

The role of the technology generation effect in the use of telecare technology interfaces among Dutch care nurses

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Author: W.F.Y. Zollner

Student nr: 0043257

E-mail: W.F.Y.Zollner@students.uu.nl

Supervisors: Prof. dr. E.H.M. Moors
Dr. L.B.M. Neven

Second reader: Dr. Ir. A. Peine

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ABSTRACT

The Dutch population is aging, and as a consequence, the increasing demand for healthcare is becoming problematic for the Dutch healthcare sector. Older people often need more healthcare, including nursing care and other social services. On the care providers' side, care nurses are also aging, and the inflow of experienced younger care nurses is expected to be too low to comply to the upcoming shortages in experienced care nurses in the upcoming years. At the same time, development of new technologies for the purpose of making healthcare processes more efficient and cost effective, without the loss of the quality of care, is advancing at an increased pace. One group of technologies that aims at increasing the efficiency and cost-effectiveness of the care provision is called 'telecare'. In this research, telecare is defined as *'the use of telecommunication and information technologies for the facilitation of the healthcare process and to provide health and social care directly to the user'* (Barlow et al, 2007, p. 172).

Although the expectations of telecare technologies are high, not many telecare technologies are being used yet in Dutch healthcare. An increasingly important factor that influences the success of a telecare technology appears to be the age of its users (Lim, 2010). Docampo Rama (2001) argues that the understanding and use of present-day telecare technology interfaces is influenced by specific previous experiences by end users (i.e. people who use telecare technologies and their interfaces, either to provide or to receive care services) of technology interfaces. A *technology generation* in that context is described as age categories of persons who experienced the availability of the same types of consumer products during their formative period, which is operationalized in this research as the time before the 25th year of age. The way users can interact with technology is mainly determined by the interface of that technology (Docampo Rama, 2001). Until now, studies on the use of telecare have mainly focused on difficulties with telecare technologies by clients of different ages as users of telecare technologies. However, the ability to understand and use telecare technology interfaces by care nurses of different ages can be just as important for the successful implementation of telecare into the daily care processes of a care organization. This research aims to provide more insight in the experiences by care nurses in working with telecare technology interfaces, and focuses on the following main research question: *'What role does the technology generation effect have among Dutch care nurses in using telecare technology interfaces?'*

Interfaces can be characterized by their associated *interaction styles*, which are defined as follows: *'In an interaction style, specifications are given of re-useable application controls, specific selections and designs of such controls, and general design principles'* (Docampo Rama et al, 2011, p. 26). Interaction styles change over time. Care nurses that are currently working can have experienced two types of interaction styles: an electro-mechanical (EM) style (until the early eighties) and a Digital Software (DS) style from the eighties until now. This categorization is based on significant changes in interaction styles.

To study what difficulties the two different technology generations of care nurses experienced with the telecare interface, an exploratory case study was carried out. In this case study, in depth-semi structured qualitative interviews were held with care nurses of different ages that were all working with telecare technologies in the same care organization. This care organization is located in the south of the Netherlands and has integrated telecare services into the daily care processes since 2005. In addition to the interviews with care nurses, three other stakeholders of the use of telecare at the care organization were interviewed: the team leader of the telecare department, a technological consultant for the implementation of the telecare technologies at the care organization, and the CEO of an organization that was involved in supervising and coordinating the implementation of telecare at the care organization.

The Social Construction of Technology (SCOT) approach was used to reflect on the influence and role of the technology generation effect in the use of telecare technology interfaces by care nurses against other characteristics that influence the willingness to work with telecare technology interfaces. All interviewees were asked open questions about their experiences with the telecare technology that is used at the care organization, their opinion about the interface of

this technology (appearance, functionality, difficulties in usage), and solutions they applied in order to deal with issues with the technology. The responses were recorded and transcribed literally, translated to English and interpreted by use of a narrative approach.

The results of the analysis show that the technology generation effect does influence the ability to understand and use telecare technology interfaces. Previous experiences with technology interfaces by older care nurses of the EM generation differed from the younger DS generation of care nurses in that the older care nurses took effort in learning new technology interfaces only when it was crucial for the ability to do their work. The younger care nurses of the DS technology generation showed more interest in new technological developments, and used trial-and-error based strategies in learning how to use the telecare technology interface, while older care nurses of the EM generation applied an incremental learning strategy and only used interface features that were crucial to be able to provide telecare. Also, care nurses of the DS generation were more concerned about the social-emotional characteristics of the use of telecare technologies, whereas older care nurses of the EM generation were more concerned about the technological features of the telecare technology interface. More importantly, the technological consultant, the CEO of the spin-off organization, the team leader and the majority of the care nurses acknowledged that there is a difference in the way different generations learn and understand new technology interfaces. However, the technology generation effect did not influence the willingness of care nurses to use telecare technologies.

The findings in this research suggest that care nurses at the telecare department did *not* consider the technology a threat to their work, nor did they see it as a replacement for their responsibilities. They did not show more discomfort in using the system. On the contrary: the social group of care nurses considered the technology a solution to individual physical problems and discomfort they experienced, and the use of telecare technologies was an *opportunity* to be able to continue their work as a care nurse. Thus, not only are older care nurses capable to learn how to use telecare technology interfaces, but it also enables them to carry out their work as a care nurse for a longer period, and to continue to provide a valuable role in the provision of care. The technology generation effect can only be problematic if managers concerned with the implementation of telecare in their care organization do not actively involve and motivate the care nurses that need to work with it. The role of the technology generation effect is that it can influence the *ability* of care nurses to understand and use telecare technology interfaces, but it does not influence the *willingness* to work with these technologies if it means that care nurses can still use their expertise as a care nurse to help clients in their daily need for care. Policy makers on the use of telecare technology related innovations for the purposes of facilitating care processes and increasing their efficiency should therefore not consider older care nurses as technologically incompetent, but instead as extremely competent potential 'telecare nurses', as long as they are actively stimulated and guided in their work with these technologies.

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1. INTRODUCTION

In a society in which healthcare is becoming more complex and more demanding, developers of health related innovations are searching for ways to facilitate care processes and increase their efficiency (Bevan *et al*, 2010; Boonstra *et al*, 2011). One factor of great influence on the increasing demand for healthcare is the aging process among members of the Western society (Milligan *et al*, 2010). This aging process is a consequence of declining birth rates and increased life expectancy due to a higher quality of life (Chan *et al*, 2009; Charness & Boot, 2009). Physical and mental health tend to deteriorate with age, and older people often need more healthcare, including nursing care and other social services, such as psychological assistance, dietary advice and physiotherapy, but also wake-up services and morning and / or evening chats (Tabata, 2005; ZorgInnovatiePlatform, 2009; Boonstra & Offenbeek, 2010; Inspectie voor de Gezondheidszorg, 2011). For the healthcare sector in the Netherlands, the focus of this research, this could have severe consequences, and these are not only related to care receivers. This growing need for care implies increasing costs of healthcare and a more demanding workload for care providers (Buerhaus, 2000). The aging population has also caused a decrease in the effective labor supply, and this trend is expected to continue in the next few decades. During the second half of the 1990s, the number of vacancies exceeded the number of unemployed people, and employers were more involved in *filling* a pool of applicants, instead of *selecting* from the existing pool. However, this scenario is changing, and the aging workforce appears to play an increasingly important part in these changes (Henkens *et al*, 2008). The increase of the number of older inhabitants in the Netherlands, together with an increasing number of people with chronic illnesses, will demand more care employees. It is expected that about 480.000 additional employees are needed in the Dutch care sector by the end of 2020, while the prognoses suggest that only 250.000 new care employees will be available until then (ZorgInnovatiePlatform, 2009).

On the care providers' side, care nurses can be regarded as the workers with the most direct and most frequent interaction with older care receivers. A care nurse can be a male or female employee of a care organization that provides care services where a care receiver (i.e. client¹) lives or temporarily resides. In Dutch healthcare, 30% of working care nurses were at an age of 50 years or older in 2011 (CBS, December 2011). This relatively large so called *baby-boom* generation is expected to reach retirement age in the upcoming years. Dutch healthcare employers are now confronted with a structural shortage of labor, for which the inflow of experienced employees is expected to be too low to comply with the increasing demand (Henkens, *et al*, 2008; Buerhaus *et al*, 2000). Thus, the aging process of the Dutch population has a double negative effect on the workload of care nurses: the more older people there are, the more care is expected to be needed, and the less care nurses there are to suffice to this demand.

At the same time, development of new technologies for the purpose of making healthcare processes more efficient and cost effective, without the loss of the quality of care, is advancing at an increased pace (ten Have & Kessler, 2011; Charness & Boot, 2009). With the high development rates and the apparent multiplier effects for societal productivity and well-being, expectations for these technologies are high (Charness, 2008). Therefore, the use and benefits of Information and Communication Technologies (ICTs) in healthcare has been a research topic of increasing interest over the past years. One group of technologies that aims at increasing the efficiency and cost-effectiveness of the care provision is called 'telecare'. Various other names and definitions for ICTs in healthcare can be found in literature, such as 'telemedicine' and 'telehealthcare'. Although these terms are often used to refer to the same type of technologies,

¹ In this research, a person who receives some form of care from any care provider is referred to as a 'client'. People who use telecare technologies and their interfaces, either to provide or to receive care services, are referred to as 'users', or 'end users'. A care nurse that uses telecare technologies to provide care services is thus considered a user, but a client who receives care via telecare technologies is also a user.

the purposes of the technologies vary. Telemedicine and telehealthcare technologies are related to diagnosis and treatment of the patient (cure), whereas telecare is more related to providing support for client care (Barlow *et al*, 2007; Vlaskamp *et al*, 2001). In this research, telecare is defined as '*the use of telecommunication and information technologies for the facilitation of the healthcare process and to provide health and social care directly to the user*' (Barlow *et al*, 2007, p. 172). A user is defined as an end user of a telecare technology. Telecare technologies are expected to help the Dutch society cope with a decreasing work force in the care sector against increasing numbers of aging people that require professional care, by providing greater efficiency through increasing self-management and by diminishing the need for face-to-face contact (Pols & Willems, 2010).

Despite these promises, not many telecare technologies are being used yet in Dutch healthcare. The majority of telecare projects is still in experimental stage and many of them are expected not to reach full implementation in day-to-day practice (Broens *et al*, 2007; Vlaskamp *et al*, 2001; ZorgOpAfstand, 2012). Reasons for the low implementation rate of telecare technologies appear to be a lack of embedding of telecare technologies in the daily care process and difficulties in financing new technologies by care providers (Peeters & Francke, 2009). Also, the lack of standardization of telecare technologies makes telecare technologies less compatible to the IT environment of healthcare organizations (van der Velde *et al*, 2008).

An increasingly important factor that influences the success of a telecare technology appears to be the age of its users (Lim, 2010). Most telecare technologies aim to help older people to maintain their independence and continue living in their own homes. In order to benefit from the use of these technologies, people need to be able to use them (Docampo Rama, 2001). Due to the technological advances in the past years, the way users interact with technologies has changed significantly. Older users of technologies are often depicted in studies on telecare technology design as being unable or unwilling to understand and use newer technologies (see for instance: Hawthorn, 2000; Dewsbury, 2003). Most authors of these studies acknowledge that there are also 'exceptions' among older users, who can and do use new technologies, but argue that it should be clear that the majority of older users has difficulties with using technologies that are designed for the current younger generations. For instance, Hawthorn (2003) noticed that many technologies are designed for younger users and that it is hard for many older users to learn and use how to use these technologies, and even impossible for some. In his study, he argues that in designing for older age restricted users, designers tend to expect much less of the user and therefore automatically assume that limiting the complexity of user interfaces would be the best solution to increase the usability for these users. In this research, an 'interface' is defined as the means in which a user controls a software application or a hardware device. Examples are a keyboard or a mouse pointing device (hardware), but also menus and clickable buttons of a computer application (software) (Johnson, 2000; Techterms, 2009). Turner and van de Walle (2006) give the impression that older users do not understand new revolutionary interactive technology interfaces, because they retired from mainstream work before this technological revolution was initiated. They refer to this group with the term 'naïve users'. Therefore, one primary concern for designers of ICTs is understanding the predictors (i.e. attitudes, abilities, knowledge) of technology use in older adults (Hawthorn, 2003; Charness & Boot, 2009; Turner & van de Walle, 2006).

Literature on telecare technologies appears to focus only on difficulties with the adoption of telecare technologies by older patients and clients as end users of the telecare technologies (Barlow *et al*, 2007; Browne, 2000; Dewsbury, 2003; Hawthorn, 2000; Hawthorn, 2003; Mair *et al*, 2005). However, telecare technologies are used by various groups of users, and many more stakeholders are concerned with the difficulties of an aging population in healthcare (Delnoij *et al*, 2010). Care nurses are also expected to work with telecare technologies, since they need to provide care to the client. Care nurses can be considered '(specialist) end users' of telecare technologies, since they work with the technology from a care providers' perspective, and

operate from a work environment instead of their private surroundings. The way users can interact with technology is mainly determined by the interface of that technology (Docampo Rama, 2001). This implies that the interface of these technologies can be very different for care nurses in comparison to what clients see and use, and can thus also be interpreted very differently. One major factor in this regard is the resistance by care nurses to work with telecare technologies, because this would mean a shift in the focus of their activities (Boonstra *et al*, 2011). This resistance will be greater when the care nurse is burdened with a monitoring function instead of face-to-face contact with the patient or client (van der Velde *et al*, 2011). It thus seems that care nurses' interpretations of telecare could also form a barrier for successful implementation of telecare technologies. Indeed, in the search for interviewees in this research, a policy advisor of a care organization that used telecare technologies in its daily care processes responded:

*'[...] It is all too clear to me that professional care nurses themselves form the greatest barrier that we need to overcome, in order to make telecare technologies a success in the Netherlands. In our own organization and other (which I visit for research purposes) I am convinced that as long as the added value of the technology is unclear to the professional, difficulties in integrating these technologies in the care processes will continue to exist.'*²

If the group of care nurses is aging and technologies are only altered so that clients can work with them, it is unlikely that care will become more efficient by use of these technologies, since the group of care nurses does not understand how to use them and what they are for. According to Lim (2010), it is necessary to understand the interactions between technology, aging (i.e. capabilities) and prior experiences, in order to explain why older users cannot participate fully in the new digital age. Three factors may potentially contribute to difficulties in using present-day consumer products by adults: *'the complexity of the user interface, age effects in perceptual, cognitive, and motor skills, and generation related lack of experience with such technology'* (Docampo Rama *et al*, 2001, p. 25). Docampo Rama (2001) argues that the understanding and use of present-day telecare technology interfaces is influenced by specific previous experiences in the use of technology interfaces. A *technology generation* in that context is described as age categories of persons who experienced the availability of the same types of consumer products during their formative period, which is between 10 and 25 years of age. The more a new technology interface can be related to a technology interface that was present during the formative years of a person, the more likely it is that that person understands the technology interface and is able to use it (Docampo Rama, 2001). If care nurses are aging, it can be expected that these factors that make it more difficult to understand and use telecare technologies are increasingly present among this group of telecare users. It would then be unlikely that the use of telecare will make healthcare more efficient if the interfaces of these telecare technologies are not understood and / or accepted by care nurses of different ages. Therefore, it is interesting to research whether the technology generation effect can also be found among care nurses working with telecare technology interfaces. This research aims to provide more insight in how the technology generation effect can be related to difficulties in using telecare technology interfaces by care nurses.

The influence of the technology generation effect among the group of care nurses that need to understand and use telecare technology interfaces by cannot be explained if factors other than age related differences are left out of consideration (Lim, 2009). Members of different user groups of telecare technologies have their own reasons and motivations to use these technologies, and members of the same user group may share reasons and motivations other than their age in the use of telecare (Boonstra & Offenbeek, 2010). In the Social Construction of Technology (SCOT) approach, Dutch care nurses that need to work with the same telecare

² This quote was translated from Dutch to English as literally as possible by the author of this thesis.

technology interface could be identified as a relevant social group, in which differences in age among care nurses is considered an important determinant for the homo- / heterogeneity of this social group (Pinch & Bijker, 1984). The SCOT approach thus offers a framework in which age related differences among care nurses can be reflected against other characteristics that influence the ability and willingness to work with a new technology interface, such as telecare technologies. For that reason, the way different technology generations of care nurses learned to work with the telecare technology interface, their previous experiences, the meaning they give to the technology and its interface, the problems they experience with it, possible solutions and their expectations are analyzed by use of the SCOT approach.

The relevance of this research to society, to innovation studies and studies on age related differences in the use of technology will be further elaborated in the next section. More specification on the problem of age related differences in the use of telecare technology interfaces is given in the Problem Definition, in which the main research question and sub-questions are also stated.

1.1. Relevance

Within the field of innovation studies, the general assumption used to be that product innovations were mainly developed by product manufacturers. However, as Oudshoorn and Pinch (2008) argue, this view has gradually changed in the past two decades, and scholars increasingly argued that the boundaries between design and use are largely artificial. The interpretation of various users and user groups of telecare technologies could also have an important influence in the determination of the success of telecare technology implementation. The importance of including users' expectations and user needs in the development process of new technologies was also stressed by various scholars in innovation studies. (Oudshoorn & Pinch, 2003; Oudshoorn & Pinch, 2008; Moors *et al*, 2008; Peine, 2011; Peine *et al*, 2011; Oudshoorn, 2011; Nahuis *et al*, 2012). From the perspective of the client, benefits are mainly found in the assumption that by use of telecare technologies, clients can remain in their own living environment for longer periods of time, without unnecessary intrusions of care professionals such as care nurses. Also, the use of these technologies is assumed to increase the independence of clients. For instance, by use of video communication technologies, the client would attain more own responsibility over his own provision of care, because he would now be able to contact a care nurse at the time that he desires, and not at predetermined moments.

However, institutions, corporations and even individual user groups that provide care might offer a different perspective to understanding difficulties around new technological innovations (Oudshoorn & Pinch, 2008). Perceptions and claims about the impact of the use of these technologies appear to differ among stakeholders. On a macro level, policy makers and technologist emphasize that telecare technologies are the only way to manage the 'economic' difficulties in the care sector as a consequence of an aging population and the increased demand for care (Roberts & Mort, 2009). Policy makers appear to agree that the use of telecare technologies is necessary to cope with the upcoming shortages in the workforce of the Dutch healthcare sector (Vlaskamp *et al*, 2001; IGZ, 2009; ZorgInnovatiePlatform, 2009). Government initiatives are mostly aimed to promote the independence of clients and short-term residence at care facilities and hospitals (ten Have & Kessler, 2011). The use of telecare technologies is therefore stimulated by subsidies³, which enable care organizations to implement these technologies without having to cope with financial losses (NZA, 2013).

³ See for instance the policies 'Healthcare Infrastructure' (Zorginfrastructuur), and 'Screen-to-Screen', which were both issued by the Dutch Healthcare Authority in 2005 and extended repeatedly in later years (CTG, 28 June 2005; CTG, 19 December 2005; NZA, 2013). I will elaborate more on these policies in chapter 4, section 4.1.

On a more local level, care organizations search for partners for telecare implementation projects, which allows them to spread costs, centralize management and share knowledge and experience with telecare technologies among each other (Peeters & Francke, 2009). In a study about the implications of an aging workforce of registered care nurses in the US, Buerhaus *et al* (2000) indicated that nursing management has been increasingly concerned about the ramifications of an aging workforce, because aging nurses would have a reduced capacity to perform certain physical tasks, and warned that this would lead to serious shortages in the care workforce within 15 years. Care commissioners emphasize that telecare is an addition to care, and not a substitution of the current face-to-face moments between care nurse and client (Roberts & Mort, 2009). However, managers and care nurses worry that the use of telecare technologies as a replacement to the physical care provision would become more important than its supportive role, if the workload on care nurses continues to increase. These care nurses appear to consider these developments a threat to the quality of care, because they do not trust the quality of telecare technologies (ten Have & Kessler, 2011).

According to Mair *et al* (2005), there is abundant literature on the subject of client / patient satisfaction with telecare, but the care providers' interpretation on the use and benefits of telecare technologies has only been addressed scarcely. In their study, Mair *et al* focused on the differences in clients' and providers' perspectives on the use of telecare technologies. Their results showed that there are significant differences in perception between client and care provider. The participating clients in their research appeared to demonstrate more positive views on the use of telecare than their healthcare providers. Their data and results appeared to indicate that care providers' perceptions on the use of telecare technologies could form just as big a barrier for the implementation of these technologies as those of clients (Mair *et al*, 2005), thus indicating that more research on this subject can be a valuable addition to the understanding of care providers' perspectives for the use of these telecare technologies. Therefore, this research focuses on perceptions of care providers, and more specifically on care nurses as (specialist) end users of telecare technologies.

