO: *David is a 65 year old retired teacher, who had a stroke 12 months ago which left him unable to control the right side of his body. David lives with his wife Mary as his main carer. He has been discharged from all therapy services six months ago where he had been receiving therapeutic exercises.*

David and Mary were approached by the SCRIPT team and have received a small personal hand/wrist therapy device which works with a small LCD monitor wirelessly. David's therapist Sandra has reviewed David's case and decided that David needs to develop better control of the fingers for grasping and releasing objects. A therapy schedule has been selected with a set of games, starting with checkers (which requires only simple movement of the wrist, together with grip-and-release operation of the fingers). Sandra uses her computer to download the therapy game/s to David's device wirelessly. The device is then delivered to David's home. At David's home, one of the researchers shows David and Mary how to use this system for the first time. Once the glove like device is worn, it seems to work like one of the gym exercise machines by resisting or assisting a movement, it is much smaller in size though and fits to a table-top. To play the game, David will move each checker peg by practising a pinch, which is supported by the therapy device. David can progress through different levels in this game. The display shows David how far he has progressed through the therapist's schedule, and how far he has progressed toward completing the current game.
Throughout this process, Sandra has been monitoring David's progress from her office, making subtle adjustments to the support that the device provides, re-adjusting the resistance settings to suit.

Therefore the project will provide two easy to operate user interfaces, one aimed at stroke patients and the 2nd for the use of clinicians and physiotherapists. The design cycle is enriched by formative and summative evaluation cycles ensuring input from end-users and other stake-holders including clinicians, caregivers and family members.

SCRIPT will use a clear design analysis in relation to the differences between the SCRIPT1 and SCRIPT2 prototypes, in terms of their contributions to functional recovery.

Expected Results & Impacts

Based on a multidisciplinary team with existing expertise in all aspects of robot-mediated therapy, clinical evaluation and interface design and usability, our developed robotic tools will be usable at stroke patients' homes after their discharge from the hospital.

Our systems will be adaptive to user requirements and provide immediate feedback on user performance using the decision support architecture.

The feedback will be provided to both the patient and the health professionals with in-depth considerations for security and confidentiality.

We believe that the SCRIPT systems will be beneficial to patient recovery and for improving overall quality of life. SCRIPT will reduce hospital and home visits for patients/carers, and therefore have a large impact on reducing hospital costs, improving the quality and standard of care.
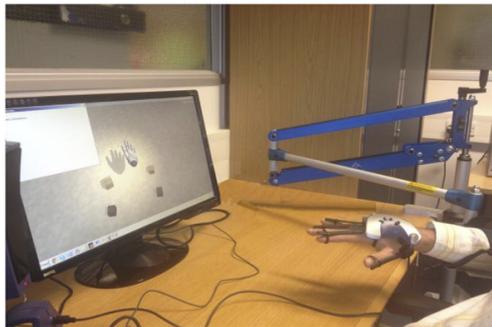

Figure showing hand gesture tracking

KEYWORDS
Stroke, Therapeutic games, Robotic for Rehabilitation, Home therapies, Hand and wrist therapies

SCRIPT
Supervised Care & Rehabilitation Involving Personal Tele-robotics

Project co-ordinator:
The University of Hertfordshire Higher Education Corporation (UH), United Kingdom

Contact person:
Dr. Farshid Amirabdollahian
Tel: +44 1707286125
Fax: +44 1707-286-423
Email: f.amirabdollahian2@herts.ac.uk

Project Website: *http://scriptproject.eu*

Partners:

- R.U.Robots Limited (RUR), United Kingdom
- The University of Sheffield (USFD), United Kingdom
- Universiteit Twente (UT), Netherlands
- Roessingh Research and Development BV (RRD), Netherlands
- MOOG BV (MOOG), Netherlands
- San Raffaele S.p.A. (SRS), Italy
- User Interface Design GMBH (UID), Germany