It appears that the use of telecare technologies is facilitated for care nurses if they are actively involved in the telecare implementation process (van de Velde *et al*, 2008; Peeters & Francke, 2009). Managers of care organizations are now looking for ways to involve both clients and care nurses (who are both groups of end users of telecare technologies) in the process of implementing the telecare technology in their organization. Henkens *et al* (2008) argue that raising the participation levels of older workers should be a key objective for policymakers and managers, for which they describe four strategies. The first is referred to as 'tapping into new target groups', which implies the use of human resources that would otherwise not have been used for the provision of care. Amongst others, this involves the recruitment of older workers if the availability of younger workers cannot suffice to the demand. The second strategy is aimed at increasing the supply of labor among the existing employees. In relation with age related factors that influence the availability of workers, this involves convincing these workers to continue working until the age of 65. The third dimension is termed 'outsourcing work and collaborating', in which tasks and responsibilities are distributed amongst collaborating organizations, to divide the work load more evenly. The fourth dimension is referred to as 'structural adjustments' and involves the relocation of production capacity to another region within the Netherlands.

These strategies do not automatically solve the upcoming shortages in labor supply as a consequence of an aging workforce. Care organizations seem to assume that the use of telecare technologies would imply that more care can be provided from one central location, and therefore more care could be provided with the same amount of care nurses (Peeters & Francke, 2009). This would also lead to a reduction of the required personnel during night shifts. Active night services would be replaced by remotely monitored video feeds, and therefore multiple homes could be monitored at the same time by one care nurse (van de Velde *et al*, 2008).

However, Oudshoorn (2012) argues that the introduction of care at a distance also has major negative consequences for healthcare, because it would imply a redefinition of the spatial dimensions of healthcare by redistributing care over multiple actors and locations. She argues that although telecare is promoted as a form of care where the locations at which this care takes place are no longer relevant, these locations still matter. Different stakeholders (i.e. individual clients, care nurses, care professionals etc.) use the technology at different locations. Because of the geographical distances between client and care providers, the created network by use of telecare technologies between those actors becomes crucial in the provision of care, in which all actors are interdependent on each other. Also, most telecare technologies are meant to be used at the homes of clients, from which information is extracted from a distance. This would redefine the concept of home as a private space. What such a technology means, and how and if it is used, appears to depend on the places where it is meant to be used, and the actor that uses it. The meaning that different stakeholders give to the technology can therefore differ as a consequence of these spatial dimensions (Oudshoorn, 2012).

More importantly, telecare technologies can only be successful when both client and care nurse are able to understand and use it (Pols & Willems, 2010). The more complex user interfaces of telecare technologies become, and the older the user becomes, the more difficult it is to overcome the complexities that are a consequence of age related difficulties with the technology interface (Docampo Rama *et al*, 2001). However, users that are familiar with the interface design of a telecare technology are expected to want more functionality at the expense of a user-friendly interface. The opposite is expected for users that can relate less to the interface design as a consequence of their previous experience with other technologies (Hawthorn, 2003; Turner & van de Walle, 2006). Care nurses need to be able to use the telecare technology to provide care, whereas clients use it to receive care. Therefore, the interfaces of these telecare technologies are often different for care nurses, compared to the ones clients use. Care nurses can therefore have different interpretations of the technology than clients. If age related factors do have an influence on the understanding and use of telecare technology interfaces, there could just as well be a relation to these difficulties in usage, the need for education on using telecare technologies and defining which type of telecare interface design is more feasible for care nurses.

The problem for designers of telecare technologies is that they have to design interfaces which can be used by as many people as possible, therefore forcing them to make decisions in the balance between usability and functionality of the interface (Hawthorn, 2003). This does not imply that low usability of telecare technologies is always caused by an overload of functionality, or vice versa. A telecare technology interface can also be inadequate by its design. Dewsbury (2003) argues that *'it is important to recognize that inappropriate design of these technologies can be debilitating and fundamentally dis-empowering'* (Dewsbury, 2003, p. 5). Designers and producers of telecare technologies appoint the low adoption rates of telecare technologies by care providers to various factors, such as the timespan to reach the break-even point between costs and benefits for healthcare organizations, the complexity for and technological difficulties in usage and maintenance, and the need for education on the use and benefits of telecare technologies (Vlaskamp *et al*, 2001; Pols, 2010). Chances of success also appear to depend on the type and main purpose of the telecare technology (Barlow *et al*, 2007). If care nurses of different ages have different interpretations on user interface complexity, knowledge on these differences could be valuable in order to design technology interfaces that are more suited to the generations of care nurses that need to work with them. Although designing technologies for older people often implies reducing the complexities, the stereotype image of older people as users that *'are less capable of using the technology'* can also be dangerous when these opinions are transcribed into the design of the technology interface, which reinforces the stereotype image of older users: because it is assumed that older people are not able to work with complex technology interfaces, they are modified and oversimplified, while these older users could perhaps also have learned to work with the more complex variant (Neven, 2011). Hawthorn

(2000) acknowledges the importance of including age related factors in the design of telecare technology interfaces, and suggests that research should look at how problems as a consequence of age are distributed. In a later study, Hawthorn confirms the stereotyping of older users of complex technologies, when he mentions that *'in designing for age restricted users we expect much less of the user and we limit the complexity of both screens and overall application structure. We preclude crowding an application with features if we foreswear menus and decide on a limited number of screens with large simple features and minimal scrolling'* (Hawthorn 2003, p.44). He continues by arguing that older users are less likely to be able to understand and use a simpler version of a complex technology interface, while younger users would be less inclined to use applications that require additional configurations to make available more complex features which they would perceive as basic and standard features.

Thus, telecare technologies could help the Dutch health care sector to cope with the problems, of an aging society and consequently an increase in the demand for care, but only if both care receiver *and* care providers are able to understand and use these technologies, which also implies that the differences in understanding and use of these technologies by care nurses of different ages should be understood as much as possible. If these care nurses belong to different technology generations, these difficulties could also be related to the technology generation effect. Understanding the influence of the technology generation effect on the use of telecare technologies could then provide additional insights in difficulties these care nurses experience in using the telecare technologies, and the understanding of how these difficulties can relate to care nurses' previous experiences with technology interfaces could be used to make technology interfaces less difficult to use by these care nurses (Lim, 2010). Therefore, this research aims to provide more insight in technology generation effects among care nurses, and thereby to illustrate the relevance of this effect in science, technology and innovation studies (STIS).

1.2. Research questions

On the basis of literature studies, it can be assumed that the technology generation effect is present and of influence among care nurses that use telecare technology interfaces. However, it would be wrong to assume that problems and solutions around the understanding and use of telecare technology interfaces are solely the consequence of age differences. As Lim (2010) argues, *'many approaches currently used in designing product and technology interfaces concentrate only on the effects of aging, and while an important factor to integrate into designs, it is not the only factor to be considered'* (Lim, 2010, p. 190). For instance, telecare technology interfaces can be rejected by their end users, because they are perceived as invading the privacy of clients' lives. For clients such as clients who suffer from a mental illness, it can be desired that the care nurse can establish a live video feed by use of the telecare technology, without the specific request of that client. Other clients that do not suffer from mental illness could experience this form of use of telecare technologies as an invasion of their private life. As a consequence, telecare technology interfaces are limited in functionality, and policy measures are taken within care organizations, to reduce the risk of invading the privacy of clients. Care nurses therefore need to take additional steps in care processes that involve the use of telecare, in order to ensure the clients' consent in using specific interface features of the telecare technology, such as a webcam. These factors and others all need to be taken into account in designing telecare technology interfaces, often at the expense of functionality available to the care nurse (Vlaskamp *et al*, 2001; van de Velde *et al*, 2008).

Also, a professional work environment is somewhat different from a private environment, when considering the ability and motivation of end users of telecare technology interfaces to learn and understand how to use them (Mair *et al*, 2005). First of all, individual clients who live at home do not have the availability of resources such as colleagues and service desks, but rely on the support by friends, family and care workers. Secondly, although both clients and care nurses

probably regard the technology as a way to support the care processes at the clients' home, other expectations and desires can differ greatly. Where clients perhaps want to use telecare as a platform for both essential as social-emotional care⁴, care nurses and care organizations see it as a way to make their work more efficient and cost-effective. Also, care nurses can use these technologies for administrative purposes, such as care dossiers. Thirdly, care nurses may be dependent on the technology that is selected for them by management, or on technology that was already present in the organization. A fourth difference in the willingness to use telecare technology interfaces can be that care nurses demand very different functionality than clients at home. A care nurses could, for example, make a call to check if a client has taken his or her medication properly. The client on the other hand appreciates that call because he sees it as a moment of social-emotional interaction (i.e. interaction that is not crucial for the care of that client, but still desired) dossiers (Mas & Seinfeld, 2008; Roberts & Mort, 2009; IGZ, 2011; ten Have & Kessler, 2011). Both values are important, but the importance differs for the different users of the telecare technology. The presence of the technology generation effect among people that work with telecare technology interfaces in a professional work environment can then also differ from people who work with these interfaces in a private environment, because the motivation to overcome technology generation related difficulties is influenced by the perceived necessity and willingness of the use of telecare in different user environments.

Technologies and their interfaces can thus have very different meanings and values to different settings and the different users involved. These values and meanings could be categorized among different age categories of care nurses. If care nurses between distinct age boundaries give the same meaning to a telecare technology interface, and this meaning is based on shared experiences during their formative period, then this could indicate a technology generation effect among the group of care nurses that uses these interfaces. (Docampo Rama, 2001). But this group may also share other properties with each other, which give them their group characteristics. The role of the technology generation effect can therefore only be explained if it is placed within the social context of the care nurses that use telecare technology interfaces (Kline & Pinch, 1996). It is interesting to study whether the presence of (technology) generation related difficulties are then still important to take into consideration for the assessment of the ability to use telecare technology interfaces by care nurses. Therefore, this research focuses on the following research question:

'What role does the technology generation effect have among Dutch care nurses in using telecare technology interfaces?'

Differences in telecare technology interfaces are a consequence of the way they are *designed* (Hawthorn, 2003; Turner & van de Walle, 2006). Interface design is influenced by technological developments and trends in mainstream design (Lim, 2010). The more a user is familiar with these developments and trends, the easier it will be to understand and use new interfaces. Users may take advantage of earlier acquired knowledge that can be related to current similar types of user interface. This transfer of knowledge can also have a negative effect if users cannot use their prior ways of using technologies and have to learn new ones. According to literature on technology generations, the knowledge and skills that were acquired during the formative period tend to be of greatest influence on behavior later in life (Docampo Rama *et al*, 2001; Lim, 2010). Thus, in order to identify a technology generation effect among care nurses that use telecare technology interfaces, the specific features of these interfaces need to be related to

⁴ Roberts and Mort (2009) describe three categories of care for older people: monitoring, physical care, and social-emotional care. Monitoring is described as a form of safety checking to make sure that the older client is still alright. Telecare provides a technologized form of this safety checking, with which care nurses can monitor clients from a distance. Physical aspects of care are related to physically assisting the client, for instance with feeding or dressing. Roberts and Mort argue that telecare technologies cannot be used for these purposes yet. Social-emotional care involves all the care that is left when the monitoring and physical care is left out, and is more oriented towards 'spending quality time' with the client.

those present during the formative years of a technology generation. Therefore, the first sub-question is:

'Which experiences by care nurses with interface features of the telecare technology can be related to experiences with technology interfaces that were present during the formative period of the various technology generations of care nurses?'

In order to identify a technology generation effect among Dutch care nurses, it is necessary to research whether there are differences between different ages of care nurses and their ability to understand and use the telecare technology interface. The perceived difficulties with and complexities of the telecare technology interface can vary among care nurses. It is therefore also necessary to investigate what technology generation related differences in the use of telecare technology interfaces can be identified among Dutch care nurses. The second sub-question is therefore:

'What technology generation related differences in the use of telecare technology interfaces can be identified among Dutch care nurses?'

Also, care nurses could perceive these differences as a generation related issue, and see this as a barrier to use the telecare technology interface. In this research, a qualitative case study was conducted to see if this technology generation effect could be identified among care nurses of a care organization that uses telecare technologies in its daily services. Given the present complexities of telecare technology interfaces and the suggested average age of care nurses that need to work with them, it was expected that the perceived difficulties with telecare technology interfaces do have a relation with the technology generations that use them.

In chapter 2. Theory, more elaboration on the concept of technology generations and the theoretic relation with the SCOT approach is given. The chosen methodological techniques, and specifications on the selection procedure and characteristics of the participants for the interviews that were held in this research is given in chapter 3. Methodology. An elaboration on and analysis of these interviews by use of a narrative approach is presented in chapter 4. Findings, followed by an analysis on the presence of the technology generation effect among care nurses in chapter 5. The implications of the findings from the interviews are given in chapter 6. Conclusion and Discussion, in which an answer to the main research question is also formulated. The adequacy of the applied theoretic framework and methodology, the scientific relevance for STI studies and studies in the field of gerontology, and a suggestion for the societal contribution of this research will be discussed in section 6.2 of that chapter.

2. THEORY

The concept of technology generations, and how the technology generation effect can be identified by focusing on the way people of different ages operate technology interfaces, is explained in further detail in the following section 2.1. In order to explain the relation between the technology generation effect and difficulties with telecare technology interfaces, section 2.1 will elaborate more on specific characteristics of interfaces, and the definitions of these characteristics that are used in this research. A further elaboration on the relation with technology generations and the SCOT approach is provided in the subsequent section 2.2.

2.1. Technology generations

The theory of technology generation and age effects on user interfaces was originally described by Sackmann and Weymann (1994), who investigated whether generations can be distinguished from people born in a specific period of time, that currently display similar behavior towards technology-based micro-technological events in their formative period. Their work was further developed by Docampo Rama (2001) and this research will follow the conceptualization of technology generations as described by her. The concept of technology generations is based on the assumption that older persons often appear to have more difficulties in operating present-day electronic products. This may suggest a relationship between age and difficulties in using these technologies. Cognitive abilities appear to change with age, and this also influences sensory and procedural memory for skills needed to operate technology interfaces. A user's ability to understand and learn technology interfaces that are new to him / her can be facilitated by previously acquired knowledge and skills that are similar to the ones needed to operate the new technology interfaces. As people grow older, they tend to rely on their most established knowledge, which is acquired during their adolescence. This period of adolescence and young adulthood is crucial for the acquisition of skills and experiences that can be used in later phases of life. It appears that the period between the 10th and 25th year of age of an individual is the most critical period in this respect. A generation is then defined as '*a range of birth cohorts that displays similar behavior, and share norms or values that are based on common sociological environments during their formative years*' (Docampo Rama, 2001, p. 4). Technology generations are identified on the basis of the types of technology that were available in the formative periods of different generations and the types of products they currently possess. Technology generations thus differ from each other in the type of technology experience during their formative years (i.e. between the age of 10 and 25).

According to Hawthorn (2000), it is necessary to consider what aspects of technology interfaces make it difficult for older users to understand and use them. Docampo Rama (2001) argues that the technology generation effect can be identified and distinguished from age related effects by focusing on the way people of different ages operate technology interfaces. She investigated this by characterizing user interfaces by their associated *interaction styles*, which are defined as follows: '*In an interaction style, specifications are given of re-useable application controls, specific selections and designs of such controls, and general design principles*' (Docampo Rama et al, 2001, p. 26).

An interaction style can be decomposed into conceptual operations, interaction techniques and the interaction structure of the interface. The interaction structure describes a specific operational procedure by which an interaction style is organized, while conceptual operations describe generic user-task options or functionality. With interaction techniques, specific input and output devices of the interaction style are defined. An example for telecare technology interfaces would then be as follows: a mouse pointing device (*interaction technique*) is used to select a client (*conceptual operation*), by clicking on the rectangular button (*interaction*

technique) which summons a pop-up window with more information and options for that location (*interaction structure*) (Docampo Rama *et al*, 2001).

Interaction styles change over time. Docampo Rama analyzed these changes by charting the technological developments of the telephone, television and video recorder in a timeline. Within the 20th century, three major interaction styles could be identified: a mechanical style (until the forties), an electro-mechanical style (until the early eighties) and a software design style from the eighties until now. This categorization is based on significant changes in interaction styles. The electro-mechanical style is characterized by hardware-based interaction techniques, in which mechanical attributes such as push buttons and rotary dials were used. These interaction techniques contained only basic functionalities, which were directly visible on the user interface with almost always a one-on-one relation between interaction techniques and functionality.

When the interaction style switched to the software style, these attributes were replaced by displays, touch buttons and wireless remote controls. The interaction structure shifted from one layer to a multi-layered style, in which not all the functionalities of the technologies are visible directly in the user interface and the one-on-one relation between a function and its corresponding interaction technique was abandoned. The software design style is divided into two sub-categories. The earlier *display style* originated from the 1980's, and is characterized by a display interface and interaction techniques that have a variety of functions depending on their mode. The second sub-style of interaction occurred around 1990, and is called the *menu style*. It can be regarded as an advanced form of the display style. This sub-style was mainly a consequence of the introduction of the computer to the consumer market. Specialized functionality was based on software based interaction techniques by use of multi-layered menus. (Docampo Rama, 2001).

A transition from one interaction style to another also means a transition to a different level of user interface complexity, which appears to increase when the applied interaction style deviates from the style that users are familiar with by operating prior technology in their formative years (Lim, 2010). Docampo Rama *et al* (2001) operationalized the beginning of a new era of the above mentioned interaction styles as the point in time where 20% diffusion within the population has been reached. A technology generation could then be distinguished by calculating which birth cohorts did not experience the above mentioned interaction styles before the age of 25, and which cohorts would therefore have experienced the various styles in that period. It appears that different technology generations behave differently with respect to technology, as a consequence of the differences in technology experience during their formative period. This implies that older care nurses are disadvantaged in using present-day complex user interfaces, because they cannot relate to these technologies on the basis of their formative years. What this could mean for user interface complexity for care nurses working with telecare technologies is that within this group, differences exist between users in the ability to understand and use these technologies due to differences in age and therefore the existence of different technology generations among care nurses. The largest group of the registered care nurses were at an age of 50 years or older in 2011 (CBS, December 2011). These nurses were born in 1962 or earlier. Taking into account the lower boundary of a formative period, 10 years have to be added to that year. The range of the formative years for nurses at the current age of 50 years or older (with a maximum of 65 years, which is the current retirement age in the Netherlands) then categorizes this group under the electro-mechanical (EM-) generation. The Digital Software (DS-) generation starts from 1980 until now. If the lower boundary of the formative period is taken into account, this would categorize all nurses born from 1970 until now under the DS generation.

2.2. The Social Construction of Technology

In the Social Construction of Technology approach, the idea is that different social groups, including user groups, can construct completely different meanings of a technology (Pinch & Bijker, 1984; Oudshoorn & Pinch, 2008). This development process is described as a multi-directional model, with which it would be possible to explain why one variant of an artifact survives, whilst others do not. Each artifact has social groups that decide which problems with the artifact are relevant and therefore need to be solved. There is only a problem when there is a social group that regards it as a problem. This does not mean that all problems will be solved just because a social group regards it as a problem. Meanings given to an artifact by one social group can be subverted when there is another group whose opinions and interests appear to be more important for the development of an artifact (Munir, 2005).

In defining meaning of the artifact to the different social groups, it is possible to determine the 'relevant social groups'. This can refer to institutions, organizations, and organized and unorganized groups of individuals. The common factor in a relevant social group is that all members share the same meaning(s) attached to the artifact. Important to note is that the largest social group is not necessarily the most relevant one. The way closely involved social groups give meaning to technological aspects such as interface specifications can be of greater influence on the eventual design than that of the largest group (Bijker, 1987). Ten Have and Kessler (2011) argue that support for implementing telecare technologies by care nurses is crucial for their success. Again, this does not mean that all problems will be solved just because the group of care nurses experiences difficulties with the telecare technology interface. Negotiation between different actors could lead to a selection of the most relevant problems that need to be solved in order to continue the development and implementation of an artifact. This would suggest that not all perceived difficulties by all relevant social groups are solved, but primarily the most dominant ones (Vergragt, 1988).

When the relevant social groups are determined, they are analyzed for homo- / heterogeneity with respect to meanings given to the artifact (Pinch & Bijker, 1984). For instance, in order to explain some meanings, a distinction can be made between different technology generations of users of a technology (Lim, 2010). For determining the role of the technology generation effect among care nurses as a relevant social group. The heterogeneity in the age of care nurses is studied in this research. With the descriptions of all relevant social groups in greater detail, more focus can be put on the problems each group has with an artifact. Around each problem, various solution directions can be identified. This can result in conflicts for decision making for development of the artifact. Solving the problems causes an artifact to stabilize to a certain degree in terms of development (Pinch and Bijker, 1984). One way to stabilize technologies can be by use of rhetoric problem solving. For example, Turner and van de Walle (2006) describe that '*communicating the underlying structure and operation of an interactive system is best achieved by means of a metaphor or analogy*' (Turner & van de Walle, 2006, p. 151). One example is the use of the term 'house' as a metaphor for a clickable box that represents a client that makes use of the telecare services. By using these metaphors, users are more likely to understand, at least for its general functionality, the purpose of an interface.

This example illustrates how problem solving mechanisms can be used to stabilize an artifact among relevant social groups. However social groups are not static. New relevant social groups can emerge over time and, for instance, start using the artifact for purposes not intended by the manufacturer. This is reflected in the different problems social groups perceive with the artifacts, but also in the different solutions and designs proposed by social groups (Kline & Pinch, 1996). This could mean that different technology generations of care nurses use the same telecare technology in different ways. If there is a shift in relevant social groups, for instance due to an aging workforce, this could mean a destabilization of a telecare technology, because the meaning that other technology generation gives to the technology is different from the former

one. The flexibility in how social groups think of, or interpret technological artifacts, is what Pinch and Bijker (1984) call 'interpretive flexibility'.

Interpretive flexibility is the first of three stages in the development of technological artifacts. The second stage is called 'closure', and refers to the degree in which problems related to the artifact have been solved. In the third stage, the content of a technological artifact is related to a wider sociopolitical milieu (Oudshoorn & Pinch, 2008). The concepts and techniques that social groups use to solve the perceived problems is referred to as a 'technological frame'. The technological frame encompasses all the factors that structure the social members' thinking and actions towards solving problems (Pinch and Bijker, 1984). A technological frame can become dominant over time, in which the frame determines the selection process for the development of an artifact. Inventors and developers become too dependent on and too focused on the aspects of the frame that has the most meaning to them. This is what Pinch and Bijker (1984) call 'inclusion'. It does not, however, mean that developers cannot operate within different technological frames. For instance, telecare technology interfaces for care nurses are often very different compared to those intended for care receivers. Focusing on the technological frame of care nurses as a complement to that of care receivers could therefore provide different problems. Different individuals of a relevant social group of care nurses that experience difficulties with the interface can communicate this to other group members. The meanings and interpretations can be adopted by other members of that group. Eventually, the group can have a collective negative attitude towards the telecare technology interface. If these issues can be related to specific technology generations, designers can adapt user interfaces to a form that is more compliant to the experiences that these technology generations of care nurses had with technologies during their formative period.

Closure, as the second stage in the development occurs when problems the technological artifact by relevant social groups appear to have disappeared. The artifact eventually stabilizes, and interpretive flexibility vanishes (Oudshoorn & Pinch, 2008). The degree of stabilization depends on whether the relevant social groups perceive the problems as being solved. Closure for telecare technology interfaces would be achieved when different technology generations of care nurse are able to understand and use these interfaces. This can, for instance, be achieved by implementing learning strategies for the way the user interface works, by using consistent interfaces that use one type of interaction procedure, or by relating the interface design more to the technology generations that use these telecare technologies (Docampo Rama, 2001).

Introducing the content of a technology to a wider sociopolitical milieu takes place when the technological artifact is stabilized and the predominant meaning and use emerges (Oudshoorn & Pinch, 2008). According to Vlaskamp *et al* (2001), the key to a wider implementation of telecare technologies lies in providing stakeholders such as healthcare professionals, insurers, and even government agencies, with a justifiable indication that telecare technologies do combine a high quality of care with lower costs and a lower human resources input. These indications form the motives behind the increasing interest in telecare technologies.

3. METHODOLOGY

This chapter elaborates on the chosen methodology for investigating the role of the technology generation effect among Dutch care nurses that use telecare technology interfaces. First, the applied research design is explained. The applied methods for gathering data and transcription of these data are explained in the subsequent section, followed by an elaboration on the applied methods for analysis of the findings. Later on in this chapter, more attention is given to the validity of the applied methods and reliability of the research.

3.1. Research design

To study what difficulties the two different technology generations of care nurses experienced with the telecare technology interface, an exploratory case study with a narrative approach was carried out, in which in-depth semi-structured qualitative interviews were held with care nurses of different ages and stakeholders that were all involved in working with telecare technologies in the same care organization. In a narrative approach, qualitative data are gathered by interviewing subjects by use of narrative interviews, which stimulates the subjects to look back in detail across his or her life course, to understand how historical events influenced how the subjects '*interpret, understand, and define the world around them*' (Bryman, 2008, p. 440). In order to research the technology generation effect among care nurses that use telecare technology interfaces, these historical events are sought in previous experience with technology interfaces. The qualitative nature of the interviews was appropriate, since there were no models available that relate the influence of differences in age of care nurses as users of telecare technology interfaces with other characteristics of these users. As described in previous sections, factors and user characteristics other than differences in age could influence the ability and willingness to use telecare. An exploratory approach was chosen because it was unknown if age related factors had were present at all among Dutch care nurses who use telecare technology interfaces. Also, the concept of technology generations is relatively new and underexplored in gerontology studies. An exploratory case study is therefore useful since it allows for new insights in technology generation effects among an unexplored group of users of telecare technology interfaces. The explorative nature is reflected in the main objective of this research project, and its corresponding research question: it aims to provide more insight in the *role* of the technology generation effect among Dutch care nurses that use telecare technology interfaces. This role could not be defined *ex ante*, since no comparable research was conducted. A narrative approach was chosen, because the research aims to provide an understanding in how previous experiences with technology interfaces influenced the ability of care nurses of different ages to use current telecare technology interfaces. The objectives of this research project are based upon an interpretation of data that were sought by use of qualitative interviews. The social scientific purpose of the research comprises of identifying and illustrating the role of the technology generation effect among care nurses that use telecare technology interfaces, which could be influenced by the care nurses' historical background with other technology interfaces.

3.1.1. Limitations of the research

The limitations of the case presented here were set by selecting one care organization that integrated the use of telecare technologies into their daily care processes, of which the care nurses that used these technologies were within the range of the EM- and DS-generation. Determining the age boundaries for a technology generation was done on the basis of their formative period. Docampo Rama *et al* (2001) conducted their research more than ten years earlier than when the care nurses were interviewed for this study and since then, technology

interfaces appeared to have changed drastically. Smartphones and tablet PCs used very different user interfaces than laptop PCs and older mobile phones did years ago (Grossman, 2010). It would be incorrect to treat the group of care nurses that was in the formative years as part of the DS-generation. Furthermore, care nurses that have not used or were not using telecare technologies were excluded from the population, since they can only provide data on *expected* difficulties, and would therefore provide speculative results.

3.1.2. Sample selection

In order to find the appropriate candidates to participate in this research, an online database was accessed, that tracks the activity of care organizations that use ICTs for the provision of care to clients and patients (Zorg op Afstand, 2012). Since the research presented here focuses only on telecare technologies, a selection of care organizations that use more or less similar telecare technologies was made from this online database. The care organization with the largest telecare department was chosen to conduct the interviews. The management team of this organization only gave permission to conduct interviews with two care nurses at first, but other candidates were found after these interviews took place, by use of snowball sampling. Snowball sampling means that interviewees are asked whether they know of any other candidates to participate in the research (Baarda & de Goede, 2001). This allowed me to find three other participating care nurses. In total, nine interviews were conducted with people that were involved in the introduction and use of telecare technologies within the same care organization. This care organization was located in the south of the Netherlands. To keep the care organization anonymous, it is given a fictitious name in this research, based on their screen-to-screen services: *S2S Care*. The interviews were held in the period from November 2012 until February 2013. One interview was held with a manager of the IT service desk of *S2S Care*. This interview was recorded but not transcribed, and was used only to provide insight for the researcher of the general communication structure around the telecare technology at *S2S Care*.

Five interviews were held with care nurses of different ages. The respective ages were 31, 39, 43, 50 and 59 years. All the interviewed care nurses were still working with the telecare technology when the interviews were held. For some of them, working by use of the telecare technology was their only form of work at the care organization, whereas others were also involved in other activities. The youngest nurse was still a district nurse, while the 50 year old nurse was involved in management activities. All the interviewees were kept anonymous. For the purpose of easy reference, all the care nurses were given fictitious names based on their corresponding ages. The different ages were labeled **A** (31 years), **B** (39 years), **C** (43 years), **D** (50 years), and **E** (59 years). Hence, the fictitious names were *Amy*, *Bill*, *Cindy*, *Doris*, and *Eva*.

All five of the above mentioned interviewees used to do some form of nursing before they started working at the telecare department. Amy and Bill used to be district nurses⁵. At the time of the interview, Amy had been working with telecare for only 4 months. Bill had been working with it for 4 years. Until his 25th year, Bill used to be a nurse in the army. Cindy was involved in the pilot phase of the telecare implementation project and explained that she was already working with a similar technology from a different supplier in 2001. Before she started working at the telecare department, she used to be a psychiatric nurse. Doris and Eva started in 2005, and were involved in the early phases of the telecare implementation project at the care organization. Doris used to be a hospital nurse. Eva was a maternity nurse, and also worked at the telecare department as a call service employee.

An additional interview was held with the CEO of an organization that developed video communication technologies, such as telecare technologies. He was involved in the pilot phase of

⁵ In this research, the term 'district nurse' is used to refer to nurses that provide care services to clients by physically visiting the homes of these clients.

the telecare project at S2S Care. Later, he became a technological consultant for the further development of the telecare technology and its technological infrastructure. The eighth interview was held with the CEO of the spin-off company that was established as a joint venture between S2S Care and another care organizations that was located in its vicinity. The main objectives of the spin-off organization were to facilitate the implementation and further development of the telecare technology at S2S Care. The other care organization could make use of the telecare services of S2S Care. In the more recent years, the spin-off company acted as an advisory partner for the coordination of the telecare department of S2S Care. The last interview was held with the team leader of the care department, who was also involved in the introduction and implementation of the telecare technology since the beginning of the project, except for the pilot phase. Before she became a team leader, she worked as a care nurse at the telecare department, and was also involved in the qualitative improvement of the primary telecare processes. The technological consultant, the CEO of a spin-off company and the team leader were also given fictitious names. The technological consultant is referred to as *Robert*, the CEO *Steven*, and the team leader *Tessa*. *I* is used to refer to the interviewer in the transcribed interviews.

Based on the ages that the interviewees had at the time of the research, Amy (31 years old) and Bill (39 years old) belonged to the Menu style (DS) generation, and Cindy (43 years old) to the Display (DS) generation. Cindy was 25 years when the era of the Display style oriented interfaces ended and the Menu style era began. Docampo Rama (2001) found that it was very difficult to empirically differentiate the display generation from the menu generation, because the interval of the display generation was only 10 years. The only indicators for differences between these styles appear to be the preferences of users to navigate through different menus, rather than manipulating the visible options. The more specialized the functions of all the available interaction techniques become, the less it would appeal to older technology generations of care nurses. Therefore, Amy, Bill and Cindy are all three considered members the DS technology generation, instead of differentiating between a Menu style and Display style. Lim (2010) found that determining the correct technology generation can be difficult for people that were 25 in the years around 1985, and argued that this is because this group of people experienced the transition from EM style to DS style in their formative period. They could thus show similarities in using technologies with either technology generation. Docampo Rama (2001) indicated that the exact moment of transition from the EM style to the display style was hard to determine, because the transition periods were different for different devices. She argued that the introduction of the new style could only be expressed in terms of fuzzy periods. If Doris (50 years old) was categorized on the basis of the operationalization that Docampo Rama (2001) applied, she would belong to the DS generation. However, since Doris only experienced two years of this DS era, and because the transition from one technology generation to another can only be expressed in fuzzy periods, it makes more sense to categorize her as a member of the EM generation. Therefore, both Doris and Eva (59 years old) are considered care nurses that belong to the EM generation in this research.

3.2. Data collection and analysis

3.2.1. Data collection

Before the first interview, I was invited to participate in a few interactive moments between Bill and a variety of clients. These clients were all informed about my participation and all of them had given their permission. This enabled me to experience how the telecare technology and its interface worked and how it was operated. Also, it provided me with more perspectives on the use and benefits / drawbacks of telecare technologies. For instance, it became clear with the first communication between client and care nurse by use of the telecare technology that it was not only used for a routine check to find out whether the client took his medication, but also as a

social 'visit' that had no direct relation to mental or physical conditions of that particular client. Thus, the participation in these activities allowed me to actually see what a care nurse was doing while using the telecare technology.

The interviews generally took between forty-five minutes and one hour, and took place in a secluded office space at S2S Care. The care nurses were asked open questions, which were structured on the basic principles of the SCOT approach. A topic list for the questions that were asked during the interviews is included in Appendix I. Questions about the technology interface were based on the indicators of its interaction style (interaction structure, interaction techniques, conceptual operations). These principles were used to study if the meaning that care nurses gave to the technology could be related to the available conceptual operations, the interaction structure and / or the interaction techniques needed to understand and use its interface. Additionally, some questions were aimed to gather data on the scope of the telecare project and to study whether this had any relation to age related difficulties with the technology. For identification of age related differences between different technology generations of care nurses, the participating care nurses were asked questions about their previous experiences with technology interfaces, and whether they thought that this had influenced their ability to work with more recent technology interfaces. Each participating care nurse was shown charts with illustrations of technologies that were common use during his or her formative period. Lim (2010) found that the use of these so called 'Visual Prompt Charts' (VPCs) were good tools to stimulate memory and facilitate discussion among interviewees. The described VPCs of Lim were supplemented with illustrations of different operating systems (MS-DOS, Windows, IOS). Also, an additional VPC was made for the period between 2000-2010. Three other VPCs were used during the interviews, showing technologies that were available between 1970-1980, 1980-1990, and 1990-2000. The prompt chart of the formative years of the interviewee was shown first, after which he / she was given the opportunity to share his or her experiences with those technologies. The most recent VPC (2000-2010) was not relevant for the formative periods of four of the five interviewees in this research, but was used to identify what kind of technology interfaces the interviewees were using at the time of the research (Lim & MacDonald, 2005; Lim, 2009). Two examples of the used VPCs (1980-1990 and 2000-2010) are included in Appendix II of this report.

The other stakeholders (Robert, Steven and Tessa) were asked questions about the background of the technology and management perspectives on the use of telecare technologies. They were also asked if they knew of any problems that care nurses experienced with the telecare technology interface, and what their expectations were about the future of these technologies. Naturally, they were also asked whether they thought age related factors influenced the understanding and use of telecare technology interfaces among care nurses, and what this meant for the success or failure of using these technology interfaces.

3.2.2. Analysis of the gathered data

All the interviews were recorded with a memo recorder, and transcribed literally. No interview analysis application or tool was used for this transcription. The questions and answers were put in a spreadsheet, so that they could be filtered and compared with each other on the basis of both the questions that were asked and the answers that were given. These transcriptions were translated into English by myself. The English transcriptions were analyzed by use of a narrative analysis. The term 'narrative analysis' is often used to refer to an approach that examines the interviewees' recounting of his / her life and events, and entails a sensitivity to the connections of interviewees' past, present and future event, and these interviewees' own interpretation of their role within those events. (Bryman, 2008). The narrative analysis allowed for a storyline to be formulated about the interviewees' experiences of, problems with, and expectations of the telecare technology interface. The formulated storyline was an historical chronology of

experiences with the telecare technology interface by care nurses, which comprised of the following stages: 1.) the introduction of the telecare technology at S2S Care; 2.) previous experiences with telecare technology interfaces by care nurses before they started working at the telecare department; 3.) first experiences with the telecare technology and its interface, and strategies for learning how to use it by care nurses; 4.) problems with using the telecare technology interface by care nurses, and used or suggested solutions for these problems; 5.) Alternative uses and expectations for future developments of the telecare technology.

In order to make statements about the perceived difficulties with and complexities of the telecare technology interface as a consequence of the technology generation effect, the data were analyzed for expressed differences among care nurses of different ages in interpretation on the use of, difficulties with and expectations for development of the telecare technology interface. These differences were then analyzed to find out whether or not they could be related to the EM generation or DS generation of care nurses. Responses on questions about previous experiences with technology interfaces were analyzed to find out if these differences could be related to different eras of interaction styles (EM style and DS style), and thus whether or not the current experiences with the use of telecare technology interfaces could be related to these previous experiences among care nurses of different technology generations.

3.2.3. Validity and reliability of the research

The construct validity is to do with the question whether the applied interview and resulting data represent the concepts that are investigated. This study aims to find indications of age- and technology related difficulties among care nurses that use telecare technology interfaces (Bryman, 2008). Based on the literature that was found on this topic, it was assumed that there would be age related differences in the use of telecare technology interfaces, and that it would be possible to make assumptions about the generation effects on the basis of qualitative interviews. The external validity of the research refers to the generalizability of the research findings, for example to other populations and/ or measurement arrangements (Bryman, 2008). It should be realized that Docampo Rama (2001) used relatively large populations of subjects for her study. This implies that these generic categorizations might not be identified when smaller populations of different age groups are investigated. The sample size of interviewed care nurses was relatively small. However, it is very difficult to gain access to care nurses for these interviews. At the time of the research, about 25 care nurses were working at the telecare department. The workload for these care nurses was very large, and S2S Care was also participating in another research, which would last until February 2013. I was therefore not allowed to interview more care nurses. The purpose of this study is not intended to make conclusive statements on the basis of the specific age boundaries between the different technology generations or changes in performances with birth cohorts, for which quantitative data of a much larger population would be needed. It is intended to explore whether or not a technology generation effect can be identified among care nurses.

For the research presented here, the internal validity is concerned with the question of whether differences in age among the interviewees are the cause of differences in interpretation of the telecare technology. The collected data and formulated storyline were therefore analyzed on an identification of other characteristics that the interviewed group of care nurses shared or differed in, and an attempt was made to identify elements of the different stages of the SCOT approach (interpretive flexibility, closure mechanisms, stabilization, technological frame, inclusion, and the wider context). Closure mechanisms and stabilization can only be explained on the basis of the actions social groups undertook *after* stabilization and closure took place. Therefore, the SCOT approach is best used for *ex post* analysis. However, interpretive flexibility does not necessarily have to be analyzed *ex post*, because the way a relevant social group gives meaning to an artifact is part of the process towards stabilization. The use of telecare

technologies has only recently been implemented by Dutch care organizations. The study by ten Have and Kessler (2011) showed that in 2008, only 11 Dutch care organizations offered telecare services, of which only two organizations used a telecare technology that was fully integrated in their daily practice. This made the use of telecare technologies relatively young at the time of the research, and was not expected to have reached full stabilization yet among Dutch care nurses. The possibility to analyze interpretive flexibility before stabilization is therefore valuable for this research. Also, the SCOT approach could provide more insight in the relevance of the technology generation effect within the technological frame around the technology interface, and the way closure mechanisms related to age related differences within this technological frame.

The reliability of a research refers to *“the degree of consistency with which instances are assigned to the same category by different observers or different occasions”* (Silverman, 2005, p. 210). To ensure the reliability of the data, all the recorded interviews were translated as literally as possible by the interviewer. The only data that were left out from the recordings were references by the interviewees to other care nurses or colleagues that did not participate in this research project. A copy of this report was sent to the manager of the telecare department of S2S Care, to validate that the data were transcribed and translated correctly.

3.3. Case study on telecare (S2S Care)

S2S Care is an experienced care provider for home care, maternity care, youth healthcare and dietary assistance. It is a member of a branch organization that supports S2S Care in the provision of high quality care. The home care division provides services for domestic help, nursing and caring. For people that need care, but not so much that they need to be relocated to a care facility, S2S Care provides telecare services, which they call Care at a Distance. This is not a replacement of the regular care services, but for many activities that do not demand physical support of a care nurse, it acts as a supportive service to relieve a part of the workload of district nurses. The telecare department at S2S Care provides its services for other care organizations as well. Clients of those organizations do not have to be located in the vicinity, but could easily be more than 150 km away from the central location of S2S Care. It is not always allowed by S2S Care for a client to make use of the telecare services; the physical and mental conditions of a client could have become too severe, by which S2S Care decides that the use of telecare services would not suffice to provide the necessary care to that client. Therefore, a care official assesses whether or not the client was eligible to use the telecare services as a part of his or her daily need for care by a care nurse.