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Instrument: STREP

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253

Appendix G: Data generation timeline

Data generation activities were conducted over a period of 55 weeks between January 2013 and February 2014. This comprised activities relating to recruitment and data generation (i.e. interviews and observations). Data generation activities were conducted separately for each case and were affected by issues related to recruitment and resolving ethical and project management issues with members of the SCRIPT project. While my intention was to work on both case studies at the same time this proved infeasible. This was most evident for the second case study as I was dependent on a research project that was working to its own milestones. As a result, data generation on the second case study started much later than anticipated. The following chart illustrates the data generation activities:

Data generation activities from Week 3 (2013) to Week 5 (2014)
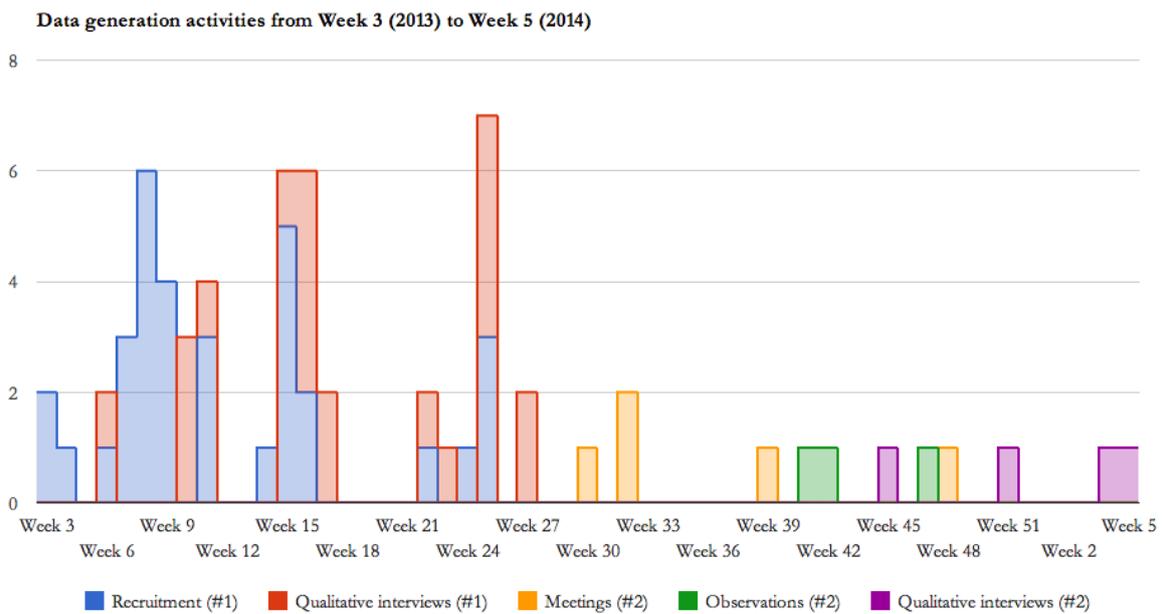
Appendix H: Guide to using my theoretical framework

In this appendix, I describe how my interactionist framework can be utilised by researchers of health and care technology engagement, and those involved in design and development. The appendix is divided into two parts because of the different emphases that stakeholders may place upon components of the framework. Both parts are based upon a vocabulary that is defined as follows:

- **Individual:** the primary or 'end' users of a health and care technology. In my thesis, individuals were referred to as older people and stroke survivors.
  - o **Agency:** the ability to make future-oriented and reasoned decisions that are within the constraints of individual capability (i.e. cognitive and physical) and social structures such as support networks (cf. Elder, 1994).
  - o **Capacity:** the *availability* of resources (e.g. education, housing and social networks) – or accessing others who have the necessary resources – and the *capability* of individuals (cognitive and physical) to utilise resources effectively to instigate change (Bandura, 2006).
  - o **Identities:** the "meanings one attributes to oneself in a role (and that others attribute to one)" (Burke and Reitzes, 1981: 84). An identity provides an individual with a standpoint or frame of reference in which to interpret situations and his or her own actions or potential actions (Burke and Reitzes, 1981). For example, identity as 'older person' or as 'stroke survivor'.
  - o **Roles:** a set of related meanings that direct an individual's behavior in a context (Rose, 1962).
- **Health and care technology:** the object that the individual interacts with. In my thesis, these were telecare and telerehabilitation systems.
  - o **Affordances:** the functional and relational aspects of health and care technologies that "frame, while not determining, the possibilities for agentic action in relation to an object" (Hutchby, 2001: 444). For example, the possibility to activate a button alarm in an emergency.
  - o **Scripts:** health and care technologies "define a framework of action together with the actors and the space in which they are supposed to act" (Akrich, 1992: 208). Scripts can be intentional (on the part of designers) or not, they

can be material or symbolic, and they can be relatively flexible or prescriptive (Ingram et al., 2007). For example, the inscription of a button alarm to be worn or an orthotic device to be 'donned' and 'doffed'.