The telecare technology is used to provide much of the care at home via a screen-to-screen connection. This connection allows clients to have an interactive audio / video moment with a care nurse who works at the telecare department. The audio and video connection can be used by both client and care nurse, but the care nurse needs permission of the client to use the video feed. The interactive moments can both be planned (a care nurse makes a scheduled call to the client) and unplanned (the client makes an unscheduled call to the telecare department). Clients can either make a regular call or an emergency call, depending on the urgency of their need for support. The service is available twenty-four hours a day, seven days per week. Clients can make a selection from a variety of telecare services, and thus do not need to make use of all the services that the telecare department offers. The client can choose to make contact only when he or she wants to, but he may also allow care nurses to call him at standard times during the day. When a care nurse calls a client, the client can decide whether he wants an automatic audio- / video connection, or that the care nurse needs to ask permission to make a video connection. Without specific prior consent of the client, the care nurse needs to ask permission to establish a video connection with every call. When a client chooses to have a care nurse call him at regular hours, he will be called once every morning and evening. Regular calls can be used to provide the

client with some structure during the day or just to check if the client is alright. The telecare technology can also be used to check if the client has taken his medication, and even to guide the client in taking medication.

3.4. Interface setup of the telecare technology (VICAT)

The telecare department makes use of two telecare systems. For the regular telecare services, S2S Care makes use of a separate technology. At the clients' homes, this technology can be integrated with interaction structures and -techniques that are already present, such as a television or personal computer of the client. Since this is the most commonly used telecare technology, this research focused primarily on the way care nurses understand and use this technology's interface. The company that developed this technology did not give its permission to use the official name of the telecare technology. Therefore, it is given a fictitious name in this research: **VICAT**, which is an abbreviation for Video Care Technology. VICAT is considered the primary telecare technology that is used at the telecare department of S2S Care.

For emergency calls, S2S Care offers tokens that could be worn as a necklace. For this service, the telecare department makes use of a secondary telecare system, which is specifically designed for emergency calls. If the client chooses to make use of this service, a specific system is installed at the client's home, which can only be used for telecare services. The client can also use this technology to interact with a care nurse via an audio- / video feed. The technology is equipped with its own interaction structure and techniques. This is thus different from the primary telecare technology.

All the work stations for the telecare services are set up in one office room at the telecare department. Every work station is provided with a VICAT interface setup, an interface setup for the emergency telecare technology, and a system for regular office necessities, such as e-mail and business administration. Each telecare work station is equipped with one mouse, a keyboard, three screens and at least one camera and one headset. Most of the secondary telecare (emergency) systems also have a camera, but only one work station also has a headset for this secondary system. In addition, flashlights and sirens are installed, to indicate an incoming emergency call. The basic set up for each work station is illustrated in figure 1.

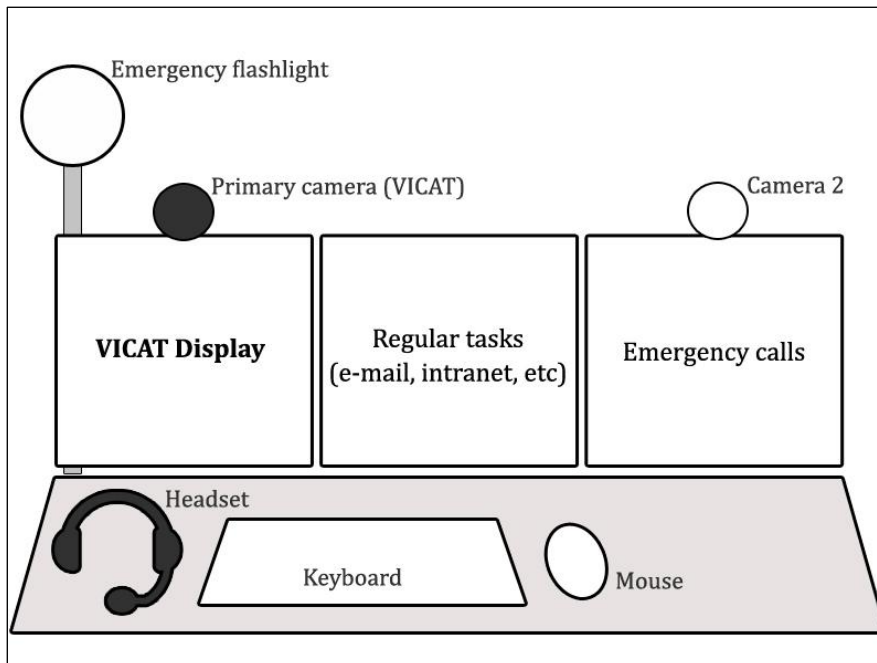


Figure 1: schematic representation of the basic setup of each work station at the telecare department of S2S Care. A second headset for the emergency call system was only installed at one work station, and therefore not illustrated in this figure.

The screen of the VICAT system displays a variety of icons, which is operated mostly by clicking on these icons rather than typing specific commands. A schematic representation of the VICAT display is illustrated in figure 2. The structure of the VICAT interface was introduced to the care nurses as a 'Graphical User Interface' (GUI). This became a commonly used term, and at the time of the research, a work station was referred to as a GUI. The interface structure was designed to operate under a Windows Operating System, which determines for the larger part the appearance of the interface. The interaction style of the display is mostly based on a multi-layered hierarchical menu style. A menu bar is displayed on the top of the display. By clicking on a menu item, a sub-menu appears, which offers the user new options, and after selecting one of these options, a new window appears, in which specific settings or functionalities of the VICAT interface can be altered. Directly under the menu bar, an horizontal icon bar is displayed, which offers the user a combination of functions that are also present in the sub-menu of the menu bar, and more direct one-on-one functionalities for more efficient use of the VICAT interface. For instance, one option in the icon bar enables the user to sort all the displayed locations of clients alphabetically, which enables users to retrieve information on clients faster. These locations are displayed as rectangular boxes, and are labeled with (a part of) the address of the client. If one of these boxes is clicked on, a new window appears, which displays information about the client, such as his name, a client dossier with important notes on the condition of the client, etc. A logo of a house is displayed on all the boxes. Therefore, many care nurses that work at the telecare department refer to these boxes as 'houses'.

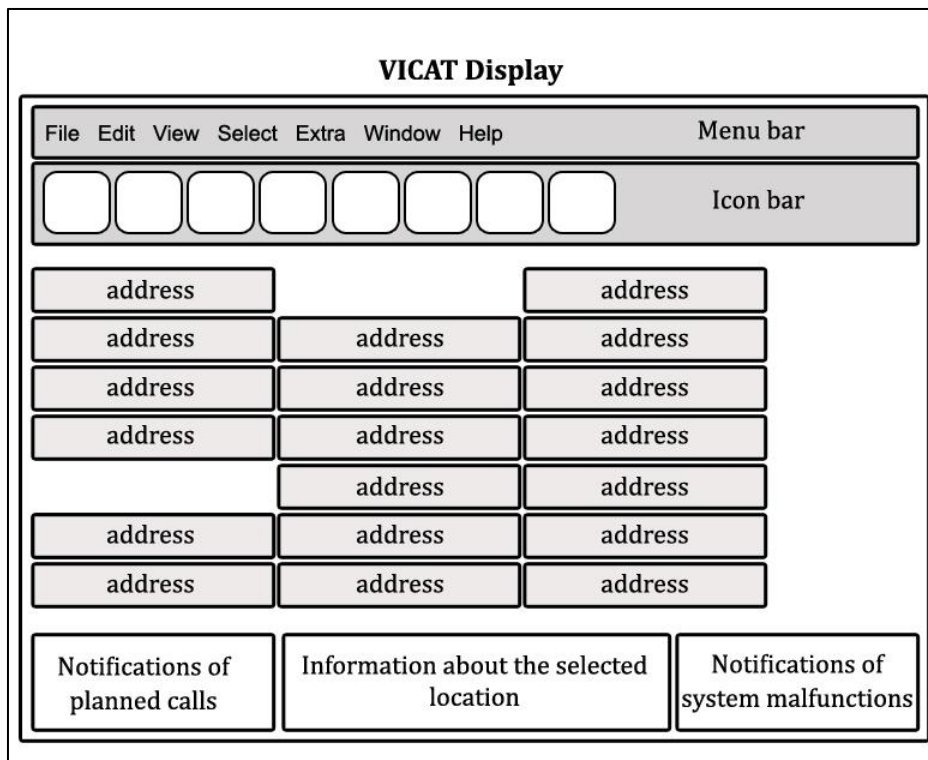


Figure 2: schematic representation of the VICAT display. The actual number of locations could be as much as 200 on one display. The empty space on the right of the screen was used to drag unprocessed calls outside the display.

On the bottom left of the screen, a small box is displayed, in which notifications of planned calls are displayed hierarchically. Incoming calls appear as pop-ups in front of other displayed items. Notifications of errors that occur within the system also appear as pop-ups, and cannot be closed until the issue is registered and forwarded to the service desk. Most pop-ups that are not processed yet are dragged to the right of the screen, so that they do not cover the other features on the display. The list of issues is also displayed in a small box in the bottom right of the screen. Steven mentioned that the basic interaction techniques had not changed much since the introduction of VICAT at S2S Care in 2005. The display, keyboard, mouse, and headset were also used from the beginning. All the care nurses at the telecare department of S2S Care make use of the above mentioned setup.

Chapter 4 (Findings) will elaborate on the experiences of the interviewees with the above mentioned setup and interface. The secondary system for emergency calls is not discussed in more detail, since is not the focus of this research. However, the secondary telecare technology will be referred to as the 'secondary telecare system', or just the 'secondary system'.

4. FINDINGS

In this chapter, the responses of the interviewed care nurses and stakeholders are presented by use of a narrative analysis. Every section in this chapter starts with a representation of the data and ends with a short analysis of these data. The experiences by care nurses and the three stakeholders from the beginning of the VICAT implementation at S2S Care is discussed and analyzed in section 4.1. In section 4.2, the storyline will continue from the perspective of the interviewed care nurses and their previous experiences with technology interfaces. The first experiences by the care nurses and the way they learned how to use VICAT is elaborated on in section 4.3. The experienced difficulties by these care nurses from the moment that they were working with VICAT until the moment that the interviews were held is analyzed in section 4.4, by focusing on the interviewees' interpretations of the VICAT interface and difficulties with its specific interface features. Besides differences in the meaning given to the VICAT interface, care nurses differed in the social-emotional value they gave to working with VICAT. This was expressed when care nurses were asked if they used or wanted to use the technology for alternative purposes, for which the technology was not originally intended, which is discussed in more detail in section 4.5.

4.1. The introduction of and first experiences with VICAT at S2S Care

The project for implementing VICAT into the daily activities originally started as a pilot in 2005. The primary goals were to make the care processes more cost-efficient and to respond to the changing care landscape, in which a more demand-driven orientation was desired. Care processes were increasingly becoming a common responsibility of care organizations, housing associations and the municipality. At the same time, the number of people that needed care was growing and the number of available care nurses was declining. The problem was not only the declining number of new employees, but also the adequacy of these new employees⁶. Different care organizations in the region were hiring from the same pool of new workers. Competition between care organizations in the region was not about the amount of clients, but about the quality of their resources, of which human resources became increasingly important. The project managers at that time realized that the growing shortage of care nurses would become problematic within a few years. A different kind of healthcare provision was needed, in which the client's independence would have to be increased. Of course, clients still needed the physical presence of care nurses as well. According to Steven, the use of technological supportive instruments would be inevitable to cope with the upcoming problems due to shortages of adequate care workers against an increasing number of clients. As CEO of the joint venture, he was also involved in the pilot phase of the telecare project, and he noticed that these changes had great impact on the way care needed to be provided:

S: "Nowadays, the trick is to find the perfect fit for telecare technologies in the new format. We notice that the care processes have to be structured more and more around the clients' needs. We did not do that previously. Back then we used to isolate a client from a specific situation to create our own settings around that client, but now we need to organize care around that client on his own local level. This has led to a mixture of centralized and decentralized care, in which telecare is used to fill the gap between the two. Not only should the client be given more responsibility in this new format for care, but also his / her social surroundings

⁶ This is a nation-wide problem, which was also stressed by van der Kwartel *et al* (2007). The number of people that are trained to be a care nurse is declining when compared to the number of people that are trained for socio-pedagogic and paramedical practices. With the increasing number of care nurses that reach retirement age, care organizations and policy makers are now looking for ways to increase the labor productivity of the limited available adequately trained care workers.

should be actively involved in the provision of care, so that a client's independence of assisted professional care is increased. "

With this organizational management structure, the number of members of the extramural care teams (i.e. teams that were not stationed within the walls of S2S Care) could be reduced, because all teams could now be coordinated from one single location and information could be provided to them from one central location. Therefore, S2S Care was looking for a technology that enabled them to provide care from a centralized care facility, for which less care nurses could provide support to more clients in the same amount of time. Extramural care teams were given the responsibility to manage specific districts. One district team member would assess if a client was eligible to use the telecare technology, and whether the technology met the quality requirements of healthcare. In the near future, district nurses would also have to be able to access the care dossiers via the technology. However, the new format for providing care was not the only incentive to start the pilot. Robert argued that it also depended on who would profit from the use of VICAT. According to him, the reasons for starting a project needed to be sought in the indicators by which the success of telecare implementation projects are measured:

R: *"What would you call success? When is something successful? My motivation has always been that it is found in the financial business case. Do they make more money? Is more money being saved? And in such a way that investments are thereby neutralized? [...] And financial structures based on subsidies are very weak, because it is just ad hoc. [...] Despite all the cheers, such a project is doomed to fail. If we agree that success for an organization is still found in profit, and not quality of care. [...] And on what conditions are stakeholders willing to make concessions and to invest in a technology?"*

I: *"But in that case the client's well-being does not matter in determining whether a telecare project was a success or not?"*

R: *Well... there is a shift in the business case. The willingness to invest in process costs, by whom this investment should be done, and who gains something from this investment is dependent on whoever is process owner. [...] It can be the health insurer that pays for the service, for instance because neither client nor care nurse need to travel anymore. But the benefit for the technology can also be for the care provider. And they will only use the technology if the current financial situation does not suffer from it. The question is not whether it is a faster way to provide care with less care nurses, but whether there are still enough financial revenues for the services they provide. And, for example, if you ask a care nurse of the night shift if he wants to work with it, he will say: 'Are you insane? That would mean that I lose my reimbursement of travel expenses!'"*

Thus, if success was measured on the basis of financial revenues, this would become a barrier for the VICAT implementation if the costs were higher than the revenues. This can be even more difficult, since cost reductions by use of telecare technologies may only occur over longer periods (5 to 10 years) (Peeters & Frankce, 2009). Other incentives were needed to start using the telecare technology. As Steven explained, a convergence of factors was needed for the successful implementation of telecare technologies:

S: *'First, someone has to be willing to innovate and to take on a leading role in that sense. That was me. Secondly, there has to be a market demand. There was a problem that emerged - a growing shortage of personnel - and we wanted to be prepared for that problem (...) Three: someone has developed something you can use. In other words: a technology has to be available that can help you. And of course, there has to be a financial incentive. This incentive came from various government policies, that offered subsidy to develop, implement and maintain a technology, and that offered the companies that were first-to-market with these*

technologies a bonus for each client that used it. One policy even subsidized the hours that employees were supposed to work with the technology.'

Thus, the financial barrier was circumvented by applying for various subsidies. In 2005, the Dutch Healthcare Authority (NZA) implemented two policies that supported the use of telecare technologies. The first was the policy 'Healthcare Infrastructure' (Zorginfrastructuur), which was intended to stimulate the provision of extramural care. With this policy, the costs for installing telecare technologies at the homes of clients could be reimbursed. Costs for installing telecare technologies in the care organization were at least partially reimbursed (CTG, 19 December 2005). The other policy was issued under the name 'Screen-to-Screen'. The number of participating care organizations was limited, because the policy was issued for an experiment with a new technology. The Exceptional Medical Expenses Act (Dutch: AWBZ) only subsidized direct face-to-face contact hours between client and care nurse. The second policy enabled participating care organizations to claim a fee for four hours per client per month (CTG, 28 June 2005; NZA, 2013). For each client that used the telecare services, S2S Care received two-hundred-and-forty euros per month. Neither the client nor S2S Care had any expenses for using the telecare technology. After a few years, the pilot phase ended and at the time that the interviews were held for this research, the organization provided telecare services by use of VICAT daily for more than 200 clients. These services were not financed directly from subsidies anymore, but were paid for by clients that used them, who could apply for reimbursement as part of the Exceptional Medical Expenses Act⁷.

Without costs as a potential barrier to the implementation of telecare technologies, and with a management team that was motivated to make the VICAT project successful, the indicators for success of the pilot were sought in the quality of the care provided, the performance of the technology itself, and the reduction of the number of necessary visits to that client. Care employees that worked with the technology in the early stages did show some resistance to use VICAT. This resistance appeared to be based on problems with interaction techniques of VICAT. The interview with Tessa (team leader) revealed that especially the camera caused difficulties among the involved care nurses:

- I: You mentioned that there was some resistance in the early stages of the VICAT implementation. Can you tell me where that resistance came from?*
- T: A variety of reasons. Some of them found it difficult that yet another screen was added, because it is another system, and people have to get used to that. Working with a camera and contact with clients through a live feed was very exciting for them. What should they ask a client? It was all becoming more personal than they expected. After a while, you cannot help but ask how he or she is doing, and that becomes easier by the day. You ask him how his children are doing, or how the weekend was, and that makes it more personal and at times very difficult.*
- I: Did the resistance come from individuals, or from groups of employees?*
- T: All the employees were a bit reserved with regard to using VICAT at first. Also because we started using the cameras with seven clients. We could look into their homes whenever we wanted to. The clients knew that, of course, but it did feel a bit like Big Brother. Employees did not like the fact that they could look into a client's private life, often without him realizing it. Of course, they were right. But it was up to us to use that option responsibly. You must have a reason to do that.*
- I: How did you deal with this problem?*

⁷ The Exceptional Medical Expenses Act (AWBZ) is a Dutch national insurance, that insures the costs of treatment, support nursing and personal care, when these costs are extremely high. Almost every inhabitant and person who works in the Netherlands is automatically insured according to this Act and pays a requisite premium for this insurance. Costs offered from the AWBZ include guidance activities to prevent neglect or admission of a client into an residential institution. This guidance is focused on the preservation or improvement of the ability of the client to live as independent as possible, which is one of the main purposes for the use of telecare by care organizations (Ministry of Health, Welfare and Sport (VWS), 2013).

T: By explaining to them what you are trying to achieve and to show them the benefits. And by just letting them work with it. That way, they would find out soon enough that it works a bit differently than they thought. If the client reacts positively to it as well, most of the resistance is gone in no time.

This approach changed the interpretation of VICAT as an impersonal instrument among care nurses. The more they worked with the technology, the more personal their conversations became. Steven acknowledged that as soon as new employees experience working with the technology, their interpretation of the use of the technology changes into a more optimistic one. He argued that convincing the care nurse was a question of redefining what invasion of privacy meant. Care nurses needed to be convinced that it was sometimes the client that did not want a care nurse to come into his home, because his private domain would then be compromised. As soon as care nurses realized that it was the client who decided whether or not the use of telecare technologies was an invasion to their privacy, the resistance was gone. Steven added:

S: "(...) And with all due respect: you can whine as much as you like, but the problem of increasing demand is not going away. If we have sufficient human resources to comply to the demand for care, there is no reason at all to use these kinds of technologies, but as soon as we notice a shortage in personnel, and the client is also satisfied with this way of communication, we cannot ignore the technology any longer. A care nurse does not take these factors into account. And perhaps it is the client that does not want the care nurse into his private domain, but does not mind communicating by use of a video connection. (...) There are more factors that determine the success of a technology, of course. But I think that in the end, the most important factor is to convince the care worker. If they do not embrace the technology, the rest is going to be very difficult...."

I: "So people do not realize that the client is willing to use the technology, but that it is the care nurse that needs convincing?"

S: "Sure...Although we need to realize that social interaction can mean very different things to different people. Younger generations are more on Facebook and perceive this as real social interaction. Perhaps they value that as much as standing in a pub. But for older people, this could be a very different perception.."

This seemed like a contradiction. On the one hand, Steven indicated that acknowledging care nurses as a relevant social group and convincing them of the benefits of the technology is the most important factor for success of telecare technologies. The way people perceive social-emotional interaction via telecare technologies could be age related. On the other hand, he argued that their opinion is irrelevant when changes in the demand for care leaves them no other option than to use the technology. Either way, it still appears to be important that care nurses can work with the telecare technology. If there was no necessity, difficulties in using telecare technologies could cause care nurses to reject them. If the use of telecare technologies would become crucial for the ability to provide clients with the necessary care, not being able to work with the technology would have a negative influence on the efficiency of care processes. If previous experiences with technology interfaces influenced the ability to work with the VICAT interface, it could be important to take technological experience into account for selecting the team of care nurses that had to work with the VICAT interface. The next step in the analysis of the responses by the interviewees was therefore to find out if there were significant differences in previous experiences among different technology generations of care nurses, and if management was aware of these differences.

4.2. Previous experiences with technology interfaces by care nurses

In order to find out whether there were any differences in previous experiences with technology interfaces among the care nurses, they were asked questions about their experiences with technology interfaces before they started working with the VICAT interface. All the interviewed care nurses were asked if they could remember what kind of technologies they used when and before they were 25 years old. It would be logical that these answers would differ, since many technologies that the younger care nurses could have experienced in their formative period were not yet available on the Dutch consumer market during the formative years of the older care nurses (Docampo Rama, 2001). All the care nurses acknowledged having used the technologies that were shown on the visual prompt charts for their formative period (see appendix II for examples of these VPCs). The only surprising additional experience with technology interfaces was mentioned by Bill. In the years as a military nurse, the medical staff used to register all the soldiers' information on their physical and mental condition in a digital database. Bill called this system 'the first electronic patient dossier', by which army nurses could send the medical data of a soldier to the medical staff of other military divisions across the Netherlands. Bill stated that they already made use of a webcam during that time. This would imply that Bill was already familiar with most of the features that were also used in the VICAT interface and would therefore need less time to be able to use the VICAT interface in comparison with care nurses who did not have these experiences.

Eva was the only interviewee who did not experience any technology interfaces of the DS-style during her formative years. Also, her formative years ended before the first personal computer was introduced to the Dutch consumer market in 1982 (See also: Geschiedenis24, 2013). At home, she purchased her first personal computer in the late '80s, but it was only used by her children to play videogames. When she was asked when she started working with computers, she answered that this was not until 2001. Before that time, she saw no need to use a computer. Eva was working as a maternity nurse since 1985, and in the 15 years that followed from that year, there was no need for her department to use computers. Doris mentioned a similar story. The first personal computer at her home was introduced in 1987, and was also meant for her children. Her experiences with using a computer started around 1995, about 7 years after her formative years ended. The younger care nurses indicated that they experienced interfaces similar to the VICAT interface in earlier years, and that they valued the knowledge they had acquired by working with other technology interfaces. As Amy argued:

- I: "Do you think that your previous experiences influenced the way you use the VICAT interface?"*
- A: "I do believe that it is easier for me to operate it, because I am used to working with these kinds of technologies [...] but it is not comparable to the current youth. My child is only 9 months old and she is already playing games on the iPad. However, my generation is more familiar with developments such as the Internet than older generations."*

After the care nurses were shown the prompt chart that was most representative for their own formative years, they were also shown the prompt charts of other decades. Eva indicated that she had used about half of the technologies shown on the prompt chart of her formative period (1970-1980) and only acknowledged having used 7 out of the 36 other technologies that were shown to her. Amy, however, indicated that she had used all the technologies except one, that were displayed on all the VPCs (she had not owned a flatscreen television). At the time of the interviews, Robert was involved in the development and implementation of telecare technologies for other organizations. During these projects, he noticed that technology is used and interpreted differently by younger generations. He confirmed that younger generations are more adaptive to new technologies, because they are more used to technological changes, and

that it would therefore become crucial for care organizations to adapt to the desires of younger employees:

- I: *“Do you take age- / generation related difficulties among care nurses into account for the future development of telecare technologies?”*
- R: *“I think developers do not do that enough. If it is true that the information-driven population is changing, than it would be stupid not to take that into account. Of course, we also realize that the current average 14-15 year old boy or girl is more used to replacing their phone, computer and other technology very often. They also do that with applications. It is almost as if they are trained to select new technologies and applications every day. Our generation is not that evolved. This means that future employees demand more diversity and more options available to them [...] And perhaps, as an organization, now is the time to start preparing for this new generation of employees. Perhaps they even need to start preparing the current generation of care nurses for a more dynamic future, so that they can introduce them to the new format all at once.”*
- I: *“But now it seems that there is no recruitment of younger personnel, and that the current workforce is aging.”*
- R: *“Sure, and it would not be wise to reflect the business processes of those 60 year old employees onto newer, younger employees. That will fail every time. If you want to make working with telecare technologies more attractive, you need to offer them something they think is fun to do. I do not believe in forcing younger people to work with outdated technologies. By the way, this is no issue for the companies I work with. They just say: ‘I will explain it to you once more, and again, and again, but after that, we have a problem.’”*

Thus, HR managers of S2S Care were confronted with a dilemma: if the objective of the organization was to make sure that their current employees could work with the telecare technology, incremental changes to their current system would be preferred. If organizations would change the technology more radically, they would risk the chance that their current employees could not work with it anymore. However, as Cindy indicated, the technological problems with the use of VICAT were in itself not a reason to refuse care nurses to work with the technology. Care nurses who were working with VICAT were primarily reviewed on their skills needed to provide caring services to the client. This review was based on the social-emotional interaction between client and care nurse, and not so much on whether care nurses could use the technology. Roberts and Mort (2009) argued that telecare technologies are often mistakenly described as a system that enables a rational, cost effective and efficient way of providing care. The work that care nurses provide by use of telecare technologies is often depicted as protocol-based, mechanical and impersonal. Personal and social-emotional care would therefore no longer be understood as part of work. The responses by care nurses and management indicated that this was not the case at S2S Care. Of course, the applicants would at least have some technological knowledge, but as Tessa stated, some affinity with sending an e-mail and using a web browser was often enough to convince management. Tessa acknowledged the presence of age related technological difficulties in using VICAT, but argued that their main concern was that new employees were experienced care nurses, and not necessarily technologically skilled:

- I: *“I only interviewed care nurses who are older than 30 years. Are there no younger care nurses working at the care central?”*
- T: *“It is true that our employees are generally above 30 years of age. We did use nursing students during the holiday season a few years ago. We noticed that when you let them work with the technology for two hours, they just know how it works. They do not need three or four weeks.”*
- I: *“So you do notice a difference in the ability to use VICAT among different generations of employees?”*

- T: *"Oh, sure. It makes a huge difference to have someone of 50 years who never did anything else than working as a district nurse, or a student."*
- I: *"Do you also hire care nurses who have less nursing experience?"*
- T: *"No, that does not occur very often. In fact, we do not even invite those for an interview."*
- I: *"Would you rather have older people that are more experienced?"*
- T: *"Not necessarily, but they need to have worked as a care nurse for at least a few years. It is essential that they are able to recognize certain syndromes or illnesses. People who just finished their education do not know these things. They need to have contact with a client first."*
- I: *"Let me ask the question a little bit differently: Would you rather have experienced care nurses who are less technologically skilled, or technologically skilled new employees who are less experienced care nurses?"*
- T: *"I would rather have experienced care nurses. Technology can be taught."*

The purpose of working with VICAT was to provide adequate care. Therefore, the management of the telecare department assessed their care nurses on their experiences and skills in caring for clients, and not on their technological skills. With 31 years of age, Amy was the youngest employee at the telecare department. Tessa stated that there were still enough care nurses that responded to vacancies at the telecare department. The care nurses that were interviewed did not appear to be technologically skilled when they started working with VICAT. New care nurses were hired because of their nursing experience, and they were hardly assessed on their technological skills.

It appears that there was at least an age related effect in previous experiences with technology interfaces. Differences were identified between the previous experiences of Doris and Eva with the other interviewed care nurses, who all had experiences with computer interfaces during their formative years. However, Docampo Rama *et al* (2001) argue that *'the transfer of earlier acquired knowledge can also be negative if users are unable to use their existing habits and have to learn new procedures'* (Docampo Rama *et al*, 2001, p. 27). A lack of experience with computer interfaces could therefore also have been a positive factor for the ability to understand and use the VICAT interface. Previous experiences could not have made it more difficult or easier to learn the VICAT interface, because Eva and Doris did not have any experiences with similar interfaces to relate to, and although hiring younger technologically skilled personnel could be beneficial to reduce the difficulties with VICAT, the organization was not actively doing so. Tessa was aware of the influence of previous experiences with technology. She realized that many care nurses did not have the opportunity to build up experience with technology interfaces, because they were working as a district nurse. These nurses did not need to use much technology interfaces for their daily activities. Tessa appeared to assume automatically that nursing students have more experience with technology interfaces, because they are from a younger technology generation. It seemed that management expected care nurses to be able to solve technological problems with the use of VICAT themselves, or that they would know who to address when they could not solve the problem. However, even if the care nurses were able to solve the problems with VICAT there could still be differences in the efficiency of problem solving mechanisms among care nurses of different ages. To find out whether there were any noticeable differences in perceived problems and solutions with the VICAT interface between care nurses of different ages, they were asked questions about what they were told about the technology when they started working at the telecare department of S2S Care, what their own perception of the use of VICAT was, how they learned to work with the technology, and what problems they experienced in using the VICAT interface.

4.3. Learning strategies for the use of VICAT by care nurses

The way the care nurses were introduced with VICAT differed. Many clients that Amy and Bill visited as a district nurse already used VICAT for their daily care support. These nurses were thus familiar with the technology from the client's perspective. Cindy, Doris and Eva were involved in the earlier stages of the VICAT implementation. All care nurses except Doris applied for a function at the telecare department. Doris was asked by management to participate in the taskforce for the reviewing of VICAT. When the interviewees were asked what they were told about the purpose of using VICAT, they all gave similar answers. As they understood it, VICAT was introduced to relieve district nurses of some of their duties. Bill described its use as a way to eliminate travelling time, because care nurses are only paid for the time that they are actually helping clients. Cindy interpreted its purpose from a client's perspective. According to her, VICAT was intended to enable the client to live at home longer, without the need of care nurses visiting them. Because Doris was involved as a member of the reviewing taskforce, she interpreted the original purposes from a management perspective: to experiment if VICAT could be used to make care processes more efficient. She did not specify the indicators to measure the degree of efficiency of the use of telecare for the daily provision of care by care nurses of S2S Care.

All of the care nurses learned how VICAT worked by using it. The care nurses who were involved in the start-up of the VICAT implementation project were given a short instruction by the provider of the technology. Later, care nurses learned how to use the technology under the guidance of a care nurse who was more experienced with it. When Bill was asked how care nurses learn to work with VICAT, he explained:

- B: "It is like acquiring your driver's license: first an instructor tells you how to do it. For VICAT, you are told to wait patiently until there is an audio connection before you speak. If you understand the basics, you may try it yourself. If you pass the 'exam', they say to you: 'now try to drive on your own'. That is scary. It is the same with VICAT and of course, people make mistakes."*
- I: "And there was no training or workshop that you could follow?"*
- B: "No. You are just trained by a colleague. Where one colleague is better at one thing, I can be better at another thing [...] and working with the icon bar is not that difficult, but when you try using the menu bar, you need to know how that works. But it does offer very interesting additional options."*

Cindy, Doris and Eva, who were already working with the system in the in the earlier stages of the project, indicated that they had more time to experiment with the technology during a day than employees that started in later years, because the number of clients was still very small in the beginning of the telecare implementation project. As Eva explained:

- I: "Were you trained to work with the system?"*
- E: "In the beginning very limited, because it was such a small project. It was fairly easy to use and between calls we had a lot of time to experiment with it. Back then, we could do that, but now it is a bit more difficult, because we do not have the time. So now there is really no other option than to learn by doing [...] It is all user experience."*

New care nurses that started working with the technology were trained by the more experienced colleagues. They still had to work with the technology from the moment that they started at the telecare department, since clients depended on their services. Care nurses that started working at the telecare department in more recent years had to be able to work with the technology in a much shorter amount of time than Doris and Eva, because the amount of care services that were provided by use of VICAT was about 30 times the amount of the services that

were provided by use of VICAT at the time that Doris and Eva started their job at the telecare department. Older care nurses indicated that they were not able to use all the functionalities that VICAT had to offer. However, for the services they needed to provide to the client, they did not even *need* to know everything about the technology and its features. Another reason why older care nurses did not use additional features was that they had a certain fear for using them. Steven realized that older people were less tempted to experiment with new technology interfaces:

- I: *“Do you notice that older people use new technology interfaces differently?”*
S: *“Yes. Older people often think that if they press the wrong button, they might break the whole thing. They hardly dare to turn the power on, let alone use a mouse to click on anything.”*

This was confirmed by Doris. When she was asked if she used additional features apart from the ones that were necessary to help a client, she replied:

- D: *“There are so many options that we do not use. I do not think that we want to learn those things, because that would only be confusing. They can build as many extra features as they like, but if you do not need it, be sure not to use it, because then it might happen that you change settings or something that you weren’t supposed to.”*

With all her experience in using the VICAT interface, Doris still expressed her fear to experiment with the features of the technology. Eva, the oldest participating care nurse, acknowledged that it was not necessary that they could use all the features of the interface, but added that the more you knew about the basic features, the easier it became to learn extra features. This was also related to the way she acquired new skills for working with the technology and its interface. Eva’s learning methods were based on an incremental approach. In the beginning, Eva had more time to learn the basic features, and as long as nothing was changed to this basis, she could gradually learn new features:

- I: *“Since then, new features were introduced, also because the number that used the system increased. Did that make it more difficult?”*
E: *“Certainly. There is also much more diversity in the support clients need. However, if you understand the basics of VICAT, the rest is not that hard anymore. Technology has also improved a lot, which makes working with VICAT easier.”*
I: *“Would you say you are a fast learner when it comes to using new technologies?”*
E: *“I think I am an average learner. I am not really fast. Sometimes I need to take the time to become more familiar with a new technology, but eventually I’ll learn.”*
I: *“When you work with a technology for the first time, do you experiment with it, or do you take on a more structured approach and take the time for each feature?”*
E: *“I want to find out what I am supposed to do with it first and how to do that, but after I have learned the basics I tend to try a few things.”*

The younger care nurses were more experimental, and for them ‘being able to work with VICAT’ meant not only that they could help the client, but also that they were able to use additional features of the technology. In a conversation with Amy about the future development of VICAT, she acknowledged the presence of age related differences in learning new technologies:

- A: *“[...] But that can be said for technologies in general. Also in the district teams. At one point, we were given a smart phone, because we could use that to plan our routes to clients and update our schedules. One of those HTC phones, with a keyboard, really poor technology. We had to attend one day of training about how to use it. I thought: ‘pick it up, press a few buttons and you’ll figure it out. There were older people at that day that were afraid of pushing any button. They tried*

each button one at a time. Those people actually needed the whole day [laughs]. That is when I really noticed a generation gap."

Amy was the youngest of the interviewed care nurses. Her reaction confirmed the difference in learning mechanisms among different technology generations of care nurses. The reason why older care nurses were less focused on learning additional features than younger ones could not be fully explained by age related differences. 'Being able to work with VICAT' had a different meaning for the younger generations of care nurses than for the older ones. When care nurses were asked if they experienced any problems with the VICAT interface, the responses revealed that there were two different aspects of working with the technology: the social-emotional characteristics of screen-to-screen communication and using the technological features of VICAT. The care nurses indicated that people often do not realize that providing care is more than helping the client in the most efficient way, and that social interaction with the client was not always related to physical or mental problems of that client. After asking Bill whether he could mention any negative aspects of working with VICAT, he answered:

B: "Now that you are recording this conversation...There are no negative aspects of VICAT! [laughs] Seriously, there really are more positive than negative aspects of the technology. Computers have been around for a long time, but now we have to explore how to use them for care. On one side of the interface there can be a client who does not understand the technology, and on the other side is a care nurse...who also does not understand the technology. So, now a care nurse has to figure out a way to deliver the necessary care to the client by use of this incomprehensible tool. And the social aspect of providing actual care by use of these technologies is something really special. You cannot write a manual about that. That is something you need to do yourself."

Using the video interface did not form a barrier for the personal characteristics of the contact between client and care nurse. Eva confirmed that the social aspects of working with VICAT were also important in the interpretation of the technology:

I: "Do you still have a desire to visit clients when you are speaking to them by use of VICAT?"

E: "No, because the way the communication works is very personal. You know the clients, because you talk to them on a regular basis. You see each other, and you are just drinking your coffee whilst speaking to them. So, yes... it feels very familiar. For the clients as well. You can notice that they really take the time for it and that they have fun using it."

The social-emotional and technological aspects of working with VICAT were interrelated. The use of a VICAT interface enabled the care nurse to acquire more information about the client, because he could look into the home of that client. If the care nurse did not experience any problems with the technology, the communication between a client and a patient could become very personal. Older care nurses had more experience on the personal and social level, but younger care nurses were expected to be more capable to understand and use the technology and its interface. The older care nurses indicated that there was more opportunity to learn how to use the VICAT interface in the early stages of the implementation. Older care nurses were expected to be experienced enough on the level of social-emotional interaction. Younger care nurses were expected to learn the technology themselves. They could always ask their colleagues for help, but it seemed more important for management to determine whether new care nurses at the department were also socially experienced enough to work with the technology. This social-emotional aspect appeared to be the most important aspect for determining whether or not care nurses were able to work with VICAT at the telecare department. The technological aspect did not appear to be of any importance. In a conversation

about the selection procedures for new care nurses that wanted to work with VICAT, Cindy emphasized the difference in importance between the two aspects:

I: *"Have care nurses ever been refused for working with VICAT?"*

C: *"Well, that only happens during the job interview, but not when you are already hired. As a care nurse, it is just one of your responsibilities, so if you work for us, it automatically means that you are also expected to work with VICAT. At the job interview they simulate an emergency situation, although it is done by phone and not by use of the technology. So, you are assessed on the way you react to that case, what kind of person you are and how you deal with stressful situations. You need to have certain qualities to handle these kinds of calls."*

With qualities, Cindy did not mean technological competences, but was purely focused on the social-emotional aspects of communicating with the client through the VICAT interface. This approach was the opposite from when the VICAT project started. It appears then that the younger care nurses were given more trust in their technological skills, but less in their expertise as a care nurse, when compared with the older care nurses. However, the way in which the VICAT interface was used also differed. When the telecare project started, care nurses followed the same routine every time they had to make contact with a client. In the early stages of the implementation project, it was more important to assess if the technical requirements met the quality demands for providing the necessary care to clients. This meant that the older care nurses only used the features that were necessary for making a call, helping the client, updating the client dossier and logging off. This difference in interacting with the VICAT interface was confirmed by Eva and Amy, when they were asked if they could state the subsequent actions to process an incoming call:

E: *"...Sure: when a call comes in, a pop-up appears on my display. When I click on that pop-up, the information of the location is shown. Next, I usually look into the log to see if there are any new concerns for this client. I then check the client data and click on 'make call'. You first get an audio connection. You ask the client if you are allowed to make a video connection and if so, you click on 'video'. When you are done with helping the client, you click on 'cancel'. Then there appears a window in which you register the reason for the call and the last thing you do is to click on 'Ok' to process the information."*

I: *"And what if you click on the 'X' in the top right of the window, to close it?"*

E: *"Why would I want to do that? The sequence has become a part of my routine, so that I cannot forget anything."*

Amy stated the opposite:

A: *"...Oh, I know what to do, of course, but I could not mention all the steps right away. I do not think that that is important, as long as I can use the technology."*

I: *"Do you think that that is different for older care nurses?"*

A: *"Yes, many of them have been working with it much longer. They have built up a routine. And for me, it is just a small part of my daily activities. Perhaps I cannot tell you how to process an incoming call, but when I am working with VICAT, I do not experience any difficulties with recalling the necessary actions."*

The qualitative analysis in the study by Lim (2010) showed that the EM generation had more difficulties with operational procedures that were linked to menu-based interactions, compared with members of the DS generation using the same technology interface. He suggested that these difficulties arose because of the presence of unnecessary features and functions of the interface. Older generations of care nurses preferred having more items at once displayed on their screen.