- **Aesthetics and design:** the 'look and feel' of health and care technologies, which includes their colour, functionality, shape, size, and other physical attributes.

- **(Immediate) sociospatial context:** the micro-level or meso-level 'world within reach' of the individual. This may be as micro-level as the room in which a health and care technology is located up to the meso-level context of the household (e.g. a sheltered housing environment).

- **Wider context:** the world beyond the (immediate) sociospatial context of the individual. This may include the service infrastructure behind the health and care technology or the geographical region or country in which it is located. It is the context in which the health and care technology is embedded, which includes political and social aspects that support provision.

- **Situations:** a set of circumstances that one interprets and defines oneself. Situations are time-specific and may be experienced over a short or long period of time.

- **Symbolic interaction:** involves the "interpretation, or ascertaining the meaning of [objects,] the actions or remarks of [others], and [the] definition, or conveying indications to another person as to how he is to act" (Blumer, 1966: 537).

- **Meaning:** the outcome of individuals' interpretations of situations (and constituent parts of those situations [e.g. contexts], including other individuals) they are acting in (cf. Dennis, 2011).

- **Action:** is " conduct which is constructed by the actor instead of response elicited from some kind of preformed organization in him [or her]" (Blumer, 1966: 537). Action, in my framework, follows from individuals' interpretation and definition of situations, their identities and roles, and the meaning of health and care technologies.

For researchers of health and care technology engagement, where the aim is to explain how and why individuals accept, reject and use the objects, the following principles should help guide investigations employing my interactionist framework:

- Conceptualise individuals as social actors who interpret and define situations and act in response to the meanings that health and care technologies have for them.

Question how individuals identify themselves and the roles that they adopt. Are these identities and roles shared across social groups?

- Focus on the meaning of health and care technologies and how these meanings influence action. However, also appreciate the design of objects and how this may constrain or promote action. Do shared meanings exist or are there multiple interpretations of the same objects? How so?

- Recognise the *relationship* between individuals, health and care technologies, and the contexts in which they are used. All three components interact with each other and are required to more fully understand technology acceptance, rejection and use. Do individuals interaction with health and care technologies in the same way or is there an element of interpretation?

For designers and developers of health and care technologies, where the aim is to produce and evaluate novel innovations, the following principles should help guide work employing my interactionist framework:

- Recognise that individuals are not sets of attributes that can be scripted into health and care technologies but are capable of action based upon definitions of situations and social interaction. While attributes may help stimulate designs they should not become a proxy for the individual.

- Go beyond 'needs-based' approaches to design by accentuating creativity and recognising action as contextual. Design for interaction but also scenarios that are not needs driven.

- Develop in-depth knowledge about the common situations that individual users find themselves in, and the meanings that they ascribe to a health and care technology. Build up a profile of individual users and evaluate how different profiles influence how objects are accepted, rejected and used.

- Promote the creativity of individuals to interpret designs and to use them in ways that are pertinent to their situations. Work with different groups of individuals with varying agency and capacities to determine how health and care technologies are used in foreseen and unforeseen ways.

- Promote evaluations that incorporate feedback from real-world interactions with health and care technologies into designs.

The principles outlined above are intended as a guideline rather than as a prescription. What my interactionist framework provides is a means of exploring the complexities inherent in health and care technology engagement that brings together the richness of the individual life course and the materiality and symbolism of technologies. Creative use of my interactionist framework is therefore encouraged, as it is possible to place more emphasis on one or more of the components. In this way, empirical data could then be used to update the framework and to add components that are more (or less) relevant to particular technologies.