That is consistent with the findings of Docampo Rama (2001), because older generations are expected to be less familiar with multi-layered interfaces where not all options are shown directly. The younger care nurses, however, explicitly expressed the desire to have more overview, and therefore less displayed information on the screen at once. This is a typical contrast between older and younger users of multi-layered interfaces, which was also indicated in the study by Hawthorn (2003). He argued that it would be better to let novice users of technologies begin with limited features in one layer before they started using more layers with additional features. This argument was confirmed by the contrast between the learning strategies of Eva and Amy. This could explain why Eva learned a routine to operate the VICAT interface, and why Amy did not care much about the sequence of her operational procedures, as long as the client was provided with care. Lim (2010) added that the EM generation appeared to be more affected by difficulties due to unfamiliarity and a lack of experience with present day devices. Thus, with regard to the VICAT interface, there appeared to be some interpretive flexibility among care nurses of different ages. In the hiring of new care nurses for the telecare department, management expected older care nurses to be more experienced in the provision of care, whereas the younger care nurses were expected to be more technologically skilled, and it seemed that the care nurses themselves shared these expectations with management. If care nurses were able to solve these problems themselves, but the problem solving mechanisms differed, it could also mean that there were age related differences in the way they solved these problems. The question was then if there even were any differences in the perceived problems and applied solutions to these problems with the VICAT interface among care nurses of different ages. Therefore, the reactions by care nurses on the questions about using the VICAT interface were assessed on the experienced difficulties with its specific interaction structure, interaction techniques and conceptual operations.

4.4. Difficulties in using the VICAT interface by care nurses

Problems were expressed in difficulties with the use and performance of the webcam and headset (audio- / visual interaction techniques), the lay-out of the GUI, its screens and emergency flashlight, and the available items on the VICAT display. Some problems with the VICAT interface were related to a combination of these elements, whereas others were specifically oriented towards one of them. All the interviewed care nurses acknowledged that there were user manuals for using the VICAT interface, but none of the employees actually used them. For smaller problems, care nurses would rather rely on the knowledge of their colleagues instead of using a written instruction. For bigger problems with the VICAT interface, the routine for solving these problems had become part of the technological frame among care nurses that were working with VICAT. Within this technological frame, problem solving techniques applied by care nurses for bigger problems (such as system crashes or not being able to establish a video connection with clients) with the VICAT interface involved calling or emailing the service desk of S2S Care, who could call the service desk of the technology provider when they could not solve the problem themselves. No age related differences could be appointed to the way care nurses dealt with these kinds of problems with the technology. However, the care nurses did express different difficulties with the interaction techniques of the VICAT interface display.

Differences in the way care nurses of different ages evaluated the VICAT interface display and general set-up of the work station were expressed when the care nurses were asked whether they experienced any problems with the changes, which were made during the years that VICAT was introduced. The older care nurses were more focused on the hardware and general design of the technology, whereas the younger ones were bothered by the amount of items on their screen, and all the pop-ups that appeared without them choosing to show these windows on the display. Both Amy and Bill indicated that the system was outdated, and that the additional features and the way the display was structured caused a lot of difficulties for them. The feature that stood out most in this respect was the addition to register the reason for a call. This option

was added only recently at the request of management, so that management could acquire data to improve the quality of the telecare services of S2S Care, and to identify new opportunities for applying this technology. As Tessa explained:

I: "Did you change anything to the VICAT interface, or the actions a care nurse needs to complete to fully process an incoming or outgoing call?"

T: "We added an option to register the reason for a call. It was added at our request."

I: "And was this addition satisfactory to your demands?"

T: "Yes. The trick is now to interpret all the data in the correct manner. It was originally intended as an improvement to our management information. We still consider that a challenge [...] Anyway, this information is only meant for management. It is not interesting for care nurses."

I: "What are you going to do with the data?"

T: "Well, we can see if there are opportunities that we missed, or track what kinds of incoming emergency calls we received, but in the end we could also use this for our invoices. In any case, we want to be able to use these data for such purposes in the future."

The pop-up window of the finished call could not be closed if care nurses did not state a reason for the call. Care nurses had to perform additional activities with every incoming and outgoing call, without benefiting from these activities directly. This led to negative experiences with the VICAT interface. Care nurses were already experiencing difficulties with pop-up windows, because a technological issue was also presented as a pop-up window. Especially the younger generations of care nurses expressed themselves negatively towards these interface features. Amy reacted as follows:

I: "You indicated earlier that you were not entirely satisfied with the overview of the display. In your opinion, what should be altered to make the display more clear to the user?"

A: [...] One thing that would help me is to be able to see more at once. When an emergency call comes in, you need to click on something, so that the flashlight is turned off. Occasionally a new alarm comes at the same time that you are finishing the last emergency call. That pop-up appears in front of the one you were just working in. Suppose you get an emergency call on your GUI. The first thing you need to do is to click on the location to which the call is related. It is important that you read the address very carefully right away, because you know that there can be another pop-up that appears in front of it. And of course, that also happens very often. [...] In order to finish my previous call, I need to drag that pop-up to the side of my screen. That is really annoying [...] If it were up to me, I would make the whole display more structured, and leave the pop-ups away. And if you click on a location, you cannot see the address anymore. It would be better to see both the location and client's name together on the screen."

I: "Is it possible to close the pop-up windows without processing them?"

A: "No, after an incoming or outgoing call, you cannot simply close the pop-up window without registering the reason for the call.[...] And if there is an issue with the connection between us and a client, it is shown in another pop-up window. Most times, I just drag it out of my display, because I need to keep the overview on my screen."

The problem of not being able to see an incoming emergency call because of overlapping pop-up windows was not an isolated event. Other care nurses reported similar incidents to management, and this was one of the reasons to install the flashlights for incoming emergency calls. Also, the interface was altered, so that incoming calls were always shown in front of all other items and in the middle of the screen. However, the problem was not solved with these

adjustments. It could still occur that two emergency calls were coming in at on GUI at the same time. The flashlight was flashing for both alarms, but as soon as the care nurse clicked on the incoming call, the flashlight was turned off. The first emergency call was still active and unanswered behind the pop-up window of the second call. If it took too much time for a care nurse to finish the second call, it could already be too late for the first caller. Although scarce, there had been occasions where a care nurse missed a call because a pop-up window was blocking the notification of the call. However, the problem that Amy mentioned was not only that care nurses could miss an incoming call, but also that the display was too crowded, and that they needed to perform too many activities for every call. This caused a lot of frustration, especially among the younger care nurses. Bill had very strong views about this problem:

I: *"Since the time that you started working at the telecare department, changes were made in the VICAT interface. Did that influence the way you worked with it?"*

B: *Not really. [...] What was added is that we need to register the reason for each call. Well... that is a real burden to my work. And do you want to know why? Because now I cannot respond to an incoming alarm fast enough. I used to click on an icon and the window was gone, but now I have to scroll down to find what I was doing – and it is not even alphabetically-, and before I can continue my regular activities, I need to register all the steps I took and why the call was made. Meanwhile, time is ticking away and the flashlight is still flashing. And if I finally manage to close the window, I still need to move windows to the right of my screen, because in that time, the system experienced some errors and I need to register these error notifications as well. And after all that, I can finally work on the incoming call. No, I do not like that at all. It takes a lot of time for me as a care nurse, and there will be a day that I am too late to respond to an important call..."*

I: *"So why did they introduce it?"*

B: *"To acquire statistical data, I think. They are useful, of course, but for management, not for us. I do not mind doing it, but it is such a waste of time. I can spend that time on better things, because our way of providing care is so much more... Clients say so much more, but the only thing you register is whether she has taken her medication. Checking the pills is just a conversation starter."*

Doris and Eva did not have any difficulties with the display, and were not bothered by the pop-up windows, or that there were some additions that required more actions by the nurse. Doris mentioned that she did not mind the large amount of information on the screen, as long as the options and displayed information were directly related to the result the care nurses were trying to achieve. When Doris was asked her opinion about the appearance of the VICAT interface she answered:

D: *"It is reasonably functional, but not very stylish or state of the art. That does not matter, as long as it is user-friendly and offers a clear overview of the necessary options... although I do think that the locations are too small, and that there are perhaps a bit too many. It is hard to read the text that is displayed on the locations."*

I: *"Have there been events that led to changes in the appearance or functionalities of the VICAT interface?"*

D: *"We introduced audio- / visual instruments for better notification of incoming emergency calls. That flashlight, for instance. Care nurses are not always behind their desk, especially not at night. If you are at the other side of the office to ask something to a colleague, you can see an incoming alarm because the flashlight is lit."*

I: *"And now no one can miss an incoming call anymore?"*

D: *"Well, two emergency calls can be made at the same time, but management decided that that was something we had to solve internally. [...] The two calls are also*

indicated at the bottom of the screen, so if a care nurse has any doubts that he forgot to answer a call, he can check this overview."

I: *"Did you experience any other difficulties with the interface?"*

D: *"Of course, but that can be expected when you are working with technology. A lot of things can go wrong with the audio- / video feed at the clients' homes. We cannot solve these problems ourselves, but need to inform the provider of the technology."*

Doris was not bothered by the items of the display and the pop-up windows, except for the size and amount of the displayed locations. Although she experienced some difficulties with using the VICAT interface, she did not relate those problems to the interaction style of the VICAT interface, but to events outside the telecare department. When Eva was asked for her opinion on the general appearance of the VICAT interface, she did not mention any of the problems that Amy, Bill or Cindy experienced. The problems Eva expressed were a consequence of her own physical condition, and the way the work stations were set up:

I: *"Since the time that you started working at the telecare department, changes were made in the VICAT interface. Did that influence the way you work with it?"*

E: *"No, In my opinion, the technology has not changed much, except for the registration of a reason for the calls, but that did not cause any problems."*

I: *"Do you have difficulties with the general appearance of the VICAT interface display?"*

E: *"Yes, I do, but that is not related to the items on the display or the way they should be used. I have more difficulties with the amount of screens at my GUI. It is very tiring for me to have to move from left to right all the time."*

I: *"Would you prefer having one screen instead of three?"*

E: *"Of course, because I would not have to move that much anymore. However, I think it is hard to merge all the displays into one. The only way to do that is to differentiate between tasks among care nurses working at the telecare department."*

Eva stressed the problem of having to move from left to right when she was working behind a GUI. Amy agreed with the argument that it would be difficult to merge all the screens into one overview, but not because the different tasks would have to be differentiated among care nurses working at the department, or that it would be technologically impossible. She was more concerned that the integration of all the interfaces into one would mean that the overview of the displays was lost. Amy was also asked whether she thought it would be better to have only one screen for all the systems the telecare department of S2S Care used. She replied:

A: *"It would, if we only had to work with the VICAT interface. However, perhaps it would even be better to split the VICAT interface into two displays: one for all the locations, and one for information about the client with whom you are calling [...] I do not know if this would be a solution, because then you would only end up with more screens."*

The interviewed care nurses of the younger DS generation were used to working with a multi-layered interface during their formative years, and had no desire to see all the available options of the interface at once. It was already shown that the younger generations of care nurses were hindered by all the pop-up windows and the amount of clickable items on the screen, and they had mentioned that they would rather choose what they wanted to see in their screen instead of being guided through the necessary steps by the interaction structure of the interface. Cindy argued that the technology had not changed that much in the past years, and that care nurses first needed to learn how to work more efficiently with the items that were displayed on this interface:

- C: *“There are moments when there are a lot of incoming calls at once. The trick is then to manage your locations in the bottom of the screen, so that only the unprocessed calls and issues are left on your display.”*
- I: *“Are there more of these ‘tricks’ that you use to make working with the VICAT interface easier?”*
- C: *“Well, I always try to minimize as much notifications and other windows as possible. I also sort them hierarchically, so that I have more overview on the information that I need. I usually drag all the notifications of technological issues to the right of my screen. Not everyone is used to working this way, but since I missed a crucial incoming call because I could not see the notification once, I always make sure that no item can be in front of the notifications of incoming calls.[...] and I would like to be able to see more information when I open a location. All the client information is displayed in small text boxes, which is not very convenient when you try to add information.”*

Cindy was not bothered by the interaction structure itself, but she did use some self-learned conceptual operations (minimizing pop-up windows and sorting them hierarchically) that facilitated the way she worked with the VICAT interface.

Thus, care nurses had a very different interpretation of the added features than management. Tessa thought it was a useful feature to improve the services of the telecare department, and eventually a way to expand the possibilities of the VICAT interface, but Amy and Bill considered it a burden to the way they wanted to work with the VICAT interface. They realized that it was important, but were bothered by the way it influenced the interaction structure of the interface, and the additional conceptual operations that had no direct benefit for neither the care nurses nor the clients. Although the interaction structure of the VICAT interface was based on a multi-layered hierarchical operating system (Windows XP), the eventual interaction had a more one-on-one interaction structure. When a client made a call, this was directly visible in the screen via the pop-up window. Issues also appeared directly in the display, and care nurses did not have to click on anything to see these notifications. If a care nurse wanted to see the information of a location, he only needed to click once on the icon of that location for a pop-up window to appear, which showed all the available information directly in one window. Older care nurses wanted more one-on-one interaction, because they had less experience with multi-layered interfaces during their formative years, and therefore did not prefer a multi-layered structure in which they were not able to see all the options they could use directly.

The methods that Cindy applied for circumventing the problem of a loss of overview, due to the amount of pop-up windows in the display, could be related to familiarity with Digital Software interaction style: Cindy was used to a multi-layered interface, but contrary to Amy and Bill, having less information and options on the display was not a priority for her, as long as the necessary information and options were displayed in a logical order. For the pop-up windows, she even wanted more information to be displayed, Cindy’s interpretation of the VICAT interface display seemed to be related to both an EM and a DS oriented interpretation of the interface. Amy and Bill were indeed more oriented towards an advanced menu (DS) style. Hawthorn (2003) argued that older users of technology interfaces are less likely to configure a simpler version of a complex interface, while younger users are less patient in having to execute a lot of conceptual operations, in order to make available what they would regard as basic and standard features. This would explain why Amy and Bill were bothered by the pop-up windows that could not be closed until they were processed. This resulted in a loss of overview on the displayed information. This overview was important, because an incoming call had to be answered as soon as possible. However, it does not explain why the younger care nurses were bothered by having to execute additional conceptual operations, such as stating the reason for a call. The younger care nurses were perfectly capable of doing so, but they were bothered by it, because the way

they perceived this feature, it offered no direct benefit for interacting with the client. the difference in interpretation had to be related to factors other than the technological features of using the VICAT interface.

4.5. Alternative uses in working with VICAT by care nurses

Bill already indicated that communicating with a client was more than just following a predetermined protocol. The more experience a care nurse had with the VICAT interface, the more personal the interaction between clients and that care nurse became. However, the interviewed care nurses also differed from each other in giving meaning to the functionality of the VICAT interface. When they were asked if they used or wanted to use the technology for alternative purposes, for which the technology was not originally intended, the older care nurses were mainly focused on additional technological features for the VICAT interface:

D: "...Well, it would be nice to expand the options of the technology, so that we can use it for things that weren't intended originally. That way, we can provide more services and more dynamic care for clients. With better technology, it would also be easier to track the insulin usage by clients."

E: "There were some pilots for other features such as heart monitoring devices. On the basis of the findings during these pilots, these features are further developed, with the intention to integrate them with VICAT in the near future. [...] It would be a valuable addition, because if we can identify problems for clients with heart conditions in an early stage, we can notify his physician and perhaps even prevent hospital admission."

Eva and Doris did not mention any social-emotional aspect that caused them to use the VICAT interface for alternative purposes. When Amy was asked whether VICAT lived up to her expectations of the technology, she answered:

A: "When I started working with VICAT, I had to let go some of the control that I was used to having when I was working as a district nurse. That is still difficult for me, so sometimes, I make additional calls to clients, just to be sure that they have taken the right medication. I also used it to contact district nurses once, because one of my clients that should have taken her medication did not respond to my call. I asked a district nurse to visit that client. As it turned out, the client was brought to a hospital in a state of emergency [...] I always want to assist a client as much as possible. That is why I sometimes still have the urge to visit a client in person, but in reality, it is better for the client to do more things herself. And if something goes wrong, who is held responsible?"

Amy had only been working with VICAT for four months, but she already used the VICAT interface for additional monitoring purposes. Bill sometimes used the VICAT interface to communicate with district nurses at the homes of clients. Less experienced district nurses could be assisted by the more experienced care nurses, and became the eyes and hands of the telecare department:

B: "[...] VICAT was not originally meant to be used that way. When I started working here, they wanted me to use standard protocols for assisting clients with VICAT, but it is so much more than that [...] and the district nurse is also a source of information. However, it should never be used to boss these nurses around, but you can guide them in the right direction."

Cindy did not mention any alternative features that were not yet present in the VICAT interface, but was more focused on the improvement of its current features:

C: "When I started working with VICAT, I did not have any expectations about what we could do with it. Nowadays, I still think that it is a very useful addition to our work, but that we are not using it to its full potential. [...] The quality of the cameras that we use has improved, but for some activities, clients are still too dependent on their own actions. We can see them taking their medication, but often not how much they are taking, and whether the amount is still sufficient for their condition.[...] I think the real improvement would be to have more supervision, and perhaps an interactive client dossier, in which district nurses also update their experiences from the clients' homes."

The social-emotional characteristics of communicating with clients via the VICAT interface also had negative consequences. The reactions care nurses gave with regard to their first experiences showed that the more care nurses got used to the VICAT interface, the more personal their interaction with clients became, and that they therefore spent more time on one client than what was originally intended. As Eva indicated, it was often not the care nurse who decided the length of an interactive moment, but the client:

E: "[...] Many clients are very fond of their privacy. They do not want someone to come into their homes four times every day. With VICAT, they decide how long the contact will take. That can be very brief, for instance: 'yes, I took my medication.' 'Perfect. Have a nice day!' Some of them want more conversation, others keep the contact limited. When someone comes to your house, it is much more difficult to make him leave."

Although one of the main objectives of using VICAT was to spend the available time during a day more efficiently, the care nurses were not actively making sure that the conversation with a client did not take too long. As Robert explained:

R: "...For example: we finished a telecare implementation project recently, in which we used the parameter 'contact time' as qualitative indicator. We excluded all contact moments that lasted less than five minutes, because video contact takes more time than contact by phone. Calling someone is done in no time: you can even make calls while doing something else. Video communication is more demanding, because you are now visible on the other side of the system and you do not do that while walking. Therefore, a video consult will almost never last only five minutes, but often ten minutes or even more. Care nurses even needed twenty minutes per client. In short, I do not believe in the time reduction by use of video contact."

Thus, the younger care nurses differed in the social-emotional meaning they gave to the use of the VICAT interface for the provision of care. In comparison with the younger generations of care nurses, the way Doris and Eva expressed themselves about alternative uses for the VICAT interface was more oriented towards the technological possibilities of the VICAT interface. When Bill and Amy were asked the same questions about alternative uses of the VICAT interface and their expectations of future developments, they did not appear to be focused on technological features. In fact, for most of the questions that were not directly related to specific technological features of the VICAT interface, the responses given by the younger generations of care nurses were oriented towards the social characteristics of the VICAT interface, whereas most of the reactions by older care nurses still concerned technological features of VICAT. The younger care nurses felt powerless sometimes, because they could not assist the client physically. The loss of the control that Amy was used to having when working as a district nurse gave her a sense of

insecurity. Therefore, the frequency of unplanned outgoing calls increased, which would imply that it took Amy more time per client than necessary, to provide care by use of VICAT. The alternative uses that Bill expressed were also more oriented towards the social-emotional characteristics of communicating with the VICAT interface. Cindy's reaction differed from what the younger and older care nurses answered. Cindy expressed the desire for technological improvements for the problem of not being able to provide adequate care to clients, whereas Amy and Bill used the technology at hand in alternative ways to solve their problems. For older care nurses, the monitoring activities for medical care by use of the VICAT interface had more priority than the social-emotional interaction with the client. These technological possibilities had less value for the younger care nurses, as long as they could use it as an extension for communicating with their clients, and sometimes the social network around that client.

The time spent per client was used by management as an indicator to assess the performance of providing care by use of VICAT. Therefore, the social-emotional aspects of the technology could have consequences for the technology assessment. As long as the number of clients per GUI was still manageable, working with VICAT was more efficient than visiting these clients physically to provide the same services. However, if the number of clients that made use of the telecare services would increase, the reactions by the care nurses would suggest that they were left with two options to provide these services: they could either reside in only providing the necessary care without additional social-emotional interaction, or they could expand the telecare department and install more GUIs. There would then also be less time to experiment with the technology, and therefore it would be unfeasible to expand the interface with new features, or to make radical changes to the VICAT interface. For older care nurses that were already working with the VICAT interface, an increased number of clients per GUI would not have much impact, since they could rely on the basic routine they built up. Younger new care nurses would have less difficulties with the amount of clients per GUI, because they were less reliant on a routine to operate the interface, but it was expected that they would complain more about the interaction structure that provided too little overview.

5. ANALYSIS: THE PRESENCE OF THE TECHNOLOGY GENERATION EFFECT

On the basis of the differences in problems, solutions and alternative uses of the VICAT interface, together with the previous experiences with technology interfaces by care nurses, age related differences among the interviewed care nurses were identified among the interviewed care nurses. These were of a technological and social-emotional nature. The identification of the technology generation effect is first further discussed in section 5.1. This analysis shows that a technology generation effect can be identified among the interviewed care nurses. However, it does not seem to be a strong enough effect to demotivate the care nurses for using VICAT. This can be explained by analyzing role of management in the stabilization of VICAT among care nurses, which is discussed in section 5.2, and by exploring the group characteristics of the social group of care nurses in further detail, which is discussed in section 5.3.

5.1. Identification of the technology generations among care nurses using VICAT

From a technological perspective, there were differences in the perceived problems and solutions with the VICAT interface that are typical indicators for the presence of technology generations among the interviewed care nurses. Considering the learning strategies for being able to work with the VICAT interface, the younger care nurses (Amy and Bill) used a faster trial-and-error based strategy, and were more oriented towards a menu style in their assessment of the VICAT interface. Older care nurses depended more on technological knowledge that was less sophisticated, which indicated an orientation towards an EM style. Eva used an incremental strategy, in which she wanted to be sure that she could operate VICAT on the most basic level. The EM generation (Doris and Eva) showed more constraint in experimenting with all features that the VICAT interface had to offer, whereas the younger care nurses were not that concerned about following a routine procedure to work with the interface.

When considering the difficulties with the interaction structure and techniques, the contrast between the care nurses was more than just age related. The younger care nurses expressed their frustration about having to process all the pop-up windows of the errors and stating a reason for a call, before they could close the pop-up windows. The presence of technology generation effects would explain why older care nurses were not bothered by the pop-up windows, because it allowed for a more direct one-on-one interaction with the interface, in which one screen automatically guided the care nurse to the next. Also, these pop-up windows contained and displayed a lot of information on the client at once, so that care nurses did not have to perform additional conceptual operations or summon hidden interface layers by selecting them. This also explains why younger care nurses expressed their frustration about the interaction style of the VICAT interface. They were used to an interface where not everything was displayed at once, which they interpreted as 'having more overview'.

When the alternative uses of the VICAT interface are concerned, there was also a contrast between care nurses of the EM generation and those of the DS generation. Care nurses that belonged to the EM generation wanted to expand VICAT so that it could be used as a monitoring tool for the physical condition of a client, whereas the DS generation of care nurses was more focused on the use of VICAT as a social medium.

From a social-emotional perspective, there was some interpretive flexibility among the interviewed care nurses in the assessment of the VICAT interface. It is difficult to determine whether the difficulties on the basis of the social aspects can be ascribed to a technology generation if the categorization as described by Docampo Rama (2001) is used. Her study did not focus on the social aspects by which care nurses of different generations could experience

difficulties with technology interfaces. As a group characteristic, it did appear to be of consequence in the assessment of the ability to work with the VICAT interface. The expressed difficulties with the VICAT interface by the different generations of care nurses showed that the younger generations were more concerned about the social-emotional characteristics (i.e. spending quality time with the client) of the use of VICAT, and less about the technological ones. This does not mean that the older care nurses were not concerned about these aspects, but that they did not assess difficulties with the VICAT interface on the basis of social-emotional characteristics.

Differences were found among the interviewed care nurses in previous experiences with technology interfaces. The diversity of interaction styles that the care nurses had experienced appeared to decrease with age. Eva only used technology interfaces that were crucial to her daily activities, and it did not seem that she was motivated to actively learn how to use other technology interfaces in the past. However, the younger generations of care nurses were not consciously choosing to work with these interfaces, but the use of these technology interfaces was integrated in the social settings of the care nurses during their formative years. This is also the reason why Amy indicated to have experienced all the technology interfaces since 1970, that were shown to her by use of the VPCs.

The interaction style of the VICAT interface was similar to that of technology interfaces that were present during the formative period of Amy and Bill, and the last formative years of Cindy. Although a Windows Operating System interaction style might suggest a more sophisticated multi-layered interface, that would be more similar to the formative years of the younger technology generations of care nurses, the VICAT interaction structure of sequential pop-ups appealed more to Doris and Eva. One reason why the interaction style of the VICAT interface appealed more to the older care nurses could be that the technology interfaces they experienced during their formative years were also based on a less hierarchical structure, with more options directly visible to the user.

Thus, the age related differences among care nurses, which were identified on the basis of the interviews, could be related to a technology generation effect. The interviewed care nurses expressed that they were aware of the presence of age- / generation related differences in using technology interfaces. For instance, Eva and Amy stated:

E: "[...] I notice that my sons are much faster with learning how to use technology. When they try to explain to me how to use these technologies, I have to ask them to slow down most times. They grow up with new technologies, and it is all developing so fast nowadays. I just cannot keep up anymore."

A: I believe that my generation is more aware of how fast all the technologies are changing and that you have to keep your knowledge up-to-date. I think that if you know that, it is easier for you to switch to other technologies."

Robert argued that the generation of care nurses that was in their formative years at the time of the research was more adaptive to new technologies and applications, because they did not know any better. They learned a new technology every day, mainly due to the availability of all these new technologies and applications. He added that it is of no use to project technologies that were designed for old care nurses onto younger generations, because it would scare them away from this occupation. This would also suggest that if they could not solve their technological difficulties with the VICAT interface within a reasonable timeframe, they would be more tempted to stop working with it, or management would not allow them to work with the technology anymore.

During the interview, Tessa was asked if there had been cases where a care nurse left the telecare department or was fired because he had too many difficulties in using the technology. After the interviews, the policy advisor was asked the same question in an e-mail. They both answered that there had been cases where a care nurse left the telecare department, but not because of difficulties with the technology. Most times, they just missed working as a district nurse, and wanted to be closer to the client. Thus, although the technology generation effect did have an influence on the understanding and use of the VICAT interface, it did not appear to make care nurses unwilling to work with telecare technologies. The technology generation effect was present among care nurses that were working with the VICAT interface, but it appeared that the explanation of the role of this effect was more sophisticated, and that it could be explained by adding more context to the definition of care nurses as a social group.

5.2. The role of management in stabilizing VICAT among aging care nurses

The influence of group characteristics other than the age of the group members was also noticeable by the apparent lack of resistance to work with the VICAT interface among the care nurses of S2S Care. It was already mentioned that there was some resistance to the invasiveness on the privacy of clients as a consequence of the use of cameras, but that this resistance was countered by management. However, the care nurses that were working with VICAT applied for their position at the telecare department. Therefore it would seem that the initial resistance to the use of these technologies for the provision of care to clients was not present among the care nurses of S2S Care, or at least not influential enough for care nurses to renounce its use. Management played an important part in convincing the care nurses of the benefits of telecare technologies. A large part of the responsibilities of managers of the telecare department was aimed at creating stabilization of the technology among the care nurses that had to use it. Steven indicated that, in order to successfully coordinate the use of the telecare technologies by care nurses, the influence of an aging population was becoming more important. However, he realized that the path towards stabilization of the VICAT interface was not always just about convincing the care nurses of different ages of the benefits of the technology, but also of the necessity of its use:

I: "Do you think that the aging population is starting to play a part in understanding and using new technologies for providing care?"

S: "I am convinced that it is, so I do think that you need to pay attention to it. However, it is not just a question of teaching people the technological aspects, but also teaching them how to be more open to new technologies mentally. I do not know if the technologies with which they grew up influences their experiences with new technologies. I do know that as long as you keep it simple and put enough effort in it, people will eventually understand and use the technology. In the end, everyone is able to use the technology. [...] And that is also how it works with using new technologies. If people object to using it by saying: 'I do not want to, because I do not understand it', then there has to be a moment where you show them that they have to, because there is no other way anymore. And of course, then you need to take the time and effort to support them in any way you can, and in a positive way...but sometimes it is just necessary to leave the old stuff behind."

It seemed that this approach worked. For instance, Eva, the oldest interviewee, acknowledged that the care sector is changing, and that it is crucial that care nurses also realize that they need to adapt to these changes:

I: "I notice that you are really motivated to work with telecare technologies."

E: "Certainly. People who visit us to learn more about the technology are often afraid. They see the three screens and almost start to panic. But once they experienced

working with it, they are already more open-minded. And in the end...well...I think they have no choice. The way care is developing now cannot be managed the way we used to anymore. Unless there are more care nurses...[...], and we should not forget that the care providers are aging. There are relatively few new young employees."

Convincing the care nurses was thus also about explaining to the care nurse that working with VICAT was part of the corporate strategy, and that at some time, care nurses would have to adapt to the changes that came with it. Cindy even indicated that for new care nurses, working with the telecare technologies had become a basic responsibility in their job description. This would also imply a change in the primary care processes, which had to be managed. S2S Care created a whole telecare department from the beginning, of which the project management was also involved in the coordination of the care nurses that had to work with the telecare technology. Steven already mentioned that the motivation and positive attitude of this management was a crucial determinant to make the telecare project a success, but according to Robert, it was much more than that. Adequate management also meant that when necessary, it could increase the pressure to change the organizational culture that its employees were used to. He argued that the influence of a generation effect was not so much about the age of an individual, but more related to the age of the organization:

R: "Suppose that your organization has been working in roughly the same manner for 50 years, and that this way is suddenly not good enough anymore. Care organizations tend to evaluate their employees on their behavior, but not on their performance. That is an entirely different culture, which makes it very hard to implement changes. [...] It used to be oriented towards providing the best care possible, regardless the costs, but now costs have become important [...] A care nurse still wants to assist the client as much as possible, but is now restricted by performance indicators. And managers need to realize that they cannot change that all at once [...] If you would ask me whether the ability to use new technologies by care nurses is age related, I would say: 'yes, but not because of aging employees. These employees have been in one organizational culture for too long. If someone is 30 years old, but also has been working in an organization for ten years, then that person is just as capable to adopt a new technology as someone that is 40 years of age and also has been working in that organization for ten years."

Robert believed that the willingness of an organization to change this culture could form a great barrier for the implementation of telecare technologies, and even if the telecare technology was implemented successfully, radical changes to this technology could destabilize its use. This would imply that age related differences between care nurses would have less importance if these care nurses had the opportunity to work with a technology interface that did not undergo radical changes. There already appeared to be some form of inclusion for the VICAT interface design. Since its implementation, the VICAT interface had not changed much, and the features that were added or altered were only incremental to the original design of the interface and its interaction style.

It would appear that the longer care nurses were working with the VICAT, the more they got used to its interface, and the less willing they would be to deviate from this interface, since they then had to learn how to use a new interaction style. However, this did not seem to matter to the care nurses that were currently working with the VICAT interface. When the care nurses were asked what they would do if S2S Care suddenly decided to radically change the technology interface (for instance by implementing tablet PCs, a different operating system and touchscreens), the care nurses remained positive:

- E: *"I would not mind learning the newer one. Assuming that the technological development will continue, I believe that it can only improve our services [...] if this project keeps growing, we might even need to connect district nurses directly with us.*
- D: *"Perhaps I would need some time to learn how to use it, but that would not be a reason for me to quit."*
- C: *"If S2S Care wants to try something new, we just adapt to it. How difficult can it be?"*
- B: *"I would adapt to the new situation. VICAT is just an instrument that can be used to provide care to the clients. If your umbrella is broken and you have another one that is just as functional, you use that other one, right? As long as it keeps you dry."*
- A: *"I would really like it if that meant that we could digitalize even more of our services and the way we communicate. To be honest, sometimes I think that the care sector in general is still in the Stone Age when it comes to using new technology."*

New care nurses were not hired because they possessed the necessary technological skills, nor were they fired for it or did they quit their jobs because they were unable or reluctant to work with the VICAT interface. However, care nurses did not *have* to work with telecare technologies, nor did management *have* to hire care nurses that could not work with these technologies. At the time of the research, there appeared to be enough care nurses that applied for a function at the telecare department, from whom management could choose. When I explained to Eva that it was a bit surprising to me that the organization did not hire more younger personnel, she replied:

- E: *"That may be true, but you should not forget that care employees are also aging. There might be enough care nurses that can work here, but there are just not enough new young care nurses [...] at S2S Care, even the district nurses have an average age of 40."*
- I: *"Does that affect your organization?"*
- E: *"Of course. Older care nurses often cannot handle the physical intensity of their work anymore, and therefore they retire from work earlier than they want to. If our care nurses get older -and we all have some physical complaint-, they can still work with VICAT. I would have been gone a long time ago otherwise [laughs]."*
- I: *"So, by use of telecare technologies, care nurses can still perform their job, even if they have physical problems?"*
- E: *"It is perhaps even better to let them continue their work, because they have a lot of knowledge due to their built up experience. They were lifting and dragging all sorts of things at the homes of clients, and many of them had a back injury because of that, but it would be stupid to let all their experience go to waste."*

The implications of physical difficulties for the use of telecare technologies were already mentioned by Eva, when she explained that her own physical condition made it harder to move from left to right in order to see and use the different interfaces that were installed at a GUI. It seemed logical that these physical difficulties were a consequence of her age. This implied that generation effects would also be expressed in this context among care nurses. However, her remark about the physical conditions of other care nurses at the telecare department would imply that changes in the physical condition of a care nurse were also a reason to work with telecare technologies instead of doing physical work at the homes of clients.

5.3. VICAT as a solution for (older) care nurses to continue working

If it was true that all the care nurses of the telecare department had some physical complaint, this would also be noticeable with the other interviewed care nurses. Thus, when the care nurses were interviewed about their first experiences with telecare technologies, it was not a question of *how* they started using VICAT, but *why*. Indeed, Eva's argument that most care nurses started working at the telecare department because of physical problems appeared to be true. The most striking example could be found in the reaction by Bill:

I: *"[...] but that means that you consciously chose to work only with VICAT?"*

B: *"Yes, but there were more factors that influenced my decision back then. First of all, I used to work as a member of the mobile night shift. I got interested in the technology by experiencing it at the clients' homes. So I was already acquiring information on the technology before I started working with it. Meanwhile, I started to experience physical complaints. However, care nurses are pigheaded, so I ignored these symptoms for a long time and continued with my work. After a while I just could not do that anymore, so I went to my doctor. He sent me to a specialist immediately. They suspected that I had a serious chronic illness. That was really hard on me. I noticed that my hands started shaking and that applying a catheter became increasingly difficult. Sometimes I lost 10% of the active substances while administering medication to a client. When that happened with a little girl I thought: 'This is as far as it can go. I have to stop because I am hurting people now. So I quit, and then I got the diagnosis. That is when I realized I just lost my job for ever. And it is really hard, because even though my hands were shaking and my legs tired, in my mind I was still the same care nurse. In that sense VICAT was my last resort..."*

With only 31 years of age, Bill was the only one that did not do any physical nursing activities anymore, and his work only consisted of providing care by use of VICAT. He interpreted the introduction of telecare technologies at S2S Care as the only way to continue the work that he so loved. Cindy and Doris had a similar story.

C: *"I left my work as a psychiatric nurse for medical reasons. I was diagnosed with chronic eczema, and that became problematic in my nursing activities. Therefore, I was looking for something that still allowed me to be a care nurse, but did not demand the physical contact with clients. They were just starting with VICAT on a very small scale here, and that is when I got introduced to it [...] Working at the telecare department is a solution for a lot of care nurses who have physical difficulties or who want to have more flexible work hours, for instance because of changes in their private life."*

D: *"...Due to physical complaints I was no longer able to assist clients in their homes, so I was looking for a desk job and preferably outside the regular working hours. You see, I did not want a baby sitter for my children. [...] so that is when I applied as a standby employee, and since then, my work became increasingly intensive."*

For four out of the five interviewed care nurses, working with VICAT meant that they could still provide care to clients, without having to do the physical work that they would otherwise do as a district- psychiatric- or maternity nurse. Additionally, Bill and Cindy indicated that they came into contact with the telecare technologies while they were working as a district nurse. This motivated them to apply for a position at the telecare department. Doris was less specific, but

she still mentioned that she had experienced similar difficulties. She also mentioned another reason to work at the telecare department: by working at the telecare department, she could work at irregular hours, and therefore spend more time with her children at home. These changes in the private situation of care nurses was also mentioned by Amy, who did not have any physical difficulties:

A: "I applied myself. I gave birth to my child ten months ago and I wanted to be with her during the day. I was also looking for a new adventure. Not directly at the clients' homes, but still something related to nursing. At the telecare department, they needed care nurses to work at night and during the weekend, so that is when I started."

Thus, the problem of not being able to work with telecare technology interfaces by care nurses was of lesser importance than not being able to work as a care nurse at all. It was not about the ability of care nurses to work with telecare technologies, but about the willingness to do so. Care nurses did experience technology generation related difficulties with the use of the VICAT interface. However, care nurses were willing to overcome technological difficulties if this meant that they could still work as a care nurse. More so, the expertise of a care nurse in working with telecare is not expressed in his / her technological skills, but it is their nursing experience which makes them good at working with telecare technologies. Telecare technologies can thus be used to ensure that this nursing expertise is not lost due to aging or physical complaints of the care nurses, but that it enables those care nurses to continue to provide a valuable role in the provision of care.

6. CONCLUSION AND DISCUSSION

6.1. Conclusion: The role of the technology generation effect

The research presented in this thesis aimed to provide more insight in how age related differences among care nurses can be related to difficulties in using telecare technology interfaces. Telecare technologies could help the Dutch health care sector to cope with the problems of an aging society and consequently an increase in the demand for care, but only if both clients and care nurses are able to understand and use these technologies. Studies on the use of telecare have mainly focused on difficulties with telecare technologies by clients of different ages as users of telecare technologies. The ability to understand and use telecare technology interfaces by care nurses of different ages can be important for the successful implementation of telecare into the daily care processes of a care organization. The concept of technology generations, as described by Docampo Rama (2001), was used in order to explore the influence of age related differences among care nurses using telecare technology interfaces. Technology generations are described as age categories care nurses who experienced the availability of the same types of consumer products during their formative years. The SCOT approach was used to provide a framework in which age related differences among care nurses could be reflected against other characteristics that influenced the ability and willingness to work with a telecare technology interface. The research sought to find an answer to the question on what role the technology generation effect has among Dutch care nurses in using telecare technology interfaces. In order to formulate an answer to this question, two sub-questions needed to be answered. The first sub-question for which an answer was sought was stated as:

'What technology generation related differences in the use of telecare technology interfaces can be identified among Dutch care nurses?'

The analysis of the data indicated the presence of age related differences in the understanding and use of telecare technologies and their interfaces by care nurses. Although the care nurses were able to learn how to use the technology and its interface themselves and were taught by their colleagues, without the need for additional training or even the use of user manuals, they did indicate that they used different learning strategies. Older care nurses of the Electro-Mechanical (EM) generation used an incremental approach and focused primarily on the features that were crucial for the basic provision of care to clients by use of VICAT. This approach was related to the expressed fear of using these kinds of technology interfaces. Younger care nurses of the Digital Software (DS) generation used a more random approach of trial-and-error, and were not concerned with learning routines for the use of the VICAT interface.

When considering the different solutions to the experienced problems among care nurses, some closure mechanisms were identified. In order to reduce the chance of missing an incoming emergency call, flashlights were installed at the telecare department. Additionally, modifications were made to the interaction structure, so that incoming emergency calls always appeared in front of the other screens. However, these solutions were interpreted differently by different generations of care nurses. Younger care nurses of the DS generation expressed their discontent with these solutions, because it resulted in a loss of overview and the original problem was still not solved. This discontent was also related to the addition of an obligatory step in the process of processing a call with a client. Older care nurses of the EM generation and management did not mind this addition, because it offered data on potential improvements and market opportunities. Younger care nurses were annoyed by this addition to the interface, because it did not fit their desire for more overview and less unnecessary buttons to push.

Interpretive flexibility was identified among care nurses of different technology generations. The younger care nurses of the DS generation were more involved in the social-emotional characteristics of the interaction, whereas older care nurses of the EM generation were more concerned with the technological possibilities of the VICAT interface. This was also indicated by the suggested alternative uses of VICAT: older care nurses of the EM generation were looking for ways to expand the technological features of the interface, whereas younger care nurses of the DS generation were trying to gain more functionality from the existing set of features of the VICAT interface. The second sub-question for which an answer was sought was stated as:

'What experiences by care nurses with interface features of telecare technologies can be related to experiences with technology interfaces that were present during the formative period of the various technology generations of care nurses?'

There were differences in previous experiences with technology interfaces among care nurses of different technology generations. The VICAT interface was oriented towards a DS interaction style, which care nurses of the EM generation had not experienced during their formative years. The older care nurses experienced similar technology interfaces much later, when they needed to work with personal computers for work purposes. The relation with experiences of care nurses with the VICAT interface was expressed in the incremental learning strategies applied by care nurses of the older EM generation vs. the radical trial-and-error based way younger care nurses of the DS generation learned how to use its specific features. More importantly, the interviewees acknowledged the importance of acquiring knowledge and skills on the use of technology interfaces during the formative years, by reflecting their own technological knowledge and skills with those of their relatives and colleagues of different ages.

Thus, the responses by the interviewed care nurses indicated that there were difficulties with using the VICAT interface, and that they did appear to differ among care nurses of different ages. Some of these problems could be related to a technology generation effect. The team leader of the telecare department, the CEO of the advisory partner organization of S2S Care, the technological consultant, and three of the five care nurses also acknowledged that there is a difference in the way different generations learn and understand new technology interfaces. The main question for which an answer was sought was stated as follows:

"What role does the technology generation effect among Dutch care nurses have with regard to difficulties in using telecare technology interfaces?"

The results showed that the influence of this technology generation effect in a professional environment is somewhat different when compared to people who use technology interfaces in a private environment. First of all, most clients that received care via telecare technologies consciously choose to have care provided to them by use of these technologies, while care nurses are expected to work with these technologies whether they like it or not. These care nurses do have a strong incentive to work with telecare technologies, because it can provide greater efficiency in the provision of care through increasing self-management and by diminishing the need for face-to-face contact (Pols & Willems, 2010). Secondly, clients could choose to make use of (parts of) their own technology interfaces. For example: VICAT could be installed in such manner that the client could make use of his own television, or personal computer. Care nurses did not have this freedom when working at the telecare department. Thirdly, telecare technology interfaces are often designed for clients, and not for care providers (Lim, 2010; Hawthorn, 2000; Hawthorn, 2003). It is often not the client that has a problem with the use of telecare technology interfaces, but the care nurse. However, the interaction style of the technology interface of a care nurse is often more complex and offers more features for care nurses than what clients see and are required to use. Therefore, age- / and technology generation related difficulties could have a greater influence on the use of the VICAT interface (Docampo Rama, 2001).

However, technology generations did not form an insurmountable barrier for the care nurses to work with telecare technologies. The main motivations as to why the influence of age- and technology generation related difficulties were overcome among care nurses that used the VICAT interface were found in the meaning these care nurses gave to the technology. Literature states that older people tend to experience more difficulties in using technology interfaces than younger ones. One important reason why older users are excluded from participating fully in the digital age is because of the complexity of technological products (Lim, 2010). However, the findings in this research suggest that care nurses at the telecare department did *not* consider the technology a threat to their work, nor did they see it as a replacement for their responsibilities. They did not, as Mair *et al* (2005) described, show more discomfort in using the system. Even if there was any resistance for using VICAT, this was short-lived. The anxiety as a consequence of poor design of the VICAT interface, as suggested by Charness and Boot (2009) was also not of any consequence for its use by older care nurses. An aging workforce of care nurses does not necessarily imply that these care nurses cannot be used for the provision of care, for instance because of physical complaints (Buerhaus *et al*, 2000). On the contrary: the social group of care nurses considered the technology a solution to their physical problems, and the use of telecare technologies was an *opportunity* to be able to continue their work as a care nurse. Thus, not only are older care nurses capable to learn how to use telecare technology interfaces, but it also enables them to work longer.

An important factor that contributes to the stabilization of the telecare technology among care nurses of different ages is the way these care nurses are managed. The conclusions in the report by ten Have and Kessler (2011) stated that active involvement of care nurses in the implementation process of telecare was very important for the acceptance of telecare technologies among care nurses. From the beginning of the project for implementing VICAT, managers of the telecare department were constantly involved in convincing the care nurses of the benefits of working with VICAT. By making telecare services a standard responsibility for care nurses that were working at S2S Care, these activities became part of the primary care processes of the organization. The management of S2S Care believed that these care nurses can always be taught to work with the technology. Therefore, care nurses were recruited on the basis of their experiences as a nurse, *not* on their technological skills. The findings on the recruitment procedures and desired competences by management for new employees indicated that care nurses at the telecare department are generally older. This is not only because the workforce of care nurses is aging, but also because older care nurses have more 'field experience', which appears to be more important for the ability to provide care by use of telecare technologies. Also, younger care nurses are preferred in the field, because they can be coordinated by the older care nurses by use of VICAT, and can at the same time obtain more experience in the provision of care that management demands from care nurses working at the telecare department. Most of these care nurses did not have much technological experience. As long as the care nurses could perform their work at the clients' homes, there was no need to learn how to use new technology interfaces. One result of the efforts made by management was that care nurses felt that what they were doing was just as important as providing care without these technologies. This reinforces the suggested strategies for dealing with the upcoming shortages in workforce, as described by Henkens *et al* (2008). Reintegrating employees that would otherwise have been given up on was also part of these strategies. Increasing the supply of labor among the existing employees is facilitated by the use of telecare technologies, since care nurses that are thinking of early retirement because of physical complaints can now be convinced that this does not necessarily mean that they cannot perform their duties as a care nurse anymore. The influence of the technology generation effect can be countered by redefinition of the technological prowess older care nurses have towards using the technology. As long as care nurses can be convinced that the technology itself is not a problem, but a solution for the care work with which care nurses are confronted, age related difficulties with such technologies can be overcome.

It does seem that these technologies offer a new way to help cope with the upcoming shortages of workforce in healthcare, by providing the means to keep the current experienced care nurses working, even if they are older and have physical complaints, and even if they have difficulties with the understanding and use of telecare technologies and the interaction styles of their interfaces. Perhaps the most important reason for these findings was stated by Bill, when we were discussing the experiences of the use of VICAT, and one of the older clients told us that she wanted to go sky diving, but that it was not allowed by her doctor, because of her bad back:

B: "She had much more than a bad back, but wasn't that beautiful? That is why we do it, and you should not forget that it is never about the technology. Not for me or my colleagues. It is about the person you are trying to help, and the way technology can be used to achieve that. That is what makes it fun."

Thus, not only are older care nurses capable to learn how to use telecare technology interfaces, but it also enables them to carry out their work as a care nurse for a longer period, and to continue to provide a valuable role in the provision of care. The role of the technology generation effect is that it can influence the *ability* of care nurses to understand and use telecare technology interfaces, but that it does not influence the *willingness* to work with these technologies, if it means that care nurses can still use their expertise as a care nurse to help clients in their daily need for care.

6.2. Discussion

In the study presented here, the presence of the technology generation effect on the care provider's side was illustrated, and, albeit in a relatively small sample, it was shown that this effect is also of influence among care nurses. Although it is present, the role of the technology generation effect is different than what literature on the subject of age related differences in the use of telecare technologies suggested. Most of the literature on older users of technologies tend to think in stereotypes: because they are older, they will have more difficulties with technology (Hawthorn, 2003; Neven, 2011) The technology generation effect adds to this that previous experiences in the formative years of users can be of great influence for technology use in later years (Docampo Rama *et al*, 2001). These studies were mostly based on users on the demand side of healthcare, such as home care patients. The study presented in this research focused on care nurses, to explore if the arguments in the literature could also be true for the care providers side. Also, the study by Docampo Rama (2001) focused primarily on the technology generation effect and age related difficulties with telecare technologies by much older individuals, which are usually not present in any work environment, since employees tend to retire around the age of 65. Therefore, the results of this study shed more light on differences between *younger* technology generations. No earlier studies have been found that focused on the presence of the technology generation effect among care providers. This work is an addition to the literature on science, technology and innovation studies by showing that it can be important to include age and technology generation related differences as a group characteristic of relevant social groups, in the analysis of a technological artifact from a social constructivist's perspective. The results presented in this research show that including the aging process among the workforce of an aging population can contribute to gerontology studies, by addressing the importance of including the older care nurses as users of new technologies in the early stages of innovation projects within care organizations.

Milligan *et al* (2011) state that telecare technologies offer a contribution to sought after 'solution' for the diminishing workforce and increased demand for services. Studies on the use of telecare technologies to cope with these problems focused on the benefits these technologies offered for clients (care receivers), and benefits for the Dutch care sector were expressed in

terms of reduction in time and cost-efficiency. According to Pols (2010), professionals in health care fear that the use of telecare systems will make it more difficult for nurses to act competently and responsibly when looking after patients, particularly because the nurse is not physically present. There is thus a concern about the loss of human interest and missing signs of trouble, which were always considered the heart of good nursing. Care nurses would therefore be more inclined to reject working with the technology. The findings in the research presented here showed that the social-emotional meaning care nurses gave to providing care via telecare technologies *increased*, the longer they worked with it. There were no signs of this suggested loss of human interest. The societal contribution of this work is that efficiency by use of telecare technologies is not only established through increasing self-management of clients, or reducing the costs and increasing efficiency in time of the primary care processes, but also that it also enables care organizations to continue to make use of the expertise of an aging workforce, which would otherwise have been lost as a consequence of the aging process.

The use of the concept of technology generations, as described by Docampo Rama (2001), proved to be a valuable approach to research age related difficulties with telecare technologies among care nurses. Categorizing these care nurses into two technology generations gave a better representation of the difference in the perceived difficulties in the use of the technology between young and old care nurses. However, the small sample size used in the research presented here also has shortcomings, for it did not allow for making generic statements on the exact boundaries between the Electro-Mechanical and the Digital Software generation. It would be valuable for future studies to identify technology generations among care nurses by use of quantitative data and a larger sample size. Since only five care nurses were interviewed, the statements about the motivations to work with the VICAT interface (such as physical complaints or being able to work at more flexible work hours), statements could be biased towards the private situation of these interviewees at the time of the research. However, when considering the construct validity of the applied methodology, the study was of an explorative nature, and the applied methodology did prove to be adequate for the identification of age related difficulties among care nurses that use telecare technology interfaces. More so, the interviewed team leader, technological consultant and CEO of the advisory partner organization reinforced the identified age related differences among the interviewed care nurses. With regard to the external validity of this research, it should be realized that the data represented employees of a care organization that successfully implemented telecare technologies into the daily provision of care, and where the telecare technology was already stabilized among the care nurses that worked with it. Interviews with employees of a care organization where the implementation is still in early stages, or where the implementation did not succeed, could thus provide different findings. It would therefore be interesting to research the influence of technology generation related difficulties among care nurses of those organizations as well.

The reliability of the research was assured by sending the report to the managers of S2S Care for validation of the transcribed and used quotes. The reliability of the responses by care nurses about the interface of VICAT was increased by the opportunity to see how and what care nurses used to interact with clients via this technology.

The qualitative interviews did provide the data that were needed for answering the research questions. The semi-structured nature of the interviews led to many follow-up questions, which differed per interview. The use of the Visual Prompt Charts (VPCs) during the interviews did provide an adequate way to guide the interviewees in recollecting their previous experiences with technology interfaces. However, although the topic list (see Appendix I) was maintained as much as possible to provide some structure during the interviews, the interviewed care nurses often gave answers that could be related to multiple topics. The use of different follow-up questions was needed to maintain an interview structure, so that the interviews could be compared with each other in the analysis and interpretation of the data. The consequence for the replicability of the research presented in this work is that it will be difficult to maintain the

same structure for the qualitative interviews. However, the use of narrative analysis as described by Bryman (2008) did offer a structured approach to analyze the gathered data, by which these data could be placed in a chronological (historical) order. By use of this approach, a clear representation of the care nurses' previous experiences with technology interfaces, their first experiences with VICAT, the problems they experienced while working with VICAT, and their expectations on the development of the technology could be made.

The objective of this research project was primarily intended to identify the presence of age- and technology related differences that influence the knowledge, ability and willingness to work with telecare technologies by care providers. Because the relevant social group (i.e. care nurses) also had other characteristics and interpretations of the telecare technology, focusing on the technology generation effect alone could not explain why this effect was not insurmountable. The use of the SCOT approach as described by Pinch and Bijker (1984), offered a theoretical framework to study other group characteristics of the social group of care nurses. The interpretive flexibility among care nurses as a consequence of differences in age was illustrated by the perceived problems in using the technology interface. Closure mechanisms were used to counter some of the difficulties with the VICAT interface, and they appeared to be a redefinition of the problem. The introduction of the flashlight for incoming emergency calls did not solve the problem of potentially missing an incoming call, nor did it eliminate age related differences in the meaning care nurses gave to the interaction structure of the telecare technology. The technology did however appear to be stabilized among care nurses and it was even introduced to a wider context. The technological frame encompassed all the general problems and applied solutions that were similar among care nurses, which mostly involved contacting the service desk for help. The inclusion of the applied VICAT interface was a result of incremental instead of radical changes in its design. This could imply that, even if new employees are of a more recent generation, the technology use of the organization is still oriented towards an older generation. This could become problematic if there was a shift in the technology generations of care nurses that would use these technologies. As long as the telecare technology interface does not change radically, care nurses that are part of the DS generation would not experience any difficulties with telecare technology interfaces, and because of this inclusion, the introduction of telecare technologies with radically new interfaces and interaction styles could destabilize the technology among the current group of care nurses.

Younger care nurses are expected to be more capable to understand and use radically new technology interfaces, since they can relate these technology interfaces to more recently obtained experiences with technology interfaces. During the interviews, the technological consultant and the team leader mentioned that they were experimenting with the use of tablet PCs for the provision of care and for time-management among district nurses. Amy was the only one who experienced the introduction of tablet PCs during her formative years. It is interesting to research whether the technology generation effect will have a greater influence when an organization such as the one described in this study suddenly decided to start using tablets with a completely different interaction style, for providing telecare to clients.

The research by Lim (2010) was done in 2005 and that of Docampo Rama (2001) even earlier. Therefore, these studies did not take these technologies into account in determining the different interaction styles. The interaction style of the interfaces of tablet PCs is very different from that of the Menu style (as part of the DS style). Instead of using a keyboard and mouse pointing device, a user can interact with a tablet by touching the desired icon directly on the screen. Conceptual operations such as minimizing a window of an application, which normally required clicking with your mouse pointer on the 'minimize logo', were replaced by using five fingers on the screen to minimize a window. Many of these interaction styles were also introduced in smartphones and digital cameras. The purposes of this research were of an explorative nature and made use of the known technology generations as described by Docampo

Rama (2001). It would be interesting to research whether these seemingly radical changes in technology interfaces of the past ten years also indicate an era of a new technology generation.

The results of the research presented in this work showed that telecare technologies can be used to ensure that experienced care nurses can continue their work, even if they experience any difficulties as a consequence of their age or physical complaints, which would otherwise have caused them to retire early. Policy makers on the use of telecare technology related innovations for the purposes of facilitating care processes and increasing their efficiency should therefore not consider older care nurses as technologically incompetent, but instead as extremely competent potential 'telecare nurses', as long as they are actively stimulated and guided in their work with these technologies.

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APPENDIX I: TOPIC LIST FOR THE SEMI-STRUCTURED QUALITATIVE INTERVIEWS

This topic list does not represent the actual questions that were asked, but the structure of the topics that was used during the interviews. Given the qualitative semi-structured and explorative nature of the interviews, many follow-up questions were used to acquire more insight in the interpretation of the telecare technology interfaces by care nurses.

General topics:

- SCOT approach:
 - Identification of the social group of care nurses that work with telecare technology interfaces
 - Interpretive flexibility:
 - Care nurses' interpretation of the interaction style of the telecare technology interface (analysis on the basis of its interaction structure, interaction techniques and conceptual operations).
 - Closure mechanisms that led to the stabilization of the telecare technology interface among care nurses of different ages.
 - Technological frame: concepts and techniques used by care nurses of different ages to solve the perceived problems with the telecare technology interface
 - Inclusion: identification of the technological frame that determines the selection process for the development of an artifact.
 - Introduction to a wider sociopolitical milieu.
- Technology generations
 - The age of the interviewee
 - Previous experiences with technology interfaces
 - Previous experiences with technology interfaces during the formative years of the interviewee
 - Difficulties with specific features of the interaction style of the telecare technology interface.
 - Acknowledgement / denial by the interviewee of the presence and influence of the technology generation effect among care nurses.

PART A: Characterization of the interviewee

(best to do this part as the final part of the interview, because personal questions could cause the interviewee to respond with more constraint in later questions)

- (USE Visual prompt charts!) What kind of technology interfaces did the interviewee experience during his / her formative period?
 - What is the age of the interviewee?
 - What kinds of technologies did the interviewee have at his / her disposal at home and in a work environment?
 - When did the interviewee start to work with computers?
 - Would the interviewee say that in general, he / she has difficulties in learning new technologies and their associated interfaces?
- What kinds of technology interfaces does the interviewee currently use?
 - Smart phone?
 - Tablet PC?
 - Laptop
 - MP3 player?
 - Etc.
- What was the reason to start working at the telecare department?

PART B: Identification of the meaning given by care nurses to the telecare technology and its purpose

- How and when was telecare introduced in the care organization?
- For what purpose was the telecare technology introduced at S2S Care?
 - What did the interviewee think?
 - What was the interviewee told about this purpose, for example by management?
- What are the benefits of using the telecare technology?
- How was the telecare technology introduced to the care nurse?
- What should the care nurse be able to do by use of the telecare technology?
 - What types of care should the care nurse be able to provide?
 - What kinds of data should the care nurse be able to register by use of the telecare technology
- What does telecare technology interface look like?
- How does the telecare technology work and how does the care nurse operate the telecare technology interface?
 - What interaction techniques, interaction structure and conceptual operations of the telecare technology interface are used by the care nurse?
- What skills and experience does the care nurse need to be able to use the VICAT interface?
 - Was the care nurse given instructions / education on the use of the telecare technology interface?
 - Is the care nurse aware of any user manuals / online helpfiles on how to use the telecare technology? Does the care nurse make use of these resources?
 - Is there a possibility to contact a service desk?
 - How long did it take the care nurse to be able to work with the telecare technology?
- Does the telecare technology live up to the expectations of the interviewee?

PART C: Problems with the telecare technology interface, their causes, consequences, applied solutions, and alterations made to the telecare technology because of these problems.

- What does the interviewee think of the general appearance of the telecare technology interface (fonts, color usage, operating system, buttons, etc.)?
- Does the interviewee consider the telecare technology interface user-friendly?
- Did the interviewee experience any problems / difficulties with the telecare technology interface (on basis of interaction structure, interaction techniques, conceptual operations).
- Did anything go wrong with the telecare technology?
 - What was the cause?
 - What were the consequences?
 - How were these problems solved?
 - Was the interviewee capable of solving these problems him- / herself?
- Did the interviewee experience difficulties in operating the telecare technology interface?
- Was the telecare technology interface altered since the time that the interviewee worked with it?
 - What was the reason for this alteration?
 - To what specifications of the interaction style could these alterations be related?
- Did the alterations provide the interview with new functionality, and were these new functionalities perceived as beneficial?

APPENDIX II: VISUAL PROMPT CHART EXAMPLES

VISUAL PROMPT CHART 1980-1990

<p>A. Telephone</p> 	<p>B. Radio / Cassette</p> 
<p>C. Personal Computer / MS-DOS</p> 	<p>D. (Color-) TV with remote control</p> 
<p>E. Walkman</p> 	<p>F. CD player</p> 
<p>G. Camera</p> 	<p>H. Operating system</p> 

VISUAL PROMPT CHART 2000-2010

<p>A. Mobile phone (2000)</p> 	<p>B. Smartphone with touchscreen (2008)</p> 
<p>C. Camera 2001</p> 	<p>D. MP3 players (since 2001)</p> 
<p>E. Laptop</p> 	<p>F. Flatscreen television with remote</p> 
<p>G. Digital camera with digital display (2002)</p> 	<p>H. Tablet + IOS / Android</p> 
<p>I. Windows Operating System</p> 	